SYLLABUS for M. Sc. CHEMISTRY
Choice Based Credit System (Semester Pattern)
Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur
Effective from 2018-2019

Candidates opting for this course are advised to go through the direction relating to the course "DIRECTION RELATING TO THE EXAMINATION LEADING TO THE DEGREE OF MASTER OF SCIENCE, SEMESTER PATTERN (CHOICE BASED CREDIT SYSTEM) AND DEGREE OF MASTER OF SCIENCE AND TECHNOLOGY (APPLIED GEOLOGY). SEMESTER PATTERN, (CHOICE BASED CREDIT SYSTEM) (FACULTY OF SCIENCE & TECHNOLOGY)" which is available on R. T. M. Nagpur University website.

The direction will provide details on admission criteria, rules for ATKT, scheme of examination, absorption scheme for CBS students into CBCS pattern, elective papers, foundation course papers, subject centric papers, coding pattern, pattern of question papers, practicals, distribution of marks, seminars, project work, internal assessment, calculation of SGPA and CGPA, etc.

Scheme of teaching and examination under semester pattern Choice Based Credit System **(**CBCS**)** for M.Sc. Program in Chemistry

M. Sc. Chemistry Semester I												
Code	Theory / Practical	Teaching scheme (Hours / Week)			Credits	Examination Scheme						
		Th	Pract	Total		Duration in hrs.	Max. Marks		Total Marks	Minimum Passing Marks	
							External Marks	Internal Ass		Th	Pract
(1T1**)**	Paper 1: Inorganic Chemistry	4	-	4	4	3	80	20	100	40	
(1T2**)**	Paper 2: Organic Chemistry	4	-	4	4	3	80	20	100	40	
(1T3**)**	Paper 3: Physical Chemistry	4	-	4	4	3	80	20	100	40	
(1T4**)**	Paper 4: Analytical Chemistry	4	-	4	4	3	80	20	100	40	
Pract. **(**1P1**)**	Practical 1: Inorganic Chemistry	-	8	8	4	3-8*	100**	-	100		40
Pract. **(**1P3**)**	Practical 2: Physical Chemistry	-	8	8	4	3-8*	100**	-	100		40
Seminar 1 **(**1S1**)**	Seminar 1	2	-	2	1			25	25	10	
	TOTAL	18	16	34	25		520	105	625	170	80

M. Sc. Chemistry Semester II												
Code	Theory / Practical	Teaching scheme (Hours / Week)			Credits	Examination Scheme						
						Duration in hrs.	Max. Marks		Total Marks	Minimum Passing Marks		
		Th	Pract	Total			External Marks	Internal Ass		Th	Pract	
(2T1)	Paper 5: Inorganic Chemistry	4	-	4	4	3	80	20	100	40		
(2T2)	Paper 6: Organic Chemistry	4	-	4	4	3	80	20	100	40		
(2T3)	Paper 7: Physical Chemistry	4	-	4	4	3	80	20	100	40		
(2T4)	Paper 8: Analytical Chemistry	4	-	4	4	3	80	20	100	40		
Pract. (2P2)	Practical 3: Organic Chemistry	-	8	8	4	3-8*	100**	-	100		40	
Pract. (2P4)	Practical 4: Analytical Chemistry	-	8	8	4	3-8*	100**	-	100		40	
Seminar 2 (2S1)	Seminar 2	2	-	2	1			25	25	10		
	TOTAL	18	16	34	25		520	105	625	170	80	

M. Sc. Chemistry Semester III												
Code	Theory / Practical	Teaching scheme (Hours / Week)			Credits	Examination Scheme						
		Th	Pract	Total		Duration in hrs.	Max. Marks		Total Marks	Minimum Passing Marks	
							External Marks	Internal Ass		Th	Pract
(3T1)	Paper 9: Special – I (Inorganic/ Organic / Physical / Analytical) Chemistry	4	-	4	4	3	80	20	100	40	
(3T2)	Paper 10: Special – II (Inorganic/ Organic / Physical / Analytical) Chemistry	4	-	4	4	3	80	20	100	40	
Elective 1 (3T3)	Paper 11: A) NuclearChemistry I (3T3A) ORB) Environmental Chemistry I (3T3B) ORC) Polymer Chemistry I(3T3C) ORD) Medicinal Chemisrty I(3T3D)	4	-	4	4	3	80	20	100	40	
Foundation Course 1 / Core Subject Centric 1 (3T4)	Paper 12: Applied AnalyticalChemistry-I / Spectroscopy I	4	-	4	4	3	80	20	100	40	
Pract. Core 9 & 10 (3P1)	Practical 5: Special (Inorganic/ Organic / Physical / Analytical) Chemistry	-	8	8	4	3-8*	100**	-	100		40
Pract. Core Elective 1 (3P3)	Practical 6: A) Nuclear Chemistry I ORB) Environmental Chemistry I ORC) Polymer Chemistry I ORD) Medicinal Chemisrty I	-	8	8	4	3-8*	100**	-	100		40
Seminar 3 (3S1)	Seminar 3	2	-	2	1			25	25	10	
	TOTAL	18	16	34	25		520	105	625	170	80

M. Sc. Chemistry Semester IV				
Code	Theory / Practical	Teaching scheme	Credits	Examination Scheme

		(Hours / Week)									
		Th	Pract	Total		Duration in hrs.	Max. Marks		Total Marks	Minimum Passing Marks	
							External Marks	Internal Ass		Th	Pract
(4T1)	Paper 13: Special – I (Inorganic/ Organic / Physical / Analytical) Chemistry	4	-	4	4	3	80	20	100	40	
(4T2)	Paper 14: Special – II (Inorganic/ Organic / Physical / Analytical) Chemistry	4	-	4	4	3	80	20	100	40	
Elective 2 (4T3)	Paper 15: A) Nuclear Chemistry II ORB) Environmental Chemistry II ORC) Polymer Chemistry II ORD) Medicinal Chemisrty II	4	-	4	4	3	80	20	100	40	
Foundation Course 2 / Subject Centric 2 (4T4)	Paper 16: Applied Analytical Chemistry II / Spectroscopy II	4	-	4	4	3	80	20	100	40	
Pract. (4P1)	Practical 7: Special (Inorganic/ Organic / Physical / Analytical) Chemistry	-	8	8	4	3-8*	100**	-	100		40
Project (4PROJ1)	Project	-	8	8	4	3-8*	100**	-	100		40
Seminar 4 (4S1)	Seminar 4	2	-	2	1			25	25	10	
	TOTAL	18	16	34	25		520	105	625	170	80

NOTE Sem III & IV:

Foundation Course: Candidate can opt for any one foundation course paper in the semester III and IV. However, Student shall opt for this paper from any other subject other than his / her main subject for postgraduation. If the candidate decides to opt for foundation course papers then he/she shall not be eligible to opt for Core (Subject Centric) papers in their respective subjects.

Core (Subject Centric): Candidate can opt for this paper as shown in the semester III and IV in their main subject of postgraduation only. If the candidate decides to opt for Core (Subject Centric) papers in their main subject of

postgraduation then he**/**she shall not be eligible to opt for foundation course papers neither in their own subject nor in any other subject**).**

- General Scheme for Distribution of Marks in Practical Examination in Chemistry
  Time:8-9h (One day Examination) Marks:100

Exercise-1	- 30 Marks	- Evaluated jointly by Internal and External Examiner
Exercise-2	- 30 Marks	- Evaluated jointly by Internal and External Examiner
Record	-20 Marks	- Evaluated by Internal
Viva-Voce	-20 Marks	- Evaluated by External
Total	**-** 100 Marks	

- General Scheme for Distribution of Marks in Project Examination in Chemisrty
  The project work will carry total 100 marks and will be evaluated by both external and internal examiners in the respective Department / Center/ Affiliated College.
  The examiners will evaluate the experimental project work taking into account the coverage of subject matter, presentation, references etc.

For written Project work	- 40 Marks	-	Evaluated jointly by External and Internal
For Presentation	- 20 Marks	-	Evaluated jointly by External and Internal
ForViva-Voce	- 20 Marks	-	Evaluated by External Examiner
Internal Assessment	- 20 Marks	-	Evaluated by Internal Examiner
Total	**-** 100 Marks		

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Semester I
Paper – I (Code: 1T1)
Inorganic Chemistry

60 h (4 h per week): 15 h per unit 80 Marks

Unit-I 5h

A) Stereochemistry and Bonding in Main Group Compound:VSEPER-Shape of simple inorganic molecules and ions containing lone pairs, various stereo chemical rules and resultant geometry of the compounds of non-transitional elements, short coming of VSEPR model. Bent's rule and energetics of hybridization.

B) Metal – Ligand Bonding: 10h

Crystal Field Theory: Splitting of d-orbital in tetragonal, square planar and trigonal bipyramidcomplexes. John teller effect, spectrochemical series, nephelauxetic effect. Limitaion of crystal field theory. M.O.Theory for octahedral, tetrahedral & square planar complexes with and without π-bonding.

Unit-II

A) Metal – Ligand Equilibria in Solution: 5h

Stepwise and overall formation constants; trends in stepwise formation constants; factors affecting stability of metal complexes with reference to nature of metal ion, ligand, chelate effect and thermodyanamic origin. Determination of formation constant by :

(1) spectrophotometric method (Job's and Mole ratio method)

(2) Potentiometric method (Irving-Rossotti Method)

B) Reaction Mechanism of Transition metal complexes: 10h

Energy Profile of a reaction, reactivity of metal complexes, Inert and Labile complexes, Kinetics of Octahedral substitution: Acid hydrolysis, factors affecting acid hydrolysis, Stereochmistry of intermidiates in SN^1& SN^2 , Base hydrolysis, Conjugate base mechanism, Direct and indirect evidences in favour of conjugate mechanism, Annation reaction, reaction without metal-ligand bond breaking.

Unit-III: Cluster- I 15h

Boron hydrides: Classification, nomenclature, structure, bonding and topology of boranes, 4-digit coding (s, t, y, x) numbers for higher boranes and their utilities. Chemistry of diboranes: Study of Metalloboranes, Carboranes and Metallocarboranes with reference to preparations and structures.

Unit – IV: Cluster-2

A) Metal-Metal bonds: 10h

Occurrence of metal-metal bond, Classification of metal clusters, Binuclear, trinuclear, tetranuclear, pentanuclear and hexanuclear with reference to halide, oxide, alkoxide and acetate clusters.

B) Isopoly, Heteropoly acids and their anions. 5h

List of Books

1) S. F. A. Kettle, J. N. Murral and S. T. Teddler: Valency Theory
2) C. A. Coulson: Valency

3) J. E. Huheey :Inorganic Chemistry
4) F .A. Cottonand G. Wilkinson: Advanced Inorganic Chemistry 3rd, 5thand 6th Editions.
5) A. F. Willims: Theoretical Approach in inorganic chemistry.
6) A. Mannas Chanda: Atomic Structure and chemical Bonding
7) L. E. Orgel: An Introduction To transition metal chemistry, Ligand field theory, 2nd Edition.
8) J. J. Logowski: Modern Inorganic Chemistry
9) B.Durrant and P.J.Durrant: Advanced Inorganic Chemistry
10) J. C. Bailar: Chemistry of coordination compounds.
11) W. L. Jolly: Modern Inorganic Chemistry
12) R. S. Drago: Physical methods in inorganic chemistry.
13) Waddington: Nonaqueous solvents.
14) Sisler: Chemistry of nonaqueous solvents.
15) A. K. Barnard: Therotical Inorganic Chemistry
16) Emeleus and Sharpe: Modern Aspect of Inorganic Chemistry.
17) F. A. Cotton: Chemical Applications of Group theory.
18) Jones: Elementary Coordination chemistry.
19) B. N. Figgis: Introduction to Ligand field.
20) S. F. A. Kettle: Coordination chemistry.
21) M.C.Day and J.Selbin: Theoretical Inorganic Chemistry.
22) J. Lewin and Wilkins: Modern Coordination Chemistry.
23) Gowarikar, Vishwanathan and Sheedar: Polymer science.
24) H. H. Jattey and M. Orchin: Symmetry in chemistry.
25) D. Schonaland: Molecular Symmetry in chemistry.
26) L. H. Hall: Group theory and Symmetry in chemistry
27) H. H. Jattey and M. Orchin: Symmetry in chemistry
28) R.L.Dutta and A.Symal: Elements of magneto chemistry
29) Inorganic Chemistry 4th Edition, P.Atkins, Oxford University Press.
30) Essential Trends in Inorganic Chemistry, D.M.P.Mingos, Oxford University Press.

Semester I

Paper II (Code: 1T2)

Organic Chemistry

60 h (4 h per week): 15 h per unit — 80 Marks

Unit-I: 15 h

A] Nature and Bonding in Organic Molecule**:**Delocalized chemical bonding, conjugation, cross conjugation, resonance, hyper-conjugation, bonding in fullerenes. Aromaticity in benzenoid and non-benzenoid compounds, alternant and non-alternant hydrocarbons Huckel's rule, energy level of π-molecules orbitals, annulenes, antiaromaticity, homo-aromoaticity. Aromatic character and chemistry of cyclopentadienyl anion, tropylium cation, tropone and tropolone. Bonds weaker than covalent-addition compounds, crown ether complexes and cryptands, inclusion compounds, cyclodextrins, catenanes and rotaxanes

B] Reactive Intermediates**:** Generation, structure, stability and chemical reactions involving carbocations, carbanions, free radical, carbenes, and nitrenes

Unit-II: 15 h

Streochemistry**:** Conformational analysis of cycloalkanes **(**5**-**8 membered rings**)**, substituted cyclohexanes, mono substituted, disubstituted and trisubstituted cyclohexanes, decalines, effect of conformation on reactivity, Cahn**-**Ingold**-**Prelog System to describe configuration at chiral centers**.** Elements of symmetry, chirality, molecules with more than one chiral center, meso compounds, threo and erythro isomers, method of resolution, optical purity, enantiotopic and distereotopic atoms, groups and faces, prochirality, addition**-**elimination reactions, stereospecific and

steroselective synthesis**.** Asymmetrical synthesis, optical activity in absence of chiral carbon **(**biphenyl and allenes**)**

Unit**-**III**:** 15 h

A**]** Reaction mechanism**:** Structure and Reactivity**:** Types of mechanism, Types of reaction, thermodynamics and kinetics requirements, kinetic and thermodynamic control, Hammond**'**s postulate, Curtin**-**Hammett principle, Potential energy diagrams, transition states and intermediates, methods of determining mechanisms, isotope effects, Hard and soft acids and bases**.**

B**]** Aliphatic nucleophilic substitution**:** The SN^1, SN^2, mixed SN^1, SN^2 and SET and SN_i mechanisms**.** Nucleophilicty, effect of leaving group, ambient nucleophiles and ambient substrates regiospecificity, substitution at allylic and vinylic carbon atoms, phase transfer catalysis

C**]** Concept of neighboring group participation Anchimeric assistance with mechanism, neighboring group participation by π and σ bonds, classical and non classical carbocations, Intramolecular displacement by hydrogen, oxygen, nitrogen, sulphur and halogen**.** Alkyl, cycloalkyl, aryl participation, participation in bicyclic system, migartory aptitude, carbocation rearrangements and related rearrangements in neighboring group participation**.**

Unit IV**:** 15h

A**]** Aromatic Nucleophilic Substitution

A general introduction to different mechanisms of aromatic nucleophilic substitution S_NAr, SN^1, benzyne and $S_{RN}1$ mechanisms, arynes as reaction intermediate, Reactivity - effect of substrate structure leaving group and attacking nucleophile. The Von Richter, Sommlet-Hauser and Smiles rearrangements.

B**]** Aromatic electrophilic substitution

The arenium ion mechanism, orientation and reactivity, energy profile diagrams. The o/p ratio, ipso attack, orientation in benzene ring with more than one substituents, orientation in other ring system. Friedel-Crafts reaction, Vilsmeir-Hack reaction, Gatterman-Koch reaction, Pechman reaction, Reimer-Tieman reaction, Diazonium coupling.

C**]** Effect of Structure on reactivity**:** Resonance and field effects, Steric effect, quantitative treatment. The Hammett equation and linear free energy relationship, substituent and reaction constants. Taft Equation.

List of books

1] Advanced Organic Chemistry –Reaction mechanism and structure. Jerry March, John Wiley
2] Advanced Organic Chemistry- F.A. Carey and R. J. Sunberg, Plenum
3] A Guidebook to Mechanism in Organic Chemistry-Peter Skyes, Longman
4] Structure and Mechanism in Organic Chemistry-C.K. Gold, Cornell University Press
5] Organic Chemistry, R.T. Morrison Boyd. Prentice Hall
6] Modern Organic Chemistry-H.O. House, Benjamin
7] Principal of Organic Chemistry-R.O.C. Norman and J.M. Coxon, Blackie Academic and Professional
8] Reaction Mechanism in Organic Chemistry-S.M. Mukharji and S.P. Singh, Macmilan
9] Stereochemistry of Organic Compounds- D. Nasipuri, New Age International
10] Stereochemistry of Organic Compounds- P. S. Kalsi, New Age International
11] Frontier Orbitals and Organic Chemical Reactions-I. Fleming
12] Orbital Symmetry – R. E. Lehr and A. P. Marchand
13] Reactive Intermediate in Organic Chemistry-N. S. Isaacs
14] Stereochemistry of Carbon Compounds- E. L. Eliel
15] Physical Organic Chemistry-J. Hine
16] Name Reaction in Organic chemistry –Surrey
17] Advanced Organic Chemistry – L. F. Fieser and M. Fieser.
18] Organic Chemistry Vol. I and II - I. L. Finar
19] Modern Organic Chemistry- J.D. Roberts and M. C. Caserio
20] The Search for Organic Reaction Pathways (Longmann), Peter Skyes

21] Organic Chemistry 5th Edition (McGraw Hill), S. H. Pine
22] Organic Chemistry (Willard Grant Press Botcon), John Mcmurry
23] A Textbook of Organic Chemistry- R. K. Bansal New Age International
24] New Trends in Green Chemistry –V. K. Ahluwalia and M. Kidwai, Anamaya publishers New Delhi
25] Organic Chemistry, J. Clayden, N. Greeves, S. Warren and P. Wothers, Oxford University Press
26] Organic Chemistry, 4th Edition, G Marc Loudon, Oxford University Press

Semester I
Paper III (Code: 1T3)
Physical Chemistry

60 h (4 h per week): 15 h per unit 80 Marks

UNIT I: CLASSICAL THEMODYNAMICS 15h

A] Recapitulation of Laws of thermodynamics, Exact and inexact differentials, condition of exactness, Ptaff differential expression and equations, Applications of Ptaff differential equations to first and second law of thermodynamics, Carathéodory's principle and its equivalence to the Kelvin Plank and Clausius statement of the Second law of Thermodynamics, Homogeneous functions of degree 0 and 1, extensive and intensive properties, derivation of thermodynamic equations of state, Maxwell's relations.

B] Third law of thermodynamics, Nernst Heat Theorem, unattainability of absolute zero, calculation of entropy based on third law of thermodynamics, residual entropy and its application. Virial equation of state.

UNIT II: GIBBS FUNCTION AND PHASE EQUILIBRIA 15h

A] Partial molar quantities: Determination of partial molar quantities, chemical potential, partial molar volume, Gibbs Duhem equation, Gibbs Duhem Mergules equation, Extent of advancement of reaction (ξ), thermodynamic criteria of chemical equilibrium.

B] Gibbs Phase rule and its derivation, calculation of degrees of freedom, reduced phase rule, construction of phase diagram, one component systems (Helium, carbon), 1st and 2nd order phase transition, lambda line, two component systems forming solid solutions having congruent and incongruent melting point, partially miscible solid phase, three component systems, graphical presentation, influence of temperature, systems with 1, 2, 3 pairs of partially miscible liquids, transition points.

UNIT III: SURFACE PHENOMENA AND MACROMOLECULES 15h

A] Recapitulation of Surface tension, Adsorption: Freundlich adsorption isotherm, Langmuir theory, Gibbs adsorption isotherm, BET theory and estimation of surface area, enthalpy and entropy of adsorption. Surface film on liquids and catalytic activity, Electro-kinetic phenomena, Surface active agents, hydrophobic interactions, micellization, Critical Micelle Concentration (CMC), mass action model and phase separation model of micelle formation, shape and structure of micelles, factors affecting CMC, micro-emulsion and reverse micelles.

B] Macromolecules: Definitions, Number and mass average molecular weights, molecular mass determination by Osmometry, Viscometry, Sedimentation, Diffusion, light scattering method, Numerical.

UNIT IV: CHEMICAL KINETICS 15h

A] Temperature dependence of chemical reaction rates, Arrhenius equation, Energy of activation, pre-exponential factor and its limitations, Collision theory and its limitations, steric factors, Transition State theory of gas and liquid phase bimolecular reactions, comparison of three theories of reaction rates.

B] Bodeinstein steady state approximation and its application in consecutive reactions, Dynamics of unimolecular reactions: Lindeman-Hinshelwood mechanism, RRKM theory, Thermodynamic formulation of transition state theory, Enthalpy, Gibbs free energy and enthalpy of activation.

List of books

1. R. P. Rastogi and R. R. Mishra, An Introduction to Chemical Thermodynamics, Vikas Publication, Gorakhpur, 2010.
2. P. W. Atkins and D. Paula, Physical Chemistry, 8th Edition, Oxford University Press, 2010.
3. E. N. Yenemin, Fundamentals of Chemical Thermodynamics, MIR, Publications.
4. G. K. Vemulapalli, Physical Chemistry, Prentice – Hall of India, 1997.
5. S. Glasstone andDe Van No Strand, Thermodynamics for Chemists, 1965.
6. S. M. Blinder, Advanced Physical Chemistry,
7. D. Mcquarie and J. Simon, Physical Chemistry – A Molecular Approach, University Press, 2000
8. G. M. Barrow, Physical Chemistry, Tata Mc-Graw Hill, V edition 2003.
9. H. K. Moudgil, Text Book of Physical Chemistry, Pretice Hall of India, New Delhi, 2010.
10. G.M.Panchenkov and V.P.Labadev, " Chemical Kinetics and catalysis", MIR Publishing
11. E.A. Moelwyn- Hughes, " Chemical Kinetics and Kinetics of Solutions", Academic
12. K.J.Laidler, Chemical Kinetics, Third Edition (1987), Harper and Row, New York.
13. J.Raja Ram and J.C.Kuriacose, Kinetics and Mechanism of Chemical Transformations MacMilllan IndianLtd., New Delhi (1993)
14. C. H. Bamford and C. F. H. Tipper, Comprehensive Chemical Kinetics, Vol 1., Elsevier Publications, New York, 1969.
15. C. H. Bamford and C. F. H. Tipper, Comprehensive Chemical Kinetics, Vol 2., Elsevier Publications, New York, 1969.
16. S. Glasstone, K. J. Laidler and H. Eyring, The Theory of Rate Processes, Mc-Graw Hill, New York, 1941.
17. A. Findley, The Phase Rule and its Applications, Longmans Green and Co., Mumbai.
18. K. S. Birdi, Surface Chemistry Essentials, CRC Press, New York, 2014.
19. Eric Keightley Rideal, An Introduction to Surface Chemistry, Cambridge University Press, 1926.
20. D. M. Ruthven, Principles of Adsorption and Adsorption Processes, John Wiley & Sons, NewYork, 1984.
21. A. W. Adamson, A. P. Gasi, Physical Chemistry of Surfaces, Wiley, 2007.
22. P. C. Hiemenz and R. Rajagopalan, Principles of Colloid and Surface Chemistry, CRC Taylor and Fransis, 2007.
23. P. D. Hede and S. P. Beier, Inorganic and Applied Chemistry, e-Book, 2007.
24. Santosh Kumar Upadhyay, Chemical Kinetics and Reaction Dynamics, Springer 2006.
25. E.M. Mc Cash, *Surface Chemistry*, Oxford University Press, Oxford (2001).
26. G. K. Agrawal, Basic Chemical Kinetics, Tata-Mc-Graw Hill, 1990.
27. N. B. Singh, N. S. Gajbhiye, S. S. Das, Comprehensive Physical Chemistry, New Age International, 2014.
28. K. L. Kapoor, Text Book of Physical Chemistry, Vol – I to Vol-VI, 2011.

Semester I

Paper IV (Code: 1T4)

Analytical Chemistry

60 h (4 h per week): 15 h per unit 80 Marks

Unit I: Introduction and statistical analysis 15h

Introduction to analytical chemistry: Types of analysis-qualitative and quantitative. Classification of analytical methods- classical and instrumental, basis of their classification with examples.

Statistical analysis and validation: Errors in chemical analysis. Classification of errors-systematic and random, additive and proportional, absolute and relative. Accuracy and precision. Mean, median, average deviation and standard deviation. Significant figures and rules to determine significant figures. Calculations involving significant figures. Confidence limit, correlation coefficient and regression analysis. Comparison of methods: F-test and T-test. Rejection of data based on Q-test. Least squares method for deriving calibration graph. Application of Microsoft

Excel in statistical analysis (statistical functions and spreadsheets in MS-Excel). Validation of newly developed analytical method. Certified reference materials (CRMs). Numerical problems.

Unit II: Separation techniques 15h

*Chromatography:*Definition and Classification. Techniques used in Paper, Thin Layer and Column chromatography. Applications in qualitative and quantitative analysis.

*Ion exchange:*Principle and technique. Types of ion exchangers. Ion exchange equilibria. Ion exchange capacity. Effect of complexing ions. Zeolites as ion-exchangers. Applications.

*Solvent extraction:*Principle and techniques. Distribution ratio and distribution coefficient. Factors affecting extraction efficiency: Ion association complexes, chelation, synergistic extraction, pH. Numericals based on multiple extractions. Role of chelating ligands, crown ethers, calixarenes and cryptands in solvent extraction. Introduction to Solid phase extraction (SPE) and Microwave assisted extraction (MAE), Applications.

Unit III: Classical methods of analysis 15h

Volumetric analysis: General principle. Criteria for reactions used in titrations. Primary standards and secondary standards. Theory of indicators. Types of titrations with examples- Acid-base, precipitation, redox and complexometric. Titration curves for monoprotic and polyprotic acids and bases. Indicators used in various types of titrations. Masking and demasking agents.

Gravimetric analysis: General principles and conditions of precipitation. Concepts of solubility, solubility product and precipitation equilibria. Steps involved in gravimetric analysis. Purity of precipitate: Co-precipitation and post-precipitation. Fractional precipitation. Precipitation from homogeneous solution. Particle size, crystal growth, colloidal state, aging and peptization phenomena. Ignition of precipitates.

Unit IV: Electrochemical methods of analysis-I 15h

Conductometry: Concepts of electrical resistance, conductance, resistivity and conductivity. Specific, molar and equivalent conductance and effect of dilution on them. Measurement of conductance. Kohlrausch's law, Applications of conductometry in determination of dissociation constant, solubility product. Conductometric titrations. High frequency titrations. Numerical problems.

Potentiometry: Circuit diagram of simple potentiometer. Indicator electrodes: hydrogen electrode, quinhydrone electrode, antimony electrode and glass electrode. Reference electrodes: Calomel electrode and Ag/AgCl electrode. Theory of potentiometric titrations. Acid-base, redox, precipitation and complexometric titrations. Nernst equation, standard electrode potential, Determination of cell potential, n, K_f and K_{sp}. pH titrations. Buffers and buffer capacity. pH of buffer mixtures based on Henderson-Hasselbalch equation.

List of books:

1. Quantitative analysis: Day and Underwood (Prentice-Hall of India)
2. Vogel's Text Book of Quantitative Inorganic Analysis-Bassett, Denney, Jeffery and Mendham (ELBS)
3. Analytical Chemistry: Gary D. Christian (Wiley, India).
4. Instrumental Methods of Analysis: Willard, Merrit, Dean, Settle (CBS Publishers, Delhi, 1986)
5. Instrumental Methods of Chemical Analysis: Braun (Tata McGraw-Hill)
6. Advanced Analytical Chemistry: Meites and Thomas (McGraw-Hill)
7. Instrumental Methods of Analysis: G. Chatwal and S. Anand (Himalaya Publishing House)
8. Analytical Chemistry: Problems and Solution- S. M. Khopkar (New Age International Publication)
9. Basic Concepts in Analytical Chemistry: S. M. Khopkar (New Age International Publication)
10. Advance Analytical Chemistry: Meites and Thomas: (Mc Graw Hill)
11. An Introduction to Separation Science: L. R. Shyder and C. H. Harvath (Wiley Interscience)
12. Fundamentals of Analytical Chemistry: S. A. Skoog and D. W. West
13. Instrumental Methods of Chemical Analysis: G. W. Ewing

Semester I
Practical-I (Code: 1P1)

Inorganic Chemistry

12 h /week Marks:100

I. Preparation of Inorganic Complexes and their characterization by:

Elemental analysis and physico-chemical methods (Electronic and IR Spectra, magnetic susceptibility measurements, Thermal analysis and Molar conductance studies).

1. K_3 [Al $(C_2O_4)_3$]$(H_2O)_3$ 2. [VO (acac) $_2$] 3. Na [Cr $(NH_3)_2(SCN)_4$]
4. $K_3[Cr(SCN)_6]$. 5. [Mn (acac) $_3$] 6. K_3 [Fe $(C_2O_4)_3$]
7. Hg [Co (SCN) $_4$] 8. [Co (Py) $_2$ Cl_2] 9. [Cu_2 $(CH_3COO)_4(H_2O)_2$]
10. [Ni (DMG) $_2$] 11.$[Ni(NH_3)_6]Cl_2$ 12. $[Cu(NH_3)_4(H_2O)_2]SO_4$

II. Quantitative Analysis:

Separation and determination of two metal ions from the following alloys involving:
Volumetric, Gravimetric and Spectrophotometric methods

i) Copper (II) and Nickel (II)
ii) Copper (II) and Zinc (II)
iii) Nickel (II)—Zinc (II) and
iv) Copper (II)—Iron (III)

III. Qualitative analysis of radicals:

Semi-micro Analysis of inorganic mixture containing four cations out of which two will be rare metal ions such as W, Mo,Se,Ti,Zr,Ce,Th,V and U.(Spot Test for individual cations should be performed)

Semester I

Practical-II (Code: 1P3)

Physical Chemistry

12 h /week Marks: 100

It is expected to perform minimum 14 experiments in a semester.

1. To study the variation of volume contraction with mole fraction of alcohol in alcohol -water system
2. To determine the activation parameters of viscous flow for a given liquid.
3. To Determine the critical micelle concentration (CMC) of a given surfactant / soap / shampoo by surface tension measurements.
4. Determination of molecular mass of a polymer by viscometry method.
5. To determine integral heat of KNO_3, at two different conc. and calculation of heat of dilution.
6. Effect of 1% NaCl, 1% succinic acid, 0.5% naphthalene on CST in phenol-water systems.
7. Distribution of succinic acid in H_2O- benzene, H_2O-ether and comparison of distribution coefficient.
8. To construct the phase diagrams of two components system (phenol- urea, diphenyl aminebenzophenone; a-naphtyl amine-phenol) forming compounds with congruent melting points.
9. To study the mutual solubility of glycerol-m-toluidine and to determine congruent points.
10. To study kinetics of hydrolysis of an ester by NaOH reaction.
11. To determine equilibrium constant of the equation $KI+I_2=KI_3$ by distribution method.
12. To study the kinetics of the reaction between potassium persulphate and potassium iodide.
13. Determination of order of reaction of oxidation of ethyl alcohol by acid dichromate.
14. To titrate conductometrically monobasic and dibasic acids with NaOH and determine the strength of given acid.
15. To determine equivalent conductance of weak electrolyte at infinite dilution by kaulrausch's method.
16. Determination of heat of reaction, entropy change and equilibrium constant of the reaction between metallic zinc and Cu^{+2} ions in solution.
17. Determination of thermodynamic constants G, H, S for $Zn^{+2}+H_2SO_4 \rightarrow ZnSO_4+ 2H^+$ by emf measurement.

18. Titration of Ferrous Ammonium Sulphate against ceric sulphate and hence the formal redox potential of $Fe^{2+} \rightleftharpoons Fe^{3+}$ and $Ce^{3+} \rightleftharpoons Ce^{4+}$ systems.
19. To determine the pH of a buffer solutions using a quinhydrone electrode
20. Complexometric titrations (EDTA based)

List of Books

1. Vogel A,IIIrd Edition : A Textbook Of Quantitative Inorganic Analysis, Longman
2. J. B. Yadav, Practical Physical Chemistry
3. Das and Behra, Practical Physical Chemistry
4. Carl W. Garland, Joseph W. Nibler and David P. Shoemaker, Experiments in Physical Chemistry, Mc-Graw Hill, 8th Edition, 2009.
5. Farrington Daniels, Joseph Howard Mathews, John Warren Williams, Paul Bender, Robert A. Alberty, Experimental Physical Chemistry, Mc-Graw Hill, Fifth Edition, 1956.
6. John W. Shriver and Michael George, Experimental Physical Chemistry, Lab Manual and Data Analysis, The University of Alabama in Huntsville, Fall 2006
7. Day And Underwood :Quantitative Analysis
8. Merits And Thomas:Advanced Analytical Chemistry
9. Ewing, G. W. : Instrumental Methods Of Chemical Analysis, Mcgraw-Hill
10. Drago, R.S:Physical Methoods In Inorganic Chemistry
11. Christain G.D:Analytical Chemistry
12. Khopkar S.M.:Basic Concept of Analytical Chemistry
13. Koltath And Ligane:Polorography
14. Braun:Instrumental Methods of Chemical Analysis
15. Willard, Merritt And Dean: Instrumental Methods of Chemical Analysis ,Van Nostrand
16. Strouts,Crifi;Llan And Wisin: Analytiacl Chemistry
17. Skoog S.A. And West D. W.:Fundamental Of Analytical Chemistry
18. Dilts R.V.: Analytiacl Chemistry
19. Jahgirdar D.V :Experiments In Chemistry
20. Chondhekar T.K: Systematic Experiments In Physical Chemistry, Rajbog S.W., Aniali Pubn.
21. Wlehov G. J: Standard Methods Of Chemicalanalysis 6th Ed
22. Akjmetov, N :General And Inorganic Chemistry

Semester I

Seminar-I (Code: 1S1)

2 h /week Marks: 25

Seminar of 30 minutes duration will be a part of internal assessment for 25marks (1credit). Seminar should be delivered by the student under the guidance of concerned teacher on the topic allotted by the teacher. The topic will be related to the syllabus. Marks will be allotted by a group of teachers.

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M.Sc. Chemistry
Semester II
Paper V (Code: 2T1)
Inorganic Chemistry

60 h (4 h per week): 15 h per unit 80 Marks

A) Electronic spectra of Transition Metal complexes 10h

Determining the Energy terms, Spin-orbit (L-S) coupling scheme, Hund's rule, Hole Formulation, Derivation of the term symbol for a d^2 configuration, Electronic spectra of transition metal complexes – Laporte 'orbital' selection rule,spin selection rule. Orgel diagrams for octahedral metal complexes. Charge transfer spectra, Racah parameters, calculations of 10Dq, B, β parameters.Tanabe- Sugano Diagrams of octahedral complexes with d^2& d^8 configuration.

B) Magnetic Properties of Transition Metal complexes 5h

Abnormal magnetic properties, orbital contributions and quenching of orbital angular momentum, spin-orbit coupling. Magnetic moment, electronic spectra and structure of tetrahalocobalt(II) complexes, tetrahedral and octahedral Ni(II) complexes. High spin-low spins crossover.

Unit – II 15h

Reaction mechanism of Transition Metal Complexres-II: Substitution reaction in square planer complexes: the trans effect, cis effect, steric effect, solvent effect, effect of leaving group, effect of charge, effect of nucleophile, effect oftemperature. Trans effect theories, uses of trans-effect, mechanism of substitution reactions in Pt(II) complexes.Electron transfer reactions. Types of electron transferreactions, conditions of electron transfer, and mechanism of one-electron transfer reactions, outer sphere and inner sphere mechanisms, two electron transfer reactions complimentary and non-complimentary reactions. Tunneling effect, cross-reaction, Marcus-Hush theory, bridged activated mechanism.

Unit-III: Metal pi-Complexes - I 15h

Metal carbonyls: Structure and bonding, vibrational spectra of metal carbonyls for bonding and structure elucidation, important reaction of metal carbonyls.Metal carbonyl clusters with reference to classification, EAN rule, synthesis and structures.

Unit – IV: Metal pi-Complexes – II 15h

Metal nitrosyls: Nitrosylating agents for synthesis of metal nitrosyls, vibrational spectra and X-ray diffraction studies of transition metal nitrosyls for bonding and structureelucidation, important reactions of transition metal nitrosyls, structure and bonding. Dinitrogen and dioxygen complexes. Wilkinson's catalyst and Vaska's compound.

List of Books

1. J.E.Huheey :Inorganic Chemistry
2. F.A.Cottonand G. Wilkinson: Advanced Inorganic Chemistry 3rd, 5th and 6th Editions.
3. A.F. Willims: Theoretical Approach in inorganic chemistry.
4. Mannas Chanda: Atomic Structure and chemical Bonding
5. L. E. Orgel: An Introduction To transition metal chemistry, Ligand field theory, 2nd Edition.
6. J. J. Logowski: Modern Inorganic Chemistry
7. B.Durrant and P.J.Durrant: Advanced Inorganic Chemistry
8. J C. Bailar: Chemistry of coordination compounds.
9. W. L. Jolly: Modern Inorganic ChemistryJones: Elementry Coordination chemistry.
10. B. N. Figgis: Introduction to Ligand field.
11. M.C.Day and J.Selbin: Therotical Inorganic Chemistry.
12. J. Lewin and Wilkins: Modern Co-ordination chemistry.
13. Purcell and Kotz: Inorganic Chemistry.

14. D. Banerjea: Co-ordination chemistry, Tata Mc. Graw. Pub.
15. A.F. Wells: Structural inorganic chemistry, 5th Edition, Oxford.
16. S. G. Davies: Organotransition metal chemistry applications to organic synthesis.
17. R. C. Mehrotra: Organometallic chemistry Tata McGraw Hill. Pub.
18. G. S. Manku: Thereotical priciples of inorganic chemistry
19. A. B. P. Lever: Inorganic electronic spectroscopy.
20. R.C.Maurya:Synthesis and charecterisation of novel nitrosyls compounds, Pioneer Pub. Jabalpur2000.
21. R.H.Crabtree:The Organometalic chemistry of Transition metals, John Wiley.
22. D.N.Styanaryan:Electronic Absorption Spectroscopy and related techniques, University Press.
23. R. S. Drago: Physical methods in inorganic chemistry
24. F.Basolo andG.Pearson: Inorganic Reaction Mechanism
25. Organometallics II and I complexes with transition metal- carbon bonds: Manfred Bochmann- Oxford Press.
26. Advanced Inorganic Chemistry Vol I and II – Satyaprakash, Tuli, Bassu and Madan- S Chand.
27. M.Tsusui,M.Nlevy,M.Ichikwa and K.Mori:Introduction to metal pi-complexe chemistry,Plenum press,NY
28. A.E.Martel;Coordination Chemistry-VolIandII,VNR.

Semester II

Paper VI (Code: 2T2)

Organic Chemistry

2T2

60 h (4 h per week): 15 h per unit 80 Marks

Unit-I 15 h

A] Addition to carbon-carbon multiple bond: Mechanistic and stereochemical aspects of addition reaction involving electrophiles, nucleophiles and free radicals, regio and chemoselectivity, Orientation and stereochemistry, Addition to cyclopropanes, Hydrogenation of double bond and triple bonds. Hydrogenation of aromatic rings, hydroboration, Michael reaction, Robinson annulation

B] Addition to carbon-hetero atom multiple bond: Mechanism of metal hydride reduction of saturated and unsaturated carbonyl compounds, acids, esters, and nitriles, Addition of Grignard reagents, organozinc and organolithium reagents to carbonyls and unsaturated carbonyl compounds, Wittig reaction, Mechanisms of condensation reactions involving enolates- Aldol, Knoevengel, Claisen, Mannich, Benzoin, Perkin, Stobbe reaction, Hydrolysis of esters and amide.

Unit-II 15 h

A] Mechanism of molecular rearrangement: Classification and General mechanistic treatment of electrophilic, nucleophilic and free radical moleculer rearrangement. Mechanism of the following rearrangement –Wagner-Meerwin, Pinacol-Pinacolone, Tiffenev –Demjnov ring expansion, benzil-benzilic acid, Favorski, Wolff, Arndt-Eistert synthesis, Curtius Lossen, Beckman, Hoffman, Schmidt rearrangement.

B] Elimination reactions: The E_1, E_2 and E_1CB mechanisms and orientation of the double bond, Saytzeff and Hoffman's rule, Effect of substrate structure, attacking base, leaving group and medium, Mechanism and orientation in pyrolytic elimination

UNIT-III

Free radical reactions: Generation of free radicals, Type of free radical reactions, free radical substitution mechanism at an aromatic substrate, aliphatic substrate, reactivity at a bridgehead position. Neighbouring group assistance, reactivity for aliphatic and aromatic substrates, reactivity in attacking radicals, effect of solvent on reactivity.Halogenation at an alkyl carbon, allylic carbon (NBS), hydroxylation at an aromatic carbon by means of Fenton's reagent. Auto-oxidation,

chlorosulphonation (Reed Reaction) Coupling of alkynes and arylation of aromatic compounds by diazonium salts, Sandmeyer reaction, Free radical rearrangement, Hunsdiecker reaction, iododecarboxylation, Barton reaction, Hoffmann-Loefler-Freytag reaction

Unit IV: Green chemistry 15 h

Green chemistry: Basic principles of green chemistry, calculation of atom economy of rearrangements, addition, substitution and elimination reaction with suitable examples, Case study of Bhopal gas tragedy and Seveso disaster, Synthesis involving basic principles of green chemistry-paracetamol, Ibuprofen, hydroquinone, adipic acid, ε-caprolactum, styrene, urethanes, Free radical bromination, Multi-component reactions (Biginelli, Ugi and Passerini reaction), Prevention or minimization of hazardous products, choice of solvents. Sonochemistry, microvave induced reactions, polymer supported reagents, reactions in aqueous medium, zeolites and ionic liquid supported reaction, Solvent free reactions, electrochemical reactions, Biocatalysts in Organic synthesis.

List of books

1] Books as Suggested in Semester I for Organic Chemistry
2] A Textbook of organic chemistry- R.K. Bansal
3] New trends in green chemistry –V.K. Ahluwalia and M. Kidwai, Anamaya publishers New Delhi
4] Heterocyclic Chemistry, John Joule, Oxford University Press
5] Books as Suggested in Semester I for Organic Chemistry
6] A Textbook of organic chemistry- R.K. Bansal
7] New trends in green chemistry –V.K. Ahluwalia and M. Kidwai, Anamaya publishers New Delhi
8] Heterocyclic Chemistry, John Joule, Oxford University Press

Semester II

Paper VII (Code: 2T3)

Physical Chemistry

60 h (4 h per week): 15 h per unit 80 Marks

UNIT I: FORMULATION OF QUANTUM MECHANICS

15h

A] Introduction of Quantum Mechanics, Wave Function, Acceptability of Wave Functions, Normalized and Orthogonal Wave Functions, Operators, Operator Algebra, Eigen Functions and Eigen Values of Quantum Mechanical Properties (e.g. Linear, Angular momentum, etc.), Hermitian Operators, Orbital and generalized Angular Momentum, Postulates of Quantum Mechanics, Problems on Operator algebra, Eigen Values and Average Values of quantities.

B] Application of Schrödinger Wave Equation to Simple Systems: Degeneracy in 3-Dimensional Box, Rigid Rotor, Potential Well of Finite Depth (Tunneling Effect), Simple Harmonic Oscillator, The Hydrogen Atom.

UNIT II: THERMODYNAMICS

15h

A] Ideal and Non-ideal Systems: Concept of fugacity, determination of fugacity, excess functions for non ideal solutions, Entropy of mixing, Enthalpy of mixing, Activity and activity coefficients, Concept of ion atmosphere and electrophoretic effect, Debye Hückel theory for activity coefficients of electrolytic solutions, determination of activity and activity coefficients, ionic strength and dependence of activity coefficients on ionic strength, numericals.

B] Nonequilibrium Thermodynamics: Conservation of mass and energy in time dependent closed and open systems, Thermodynamic criteria of irreversibility, rate of entropy production and entropy exchange in irreversible processes. The generation of the concept of Chemical Affinity and the

extent of advancement of chemical reactions, Thermodynamic constraints on the signs of chemical affinity and the velocity of chemical reaction, application to any one coupled reaction.

UNIT III: SOLID STATE CHEMISTRY 15h

A] Introduction to crystals, Unit Cell and lattice parameters, Symmetry elements in crystals, Absence of fivefold axis, Space groups, The Bravais Lattices, Miller Indices, Bragg's Equation, seven crystal system, Packing in crystals, Hexagonal Closest Packing (HCP) Cubic Closest Packing (CCP), Voids, packing fraction, Numericals.

B] Crystal Defects and Non-stiochiometry: Perfect and imperfect crystals, point defects, line and plane defects. Thermodynamics of Schottky and Frenkel defect formation, colour centers, non-stiochiometry and defects.

UNIT IV: STATISTICAL THERMODYNAMICS AND NUCLEAR CHEMISTRY 15h

A] Statistical thermodynamics: Lagrange's Method of Undetermined Multipliers (Conditional Maximization), Stirling Approximation, Concept of Distribution, Thermodynamic Probability and most probable distribution, Maxwell Boltzmann, Bose Einestein, Fermi Dirac statistics, comparison between three statistics.

B] Nuclear Chemistry: Introduction, radioactive decay and equilibrium, thermonuclear reactions, photonuclear reactions, Radiometric titration, isotopic dilution analysis, NAA. Counters: Proportional counter, GM counter, Scintillation counter, Ionization chamber counter.

List of books

1. Ira .N. Levine, Quantum Chemistry, 5th edition(2000), Pearson educ., Inc.New Delhi
2. A.K.Chandra, Introductory Quantum Chemistry, 4th edition (1994), Tata Mcgraw Hill, New Delhi.
3. M.W.Hanna, " Quantum Mechanics in Chemistry", Benjamin
4. L. Pualing and E. B. Wilson, Introduction to Quantum Mechanics with Applications to Chemistry, McGraw Hill, New York (1935).
5. R. K. Prasad, Quantum Chemistry, New Age International, Delhi.
6. R. K. Prasad, Quantum Chemistry through problems and solutions, New Age International, New Delhi, 2009.
7. B. C. Reed, Quantum Mechanics, Jones and Bartlett, New Delhi, 2010.
8. R. P. Rastogi and R. R. Mishra, An Introduction to Chemical Thermodynamics, Vikas Publication, Gorakhpur, 2010.
9. P. W. Atkins'and D. Paula, Physical Chemistry, 8th Edition, Oxford University Press, 2010.
10. G. K. Vemulapalli, Physical Chemistry, Prentice – Hall of India, 1997.
11. S. Glasstone, An Introduction to Electrochemistry, East-West Press Pvt. Ltd., New Delhi, 2004.
12. H. K. Moudgil, Text Book of Physical Chemistry, Pretice Hall of India, New Delhi, 2010.
13. S. O. Pillai, Solid State Physics, New Age International, New Delhi, 2102.
14. N. B. Hanny, Treaties in Solid State Chemistry,
15. M. C. Day and J Selbin, Theoretical Inorganic Chemistry, Reinhold Pub. Corp., New York,
16. I Prigogine and R. Defay, Chemical Thermodynamics, Longmans, London, 1954.
17. S. R. DeGroot and P. Mazoor, Non-Equilibrium Thermodynamics, North-Holland Co., Amsterdam, 1969.
18. G. Lebon, D. Jou and Casa Vazquez, Understanding Non-equilibrium Thermodynamics, Springer, 2008.
19. I.Prigoggine, "An Introduction to Thermodynamics of Irreversible Processes," Wiley-Interscience.
20. R. P. Rastogi, Introduction to Non-equilibrium Physical Chemistry, Elsevier, Amsterdam, 2008.
21. G. A. Somorjai, Introduction to Surface Chemistry and Catalysis, Wiley, 2010.
22. M. C. Gupta, Statistical Thermodynamics, New Age International.
23. K. Huang, Statistical Mechanics, Wiley, New Delhi, 2003.
24. Andrew Maczek, *Statistical Thermodynamics,* Oxford University Press Inc., New York (1998).
25. C.N.Rao. Nuclear Chemistry

26. B. G. Harvey, *Introduction to Nuclear Physics and Chemistry,* Prentice Hall, Inc. (1969).
27. H.J. Arnikar, *Essentials of Nuclear Chemistry*, 4th Edition (1995), Wiely-Eastern Ltd., New Delhi.
28. C.Kittel, " Introduction to solid state Physics",Wiley
29. L.V.Azaroff, " Introduction to solids", McGraw Hill
30. L. E. Smart and E. A. Moore, Solid State Chemistry-An Introduction, CRC Tylor and Fransis, 2005.
31. D. D. Sood, A. V. R. Reddy, Fundamentals of Radiochemistry, Indian Association of Nuclear Chemists and Allied Scientists, 2007.
32. C. N. R. Rao and Gopalakrishnan, "New Directions in Solid State Chemistry " Second Edition, Cambridge University Press.
33. Anthony R. West, "Solid State Chemistry and its Applications" Wiley India Edition.
34. C. Kalidas and M. V. Sangaranarayana, Non-Equilibrium Thermodynamics.
35. D. K. Chakravorty, Solid State, New Age International.

Semester II

Paper VIII (Code: 2T4)

Analytical Chemistry

60 h (4 h per week): 15 h per unit 80 Marks

Unit-I: Sampling and quantification 15h

A] *Sampling and sample treatment*: Criteria for representative sample. Techniques of sampling of gases (ambient air and exhaust gases), liquids (water and milk samples), solids (soil and coal samples) and particulates. Hazards in sampling. Safety aspects in handling hazardous chemicals.Sample dissolution methods for elemental analysis: Dry and wet ashing, acid digestion, fusion processes and dissolution of organic samples.

B] *Detection and quantification*: Concepts and difference between sensitivity, limit of detection and limit of quantification, role of noise in determination of detection limit of analytical techniques.Units in chemical analysis and their interconversion.

C] *Stoichiometry:* Stoichiometric and sub-stoichiometric reactions and calculations.

Unit-II: Modern separation techniques 15h

A] *Gas Chromatography*: Principle including concept of theoretical plates and van-Deemter equation. Instrumental set up- carrier gas, sampling system, column and detector. Types of columns, their advantages and limitations. Detectors in GC analysis. Temperature programmed GC. Factors affecting retention, peak resolution and peak broadening.

B] *Liquid chromatography*: Principle, Instrumentation, Advantages and applications of HPLC. Types of columns and detectors. Principle and applications of size exclusion, gel permeation, ion retardation, normal phase and reverse phase chromatography.

C] *Supercritical fluid chromatography*: Introduction and applications.

Unit III: Optical methods of analysis-I 15h

A] Spectrophotometry and Colorimetry: Principle of colorimetry. Beer's law, its verification and deviations. Instrumentation in colorimetry and spectrophotometry (single and double beam). Sensitivity and analytical significance of molar extinction coefficient and λ_{max}. Comparison method, calibration curve method and standard addition method for quantitative estimation. Role of organic ligands in spectrophotometric analysis of metal ions. Ringbom plot and Sandell's sensitivity. Photometric titrations. Determination of pK value of indicator. Simultaneous determination. Composition and stability constant of complex by Job's and mole ratio methods. Derivative spectrophotometry. Numerical problems.

B] Flame photometry: Principle. Instrumentation and types of burners. Factors affecting flame photometric determination. Limitations of flame photometry. Interferences in flame photometry. Applications.

Unit-IV: Electrochemical methods of analysis-II 15h

A] *Polarography*: Principle of DC polarography. Instrumentation in polarography. Advantages and limitations of DME. Types of currents- residual current, migration current, diffusion current, limiting current, adsorption current, kinetic current and catalytic current. Ilkovic equation-diffusion current constant and capillary characteristics. Derivation of equation of polarographic wave and half wave potential. Experimental determination of half wave potential. Reversible, quasi reversible and irreversible electrode reactions. Polarographic maxima and maximum suppressor. Oxygen interference and deaeration. Introduction to pulse, a.c. and oscillographic techniques and their advantages. Applications of polarography in determination of dissolved oxygen, metal ion quantification and speciation, simultaneous determination of metal ions, analysis of organic compounds. Limitations of polarography.

B] Amperometric titrations**:** Principle, types and applications in analytical chemistry.

List of books**:**

1. Quantitative analysis**:** Day and Underwood **(**Prentice**-**Hall of India**)**
2. Vogel's Text Book of Quantitative Inorganic Analysis-Bassett, Denney, Jeffery and Mendham (ELBS)
3. Analytical Chemistry**:** Gary D**.** Christian **(**Wiley India**).**
4. Instrumental Methods of Analysis**:** Willard, Merrit, Dean, Settle (CBS Publishers, Delhi, 1986)
5. Sample Pre-treatment and Separation: R. Anderson (John Wiley and Sons)
6. Stoichiometry: B.I.Bhatt and S.M. Vora, 2nd Edition (Tata Mc-Graw Hill publication)
7. Instrumental Methods of Chemical Analysis: Braun (Tata McGraw-Hill)
8. Advanced Analytical Chemistry: Meites and Thomas (McGraw-Hill)
9. Instrumental Methods of Analysis: G. Chatwal and S. Anand (Himalaya Publishing House)
10. Analytical Chemistry: Problems and Solution- S. M. Khopkar (New Age International Publication)
11. Basic Concepts in Analytical Chemistry: S. M. Khopkar (New Age International Publication)
12. Advance Analytical Chemistry: Meites and Thomas: (Mc Graw Hill)
13. An Introduction to Separation Science: L. R. Shyder and C. H. Harvath (Wiley Interscience)
14. Fundamental of Analytical Chemistry: S. A. Skoog and D. W. West
15. Instrumental Methods of Chemical Analysis: G. W. Ewing
16. Polarography: Koltoff and Ligane
17. Electroanalytical Chemistry: Sane and Joshi (Quest Publications)

Semester II
Practical**-**III **(**Code**:** 2P2**)**
Organic Chemistry

12 h /week Marks: 100

[A**]** Qualitative Analysis**:** Separation, purification and identification of the mixture of two organic compounds (binary mixture with two solid, one solid one liquid and two liquids) using chemical methods or physical techniques.
Minimum 8-10 mixtures to be analyzed.
Purification of the compounds by crystallization, TLC and chromatographic techniques.

[B**]** Organic preparations**:**Student is expected to carry out minimum of 5-6 two stage organic preparation and 5-6 single stage preparation from the following lists.

[1] Oxidation: Adipic acid by chromic acid oxidation of cyclohexanol.
[2] Benzophenone → benzhydrol
[3] Aldol condensation: Dibenzal acetone from benzaldehyde.
[4] Sandmeyer reaction: *p*- chlorotoluene from *p*-toluidine
[5] Cannizzaro reaction
[6] Friedel Crafts Reaction: β-Benzoyl propionic acid from succinic anhydride and benzene.
[7] Benzil → 2,4,5-triphenyl imidizole

[8] Sucrose → Oxalic acid
[9] Methyl acetoacetate → 5-methyl-isoxazol-3-ol
[10] Ethyl acetoacetate →4-aryl-6-methyl-3,4-dihydro-2(1*H*)-pyrimidinone ester
[11] Ethyl acetoacetate → Diethyl 1,4-dihydro-2,6-dimethyl-4-phenylpyridine-3,-5dicarboxylate
[12] Dye prepartion : Sulphanilic acid → Methyl orange
[13] Dye prepartion : p-nitroaniline → p-red
[14] Acetanilide →*p*-nitroacetanilide →*p*-nitroaniline
[15] Aniline → 2,4,6-tribromo aniline → 2,4,6-tribromoacetanilide
[16] Nitrobenzene →*m*-dinitrobenzene →*m*-nitroaniline
[17] toluene →p-nitrotoluene →*p*-nitrobenzoic acid
[18] Glycine → Benzoyl glycine → 4-benzilidene-2-phenyl oxazole

Semester II

Practical-IV (Code: 2P4)

Analytical Chemistry

12 h /week Marks: 100

Section (A): Classical methods and separation techniques: Calibration, validation and computers

1. Calibration of pipette and burette.
2. Statistical analysis of data.
3. Use of MS-Excel in statistical analysis of data and curve fitting.

Volumetry

1. Determination of Na_2CO_3 in washing soda.
2. Determination of NaOH and Na_2CO_3 in a mixture.
3. Estimation of nickel in given solution by direct complexometric titration with EDTA using bromopyrogallol red.
4. Estimation of nickel in given solution by complexometric back-titration with EDTA.
5. Estimation of chloride in given solution by Mohr's titration.
6. Estimation of chloride in given solution by Volhard's titration.
7. Determination of volume strength of commercial hydrogen peroxide by redox titration with $KMnO_4$.
8. Estimation of phenol/ aniline by bromination method.
9. Estimation of glucose.
10. Estimation of acetone.
11. Estimation of formaldehyde.
12. Estimation of Mn in the presence of Fe using masking phenomenon (ferromanganese alloy).

Gravimetry

1. Estimation of barium as barium sulphate.
2. Estimation of calcium as calcium oxalate/ calcium carbonate/ calcium oxide.

Separation techniques

1. Qualitative separation of metal ions by paper chromatography for 2/3 components.
2. Determination of ion-exchange capacity of resin.
3. Separation of ions by ion exchange.

Section (B): Instrumental techniques: Electroanalytical techniques

1. Analysis of commercial vinegar by conductometric titration.
2. Estimation of phenol by conductometric titration with NaOH.
3. Determination of strength of HCl and CH_3COOH in a mixture conductometrically.

4. Determination of strength of HCl and oxalic acid in a mixture conductometrically.
5. Determination of strength of oxalic acid and CH_3COOH in a mixture conductometrically.
6. Determination of degree of dissociation and dissociation constant of acetic acid conductometrically.
7. Estimation of phenol in dilute solution by conductometric titration with NaOH.
8. Determination of strength of HCl and CH_3COOH individually and in a mixture potentiometrically.
9. Determination of Fe(II) by potentiometric titration with $K_2Cr_2O_7$.
10. Determination of three dissociation constants of H_3PO_4 by pH-metric/ potentiometric titration.

Optical methods

1. Determination of pK of indicator by colorimetry.
2. To estimate the amount of NH_4Cl colorimetrically using Nesseler's Reagent.
3. To study the complex formation between Fe(III) and salicylic acid and find the formula and stability constant of the complex colorimetrically (Job's method).
4. To determine the dissociation constant of phenolphthalein colorimetrically.
5. Estimation of iron in wastewater sample using 1,10-phenanthroline.

Note: One experiment from each section should be performed in the examination.

Semester II

Seminar-II (Code: 2S1)

2 h /week Marks: 25

Seminar of 30 minutes duration will be a part of internal assessment for 25 marks (1 Credit). Seminar should be delivered by the student under the guidance of concerned teacher on the topic allotted by the teacher. The topic will be related to the syllabus. Marks will be allotted by a group of teachers.

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M.Sc. Chemistry
Semester III
INORGANIC CHEMISTRY SPECILIZATION
Paper IX (Code: 3T1)
Special I-Inorganic Chemistry

60 h (4 h per week): 15 h per unit 80 Marks

Unit -I 15h

A) Essential and trace metals in biological systems: Biological functions of inorganic elements, biological ligands for metal ions. Coordination by proteins, Tetrapyrrole ligands and other macrocycle. Influence of excess and difficiency of V, Cr, Mn, Fe, Co, Cu,& Zn. Genetic defects in the absorption of trace elements. Regulation and storage of trace elements. Role of minerals. Toxic effects of metals.

B) Metal storage, transport and biomineralization with respect to Ferritin, Transferrin and Siderophores, Na^+ /K^+ pump. Role of Ca in transport and regulation in living cells.

C) Medicinal use of metal complexes as antibacterial, anticancer, use of cis-platin as antitumor drug, antibiotics & related compounds. Metal used for dignosis and chemotherapy with particular reference to anti cancer drugs.

Unit-II 15h

A) Bio-energetics and ATP cycle: DNA polymerization, metal complexes in transmission of energy, chlorophylls, photosystem I and photosystem II in cleavage of water, Model systems.

B) Electron transfer in Biology: Structure and functions of metalloproteins in electron transfer proteins, cytochromes & Fe-S proteins, Non-heme iron proteins; Rubredoxins, Synthetic models. Biological Nitrogen fixation (in vitro and in vivo)

Unit-III

15h

Transport & Storage of Dioxygen: Heme proteins & oxygen uptake, structure and functions of haemoglobin, myoglobin, hemocyanins & hemerythrin. Perutz mechanism showing structural changes in porphyrin ring system. Oxygenation and deoxygenation. Model compounds. Cyanide poisoningand treatment. Vanadium storage and transport.

Unit-IV 15h

Metallo enzymes: Apoenzymes, Haloenzyme & Coenzyme. The principle involved and role of various metals ini) Zn-enzyme:- Carboxyl peptidase & Carbonic anhydrase. ii) Fe-enzyme:-Catalase Peroxidase & Cytochrome P-450 iii) Cu-enzyme:-Super Oxide dismutase iv) Molybdenum:-Oxatransferase enzymes, Xanthine oxidase,Co-enzyme Vit.B12, Structure of vitamin B12 Co-C bond cleavage, Mutaseactivity of co- Enzyme B-12, Alkylation reactions of Methyl Cobalamin. Synthetc model of enzyme action, stability and ageing of enzyme.

List of Books:

1. Akhmetov, N.: General and Inorganic Chemistry.
2. Aylett, B. and Smith, B.: Problems in Inorganic Chemistry, (English University Press)
3. Bertini, et al: Bioinorganic Chemistry (Viva)
4. Charlot, G and Bezier, D.: Quantitative Inorganic Analysis (johnWiley).
5. Douglas, B. E. McDanirl, D. H. et al: Concept and Models of Inorganic Chemistry (4th edt.) J. Wiley
6. Dutt P. K.: General and Inorganic Chemistry.(Sarat Books House)
7. Fenton, David E.: Biocoordination chemistry, Oxford

8. Jolly, W. L. : Inorganic Chemistry (4th edn.) Addison-Wesley.
9. Katakis, D. and Gordon, G.: Mechanism of Inorganic Reactions.(J.Wiley).

Semester III

Paper X (Code: 3T2)

Special II-Inorganic Chemistry

60 h (4 h per week): 15 h per unit 80 Marks

Unit-I 15 h

Crystal Structure of Some Simple Compounds:

i) Ionic Crystals &Their structures, radius ratio rule, effect of polarization on crystals.
ii) Covalent structure type- Sphalerite & Wurtzite.
iii) Geometry of simple crystal AB type: NaCl, CsCl & NiAs, reasons for preference for a particular structure in above AB type of compounds.
iv) AB_2 type: Fluorite, antifluorites, Rutile structures. Li_2O, Na_2O,,$CdCl_2$, CdI_2 structures.
v) Ternary Compounds ABO_3 type: Perovskite, Barium titanate, lead titanate, $CaTiO_3$, Tolerance factor, charge neutrality & deviation structures. $FeTiO_3$.

Unit-II 15h

A) AB_2O_4 type- compounds: Normal & inverse,2-3 and 4-2 spinel,packing of oxygen in tetrahedral & octahedral sites, sites occupancy number of site surrounding each oxygen,application of charge neutrality principles, site preferences in spinel, distorted spinel.Hausmannite(Jahn-Teller distortions),Factors causing distortion in spinel.

B) Lattice Defects: Per fect &Imperfect crystals, point defects, Interstitial, Schottky defect, Frenkel defect, line defect & other entities, thermodynamics of Schottky & Frankel defects. Dissociation, theory of dislocation, plane defects- Lineage boundary, grain boundary, stacking fault, 3D defects, Defects & their concentrations, ionic conductivity in solids, Non stoichiometric compounds. Electronicproperties of Non-stoichiometric oxides.

Unit-III 15h

Glasses, Ceramics and composite:Glasses, Ceramics Composites and Nano-materials: Glassy state, glass formers and GlassModifiers. Glasses, Ceramics, Clay products, Refractories with reference to: preparation, Properties and applications. Microscopic composites, dispersion, strengtheried and particlereinforced, fibre reinforced Composites, microscopic composites, nanocrystaline phase, preparation procedure, special properties and applications.

Unit-IV

15 h

Liquid Crystals: Mesomorphic behaviour, thermotropic liquid crystals, positional order, bond orientational order, nematics & smectic mesophases; smectic-Nematic transition clearing temperature-homeotrpic, planer & schlieren textures twisted nematics, chiral nematics, molecular arrngement insmectic A & smectic C phases, optical properties of liquid crystals. Dielectric susceptibility & dielectric constants. Lyotropic phases & their description of ordering in liquid crystals.

List of Books:

1. Akhmetov, N.: General and Inorganic Chemistry.
2. Aylett, B. and Smith, B.: Problems in Inorganic Chemistry, (English University Press)
3. Bertini, et al: Bioinorganic Chemistry (Viva)
4. Charlot, G and Bezier, D.: Quantitative Inorganic Analysis (johnWiley).

5. Douglas, B. E. McDanirl, D. H. et al: Concept and Models of Inorganic Chemistry (4th edt.) J. Wiley
6. Dutt P. K.: General and Inorganic Chemistry.(Sarat Books House)
7. Fenton, David E.: Biocoordination chemistry, Oxford
8. Jolly, W. L. : Inorganic Chemistry (4th edn.) Addison-Wesley.
9. Katakis, D. and Gordon, G.: Mechanism of Inorganic Reactions.(J.Wiley).
10. Peter J. Collings, Liquid Crystals-Nature's delicate Phase of Matter, New Age International.
11. S. Chandrasekhar, Liquid Crystals, Cambidge University Press.

Semester III

Practical-V (Code: 3P1)

Inorganic Chemistry Special

12 h /week Marks: 100

A INSTRUMENTAL METHODS

I pH METRY:

1. Stepwise proton ligand and metal ligand constant of complexes by Irving Rossetti method

II COLORIMETRY AND SPECTROPHOTOMETRY

1. simultaneous determination of manganese (KMnO$_4$) and chromium ($K_2Cr_2O_7$)
2. simultaneous determination of cobalt (II) and nickel(II)
3. Determination of composition and stability constant of complexes by Job's method of continuous variation , mole ratio method and slope ratio method

III POTENTIOMETRY

1. Estimation of halide in a mixture by potentiometry
2. Determination of stepwise stability constant of silver thiosulphate complex by potentiometrically

IV CONDUCTOMETRY

1. Estimation of amount of acid in a mixture by conductometric titration

B INORGANIC REACTION MECHANISM

Kinetics and mechanism of following reactions:

1. Substitution reactions in octahedral complexes (acid/base hydrolysis)
2. Redox reactions in octahedral complexes
3. Isomerization reaction of octahedral complexes

C BIOINORGANIC CHEMISTRY (CHLOROPHYLL

1. Extraction and absorption spectral study of chlorophyll from green leaves of student choice
2. separation of chlorophyll and their electronic spectral studies
3. Complexation study of metal ions with biologically important amino acids

List of Books

1. Day And Underwood :Quantitative Analysis
2. Vogel A : A Textbook Of Quantitative Inorganic Analysis, Longman
3. Flaschka : Edta Titration
4. Merits And Thomas:Advanced Analytical Chemistry
5. Ewing, G. W. : Instrumental Methods Of Chemical Analysis, Mcgraw-Hill
6. Drago, R.S:Physical Methoods In Inorganic Chemistry
7. Christain G.D:Analytical Chemistry
8. Khopkar S.M.:Basic Concept Of Analytical Chemistry
9. Koltath And Ligane:Polorography

10. Braun:Instrumental Methods Of Chemical Analysis
11. Willard, Merritt And Dean: Instrumental Methods Of Chemical Analysis ,Van Nostrand
12. Strouts,Crifi;Llan And Wisin: Analytiacl Chemistry
13. Skoog S.A. And West D. W.:Fundamental Of Analytical Chemistry
14. Dilts R.V.: Analytiacl Chemistry
15. Jahgirdar D.V :Experiments In Chemistry
16. Chondhekar T.K: Systematic Experiments In Physical Chemistry, Rajbog S.W., Aniali Pubn.
17. Wlehov G. J: Standard Methods Of Chemicalanalysis 6th Ed
18. Ramesh Rand Anbu M , Chemical Methods For Envirnmental Analysis : Watewr And Sedient , Macmillion India
19. Akjmetov, N :General And Inorganic Chemistry
20. Aylett, B. And Smith , B. :Problems In Inorganic Chemistry
21. Charlot, G. And Bezier, D.: Quantitative Inorganic Analysis (John Wilry)
22. Douglas, B. E. Mcdanirl, D. H. Et Al : Concept Amd Models Of Inorganic Chemistry (4th Ed) J Wiley
23. Dutt P. K.:General And Inorganic Chemistry (Sarat Book House)
24. Fenton, David E.:Biocoordination Chemistry, Oxford
25. Jolly, W. L. :Inorganic Chemistryu (4 Th Ed) Addison-Wesley
26. Bertini, Et Al:Bioinorganic Chemistry (Viva)
27. Katakis, D. And Gordon, G :Mechanism Of Inorganic Reactions (J. Wiley)

Semester III

ORGANIC CHEMISTRY SPECIALIZATION

Paper IX (Code: 3T1)

Special I-Organic Chemistry

60h (4h/week) 15h/ unit 80 Marks

UnitI: Photochemistry 15 h

Interaction of radiation with matter, types of excitation, rate of excited molecules, quenching, Quantum efficiency, quantum yield, transfer of excitation energy, singlet and triplet states, experimental methods in photochemistry of carbonyl compounds, and transition, Norrish type I and Norrish type II reactions Paterno–Buchi reaction, Photoreduction, Photochemistry of enones, Hydrogen abstraction rearrangement of unsaturated ketones and cyclohexadienones, Photochemistry of parabenzoquinones, photochemistry of Aromatic compounds with reference to isomerisation additon and substitution Photochemical isomerization of cis and trans alkenes, Photochemical cyclization of reaction, Photo-Fries rearrangement, di-pi methane rearrangement, Photo theory reaction of anilides, photochemistry of vision, Applications of photochemical methods in synthesis: Isocomene, Cedrene, Hirsutene

Unit II: Pericyclic Reactions 15 h

Molecular orbital symmetry, Frontier orbitals of ethylene, 1,3-butadiene, 1, 3, 5-hexatriene, allyl system, classification of pericyclic reaction. FMO approach, Woodward-Hoffman correlation diagram method and Perturbation of Molecular Orbital (PMO) approach of pericyclic reaction under thermal and photochemical conditions Electrocyclic reactions, conrotatary and disrotatary motion 4n and (4n+2) systems, Cycloaddition reaction with more emphasis on [2+2] and [4+2], Cycloaddition of ketones Secondary effects in [4+2] cycloaddition. Stereochemical effects and effect of substituents on rate of cycloaddition reaction, Diels-Alder reaction, 1,3-dipolar cycloaddition and chelotropic reaction. Sigmotropic rearrangement, suprafacial, and antarafacial shift involving carbon moieties, retention and inversion of configuration, [3,3] and [3,5] sigmotropic rearrangements, Claisen, Cope, Sommelet-Hauser rearrangements, Ene reaction.

Unit III 15 h

A] Oxidation: Oxidation of alkanes, aromatic hydrocarbons and alkenes, Dehydrogenation with S, Se, Fremy's salt, DDQ, chloranil and $PhI(OAc)_2$, Oxidation with SeO_2, Epoxidation of olefins, Synthetic

application of epoxides, Sharpless asymmetric epoxidation, Dihydroxylation of olefins using $KMnO_4$, OsO_4, Woodward and Prevost dihydroxylation, Oxidative cleavage of olefins, Ozonolysis

a) Oxidation of alcohols: Chromium reagents, pyridinium chlorochromate (PCC), pyridinium dichromate (PDC), Collin and Jones reagent, Combination of DMSO with DCC, $(COCl)_2$, NCS and $(CH_3CO)_2O$ for oxidation of alcohols, Oxidation with MnO_2, Oppenauer oxidation
b) Oxidation of aldehydes and ketones, Conversion of ketones to α, β-unsaturated ketones and α-hydroxy ketones, Baeyer-Villiger oxidation , Chemistry and synthetic applications of $Pb(OAc)_4$, Dess-Martin periiodinane, IBX

B**]** Reduction**:** Catalytic heterogeneous and homogeneous hydrogenation, Hydrogenation of alkenes, alkynes and arenes, Selectivity of reduction, Mechanism and stereochemistry of reduction, Raney Ni-catalyst, Adam catalyst, Lindlar catalyst, Wilkinson catalyst.

a) Reduction by dissolving metals, Reduction of carbonyl compounds, conjugated systems, aromatic compounds and alkynes. Birch reduction, Hydrogenolysis
b) Reduction by hydride transfer reagents, Meerwein-Pondorff-Verley reduction, Reduction with $LiAlH_4$ and $NaBH_4$, stereochemical aspects of hydride addition, Derivatives of $LiAlH_4$ and $NaBH_4$, Selectivity issues, Diisobutylaluminium hydride (DIBAL-H), Sodium cyanoborohydride, Reduction with boranes and derivatives Reduction with Bu_3SnH., Reduction of carbonyl group to methylene, Reduction with diimide and trialkylsilanes

Unit IV**:** Chemistry of P, S, Si,and Boron compounds 15 h

a) Phosphours and sulphur ylide: Preperation and their synthetic application along with stereochemistry
b) Umpolung concept: Dipole inversion, generation of acyl anion, use of 1,3-dithiane, ethylmethylthiomethylsulphoxide, bis-phenylthiomethane, metallated enol ethers, alkylidene dithiane, ketone thioacetals, 2-propenethiobismethyl thioallyl anion, thiamine hydrochloride based generation of acyl anion
c) Organoboranes- preparation and properties of organoborane reagents e.g. RBH_2, R_2BH, R_3B, 9-BBN, catechol borane. Thexyl borane, cyclohexyl borane, $ICPBH_2$, IPC_2BH, Hydrboration-mechanism, stereo and regeoselectivity, uses in synthesis of primary, secondary tertiary alcohols, aldehydes, ketones, alkenes, Synthesis of EE, EZ, ZZ dienes and alkyenes. Mechanism of addition of IPC_2BH. Allyl boranes- synthesis, mechanism and uses
d) Organo silicon compounds in organic synthesis, Me_3SiCl, Me_3SiH and Paterson synthesis

List of books

1] Books as suggested in Semester I for organic chemistry
2] Organic Synthesis, The disconnection approach-S. Warren
3] Designing Organic Synthesis-S. Warren
4] Some Modern Methods of Organic Synthesis-W. Carruthers
5] Advance Organic Chemistry Part-B-F. A. Caray and R. J. Sundberg Plenum Press
6] Protective Group in Organic Synthesis-T. W. Greene and PGM
7] The Chemistry of Organo Phosphorous-A. J. Kirbi and S.G. Warren
8] Organo Silicon Compound-C. Eabon
9] Organic Synthesis via Boranes-H. C. Brown
10] Organo Borane Chemistry-T. P. Onak
11] Organic Chemistry of Boron-W. Gerrard
12] Fundamentals of Photochemistry-K. K. Rohatgi-Mukharji, Wiley Eastern Limited
13] Photochemistry-Cundau and Gilbert
14] Aspects of Organic Photochemistry-W. M. Horspoot
15] Photochemistry-J. D. Calvert
16] Photochemistry-R. P. Wayne

Semester III
Paper X (Code: 3T2)
SpecialII-Organic Chemistry

60h (4h/week) 15h/ unit 80 Marks

Unit – I

15 h

A] Terpenoids: Classification, nomenclature, occurrence, isolation, general methods of structure determination, isoprene rule. Structure determination, stereochemistry, and synthesis of the following representative molecules: Citral, Geraniol, α-terpeneol, Menthol, Farnesol, Zingiberene, Santonin, Phytol, Abietic acid and β-carotene, Vitamin A Genesis of biological isoprene unit, Biosynthesis (ONLY) of the following tepenoids: myrecene, linalool, geraniol, α-terpeneol, limonene, camphor, α-pinene, β-pinene, farnesol, β-bisabolene and squelene

B] Porphyrins: Structure and synthesis of Haemoglobin and Chlorophyll

Unit II 15 h

A] Alkaloids: Definition, nomenclature and physiological action, occurrence, isolation, general methods of structure elucidation, degradation, classification based on nitrogen heterocyclic ring, role of alkaloids in plants Structure, stereochemistry, and synthesis of the following: Ephedrine, (+)-coniine, Nicotine, Atropine, Quinine, Reserpine and Morphine,
Biosynthesis (ONLY) of the followings: hygrine, tropinone, nicotine, pelletierine, conine

B] Prostaglandins: Occurrence, nomenclature, classification, biogenesis and physiological effects. Synthesis of PGE_2 and $PGF_{2\alpha}$

Unit-III 15 h

A] Steroids: Occurrence, nomenclature, basic skeleton, Diel's hydrocarbon and stereochemistry. Isolation, structure determination and synthesis of Cholesterol, Bile acids, Androsterone, Testosterone, Estrone, Progesterone and Aldosterone.
Biosynthesis of steroids (lanosterol)

B] Plant Pigments: Occurrence, nomenclature and general methods of structure determination, isolation and synthesis of Apigenin, Luteolin, Quercetin, Myrcetin, Quercetin-3-glucoside, Vitexin, Diadzein, Butein, Cyanidin-7-arabinoside, Cyanidin, Hirsutidin.
Biosynthesis of flavonoids: Acetate pathway and Shikimic acid pathway

Unit IV: 15 h

A] Carbohydrate: Types of naturally occurring sugars, deoxy sugars, amino sugars, branched chain sugars, methyl ethers and acid derivatives of sugars, general methods of structure and ring size determination with reference to maltose, lactose, sucrose, Chemistry of starch and cellulose.

B] Amino acids, protein and peptides: Amino acids, structural characteristics, acid base property, stereochemistry of amino acids, optical resolution, Stecker synthesis, peptide and proteins structure of peptide and protein, primary, secondary, tertiary and quaternary structure. Reaction of polypeptide, structure determination of polypeptide, Solid phase peptide synthesis, end group analysis.

List of books

1] Chemistry of Alkloids-S. W. Pelletier
2] Chemistry of Steroids-L. F. Fisher and M. Fisher
3] The Molecules of Nature-J. B. Hendricsion
4] Biogenesis of Natural Compound - Benfield
5] Natural Product Chemistry and Biological Significance- J. Mann, R. S Devison, J. B. Hobbs, D. V. Banthripde and J. B. Horborne
6] Introduction to Flavonoids-B. A. Bohm, Harwood
7] Chemistry of Naturally Occurring Quinines-R. H. Thomson
8] The Systematic Identification of Flavonoids- Marby, Markham, and Thomos

9] Text Book of Organic Medicinal Chemistry-Wilson, Geswold
10] Medicinal Chemistry Vol I and II-Burger
11] Synthetic Organic Chemistry -Gurudeep Chatwal.
12] Organic Chemistry of Natural Products Vol I and II-O. P. Agrawal
13] Organic Chemistry of Natural Products -Gurudeep Chatwal
14] A Textbook of Pharmaceutical Chemistry-Jayshree Ghosh
15] Synthetic Dyes Series -Venkatraman
16] Chemistry Process Industries-Shreve and Brink
17] Principal of Modern Heterocyclic Chemistry-L. A. Paquelte
18] Heterocyclic Chemistry-J. Joule and G. Smith
19] Heterocyclic Chemistry-Morton
20] An Introduction to Chemistry of Heterocyclic Compound-J. B. Acheson
21] Introduction to Medicinal Chemistry-A. Gringuadge
22] Wilson and Gisvold Text Book of Organic Medicinal and Pharmaceutical Chemistry-Ed. Robert F Dorge
23] An Introduction to Drug Design-S. S. Pandey and J. R. Demmock
24] Polymer Science-V. Govarikar
25] Principle of Polymer Chemistry-P. J. Flory
26] An Outline of Polymer Chemistry-James Q. Allen
27] Organic Polymer Chemistry-K. J. Saunders

Semester III

Practical-V (Code: 3P1)
Organic Chemistry Special)

12 h /week Marks: 100

[A**]** Quantitative Analysis

Student is expected to carry out following estimations (minimum 6 estimations.)

1. Estimation of Vitamin "C" Iodometry.
2. Estimation of Phenol by $KBrO_3$-KBr.
3. Estimation of Amine by Bromate/ Bromide solution.
4. Estimation of Formaldyde by Iodometry.
5. Estimation of Glucose by Benedict's solution.
6. Estimation of given carbonyl compound by hydrazone formation.
7. Estimation of Aldehyde by Oxidation method.
8. Determination of percentage of number of hydroxyl group in an organic compound by acetylation method.

[B**]** Isolation of Organic Compounds from Natural Source **(**Any six**)**

a) Isolation of caffeine from tea leaves.
b) Isolation of casein from milk (the students are required to try some typical colour reactions of proteins)
c) Isolation of lactose from milk (purity of sugar should be checked by TLC and PC and Rf value reported.)
d) Isolation of nicotine dipicrate from tobacco
e) Isolation of cinchonine from cinchona bark
f) Isolation of piperine from black pepper
g) Isolation of lycopene from tomatoes
h) Isolation of β-carotene from carrots
i) Isolation of cysteine from hair
j) Isolation of oleic acid from olive oil (involving the preparation of complex with urea and separation of linoleic acid
k) Isolation of eugenol from cloves

l) Isolation of (+) limonine from citrus rinds

[C**]** QUALITATIVE ANALYSIS

Separation of the components of a mixture of three organic compounds (three solids, two solids and one liquid, two liquids and one solid, all three liquids and identification of any two components using chemical methods or physical techniques. Minimum 10-12 mixtures to be analyzed.

Semester III

PHYSICAL CHEMISTRY SPECIALIZATION

Paper IX **(**Code**:** 3T1**)**

Special I**-**Physical Chemistry

60h *(*4h/week*)* 15h/unit 80 Marks

UNIT I **:** STATISTICAL THERMODYNAMICS 15h

A**]** Statistical thermodynamics**:** Atomic and Molecular quantum levels, Significance of Boltzmann Distribution law, partition Functions and ensembles, ensemble averaging, postulates of ensemble averaging, canonical, grand canonical and micro canonical ensembles, corresponding distribution laws using Lagranges method of undetermined multipliers*. Ortho and para hydrogen, principle of equipartition of energy, calculation of average energy*

B**]** Partition function, Translational partition function, Rotational partition function, Vibrational partition function, Electronic partition function, Applications of partition functions, Numericals**.**

UNIT II**:** ELECTROCHEMISTRY OF INTERFACES 15h

A**]** Electrode Interfaces**:** Quantum aspects of charge transfer at electrode**-**solution interfaces, quantization of charge transfer, tunneling**.** Semiconductor interfaces**:** Theory of double layer at semiconductor, electrolyte solution interfaces, structure of double layer interfaces, effect of light at semiconductor solution interface**.**

B**]** Electro catalysis**:** Comparison of electro catalytic activity, importance of oxygen reduction and hydrogen evolution reactions, and their mechanism, volcanoes**.**

C**]** Bio**-**electrochemistry**:** Threshold membrane phenomena, Nernst Plank equation, Hodges Huxley equations, core conductor models, electrocardiography**.**

UNIT III**:** CHEMICAL DYNAMICS **-** I 15h

A**]** Dynamics of complex reactions**:** reversible, parallel, consecutive, concurrent and branching reactions, free radical and chain reactions, reaction between Hydrogen **–** Bromine and Hydrogen **–** Chlorine **(**thermal and photochemical**)**, decomposition of ethane, acetaldehyde, N_2O_5, Rice Herzfeld mechanism, Oscillatory autocatalytic and Belousov**-**Zhabotinsky reactions**.**

B**]** Fast Reactions**:** relaxation methods, flow methods, flash photolysis, magnetic resonance method, relaxation time and numericals**.**

UNIT IV**:** PHOTOCHEMISTRY 15h

A**]** Photophysical phenomenon**:** Introduction, photo and photochemical excitation and de**-**excitation, fluorescence, delayed fluorescence, and phosphorescence, fluorescence quenching**:** concentration quenching, quenching by excimer and exciplex emission, fluorescence resonance energy transfer between photoexcited donor and acceptor systems**.** Stern**-**Volmer relation, critical energy transfer distances, energy transfer efficiency, examples and analytical significance, bimolecular collisions, quenching and Stern**-**Volmer equation**.**

B**]** Photochemical reactions**:** photoreduction, photooxidation, photodimerization, photochemical substitution, photoisomerization, photosenitisation, chemiluminescence, photochemistry of environment**:** Green house effect**.**

List of books:

1. G. M. Panchenkov and V. P. Labadev, " Chemical Kinetics and catalysis", MIR Publishing
2. E.A. Moelwyn- Hughes, "Chemical Kinetics and Kinetics of Solutions", Academic
3. K. J. Laidler, Chemical Kinetics, Third Edition (1987), Harper and Row, New York
4. J. Raja Ram and J. C. Kuriacose, Kinetics and Mechanism of Chemical Transformations MacMilllan Indian Ltd., New Delhi (1993)
5. J.G. Calvert and J.N. Pitts, Jr., *Photochemistry,* John Wiley and Sons, New York (1966).
6. K. K. Rohtagi-Mukherjee, *Fundamentals of Photochemistry,* New Age International, New Delhi(1986).
7. R. P. Wayne, *Principles and Applications of Photochemistry,* Oxford University Press, Oxford(1988).
8. N. J. Turro, *Modern Molecular Photochemistry,* Univ. Science Books, Sansalito (1991).
9. J. F. L. Lakowicz, *Principles of Fluorescence Spectroscopy,* 2nd Edition (1999), PlenumPublishers, NewYork.
10. F.W.Sears, " Introdction to Thermodynamics, Kinetic Theory of Gases and statistical mechanics".AddisonWesley
11. H. K. Moudgil, Text Book of Physical Chemistry, Pretice Hall of India, New Delhi, 2010.
12. M. C. Day and J Selbin, Theoretical Inorganic Chemistry, Reinhold Pub. Corp., New York,
13. N. J. Turro, V. Ramamurthy and J. C. Scaiano, Principles of Photochemistry – An Introduction, Viva Books, New Delhi, 2015.
14. G. A. Somorjai, Introduction to Surface Chemistry and Catalysis, Wiley, 2010.
15. M. C. Gupta, Statistical Thermodynamics, New Age International.
16. K. Huang, Statistical Mechanics, Wiley, New Delhi, 2003.
17. Andrew Maczek, *Statistical Thermodynamics,* Oxford University Press Inc., New York (1998).
18. B. K. Agarwal and M. Eisner, *Statistical Mechanics*, Wiley Eastern, New Delhi (1988).
19. D. A. McQuarrie, *Statistical mechanics*, Harper and Row Publishers, New York (1976).
20. J.O.M.Bokris and A.K.N.Reddy, "Modern Elcrtrochemistry". Wiley
21. S. Glasstone, "Introduction to Electrochemistry" Affilisated East West Press, New Delhi.
22. D. R. Crow, " The Principle of electrochemistry", Chapman Hall
23. G. K. Agrawal, Basic Chemical Kinetics, Tata-Mc-Graw Hill Pvt., Ltd. 1990
24. K. L. Kapoor, Text Book of Physical Chemistry, Vol – I to Vol-VI, 2011.

Semester III

Paper X (Code: 3T2)

Special II-Physical Chemistry

60h *(4h/week)* 15h/unit 80 Marks

UNIT-I: QUANTUM MECHANICS - II 15h

A] Applications of Quantum Mechanics: Approximate methods, variation principle, its application in Linear and non-linear functions, MO theory applied to H_2^+ molecule and H_2 molecule (calculation of energy), perturbation theory, application of perturbation theory to helium atom, generation of the concept of resonance.

B] Electronic structure of atoms: Russel Sanders terms and coupling schemes, Slater determinents, term separation energies of the p^n configuration, term separation energies for d^n configuration, magnetic effects: spin orbit coupling and Zeeman splitting.

C] Hybridization, hybrid orbitals in terms of wave functions of s and p orbitals, sp and sp^2 hybridizations, Simple Hückel theory applied to: ethylene, butadiene, cyclobutadiene, cyclopropenyl radical.

Unit II: SOLID STATE REACTIONS AND NANOPARTICLES 15h

A] Solid State Reactions: General principle, types of reactions: Additive, decomposition and phase transition reactions, tarnish reactions, kinetics of solid state reactions, factors affecting the solid state reactions. photographic process.

B] Nanoparticles and Nanostructural materials: Introduction, methods of preparation, physical properties, and chemical properties, sol-gel chemistry of metal alkoxide, application of Nanoparticles, Charecterization of Nanoparticles by SEM and TEM. Nanoporous Materials: Introduction, Zeolites and molecular sieves, determination of surface acidity, porous lamellar solids, composition-structure, preparation and applications.

UNIT-III: ELECTROCHEMISTRY OF SOLUTION 15h

A] Metal/Electrolyte interface: OHP and IHP, potential profile across double layer region, potential difference across electrified interface; Structure of the double layer : Helmholtz-Perrin, Gouy Chapman model, Stern region, Graham Devanathan- Mottwatts, Tobin, Bockris, Devnathan Models.

B] Over potentials, exchange current density, derivation of Butler Volmer equation under near equilibrium and non-equilibrium conditions, Tafel plot

C] Electrical double lever, theories of double layer, electro-capillary phenomena, electro-capillary curve. Electro-osmosis, electrophoreses. Streaming and Sedimentation potentials. Zeta potentials and its determination by electrophoresis, influence of ions on Zeta potential.

UNIT IV: IRREVERSIBLE THERMODYNAMICS 15h

A] Microscopic reversibility and Onsager reciprocity relation, phenomenological equations, Transformation of generalized fluxes and forces. The cyclic version of Clausius' inequality and its integrated form and their correspondence with time's arrow and irreversibility, Clausius' uncompensated heat. Derivation of the differential form of Clausius' inequality.

B] Rate of entropy production and the concept of Chemical affinity and its application to the cases of chemical reactions, coupled reactions, electrochemical reactions. Derivation of Gibbs relation and its DeDonderian version (time rate form) for spatially uniform chemically reacting closed systems, entropy production in spatially non-uniform systems like heat flow, Electrokinetic effect – Saxen relation.

List of books:

1. Ira .N. Levine, Quantum Chemistry, 5th edition(2000), Pearson educ., Inc.New Delhi
2. A.K.Chandra, Introductory Quantum Chemistry, 4th edition (1994), Tata Mcgraw Hill, New Delhi.
3. M.W.Hanna, " Quantum Mechanics in Chemistry", Benjamin
4. L. Pualing and E. B. Wilson, Introduction to Quantum Mechanics with Applications to Chemistry, McGraw Hill, New York (1935).
5. R. K. Prasad, Quantum Chemistry, New Age International, Delhi.
6. R. K. Prasad, Quantum Chemistry through problems and solutions, New Age International, New Delhi, 2009.
7. B. C. Reed, Quantum Mechanics, Jones and Bartlett, New Delhi, 2010.
8. S. Glasstone, An Introduction to Electrochemistry, East-West Press Pvt. Ltd., New Delhi, 2004.
9. D. Mcquarie and J. Simon, Physical Chemistry – A Molecular Approach, University Press, 2000
10. H. K. Moudgil, Text Book of Physical Chemistry, Pretice Hall of India, New Delhi, 2010.
11. S. O. Pillai, Solid State Physics, New Age International, New Delhi, 2102.
12. M. C. Day and J Selbin, Theoretical Inorganic Chemistry, Reinhold Pub. Corp., New York,
13. I Prigogine and R. Defay, Chemical Thermodynamics, Longmans, London, 1954.
14. S. R. DeGroot and P. Mazoor, Non-Equilibrium Thermodynamics, North-Holland Co., Amsterdam, 1969.
15. G. Lebon, D. Jou and Casa Vazquez, Understanding Non-equilibrium Thermodynamics, Springer, 2008.
16. I.Prigoggine, "An Introduction to Thermodynamics of Irreversible Processes," Wiley-Interscience.
17. R. P. Rastogi, Introduction to Non-equilibrium Physical Chemistry, Elsevier, Amsterdam, 2008.
18. J.O.M.Bokris and A.K.N.Reddy, "Modern Elcrtrochemistry". Wiley
19. S. Glasstone, "Introduction to Electrochemistry" Affilisated East West Press, New Delhi.
20. D. R. Crow, " The Principle of electrochemistry", Chapman Hall

21. C.Kittel, " Introduction to solid state Physics",Wiley
22. L.V.Azaroff, " Introduction to solids", McGraw Hill
23. Santosh Kumar Upadhyay, Chemical Kinetics and Reaction Dynamics, Springer 2006.
24. N. B. Hanny, Treaties in Solid State Chemistry, 4th Edn,
25. N. B. Hanny, Solids,
26. Sulbha Kulkarni, Nanotechnology: Principles and Practices, Capital Publishing House, 2011.
27. T. Pradeep, Nano: The Essentials, Tata Mc-Graw Hill, 2012
28. K. L. Kapoor, Text Book of Physical Chemistry, Vol – I to Vol-VI, 2011.
29. N. B. Hanny, "Solid State Chemistry"
30. C. N. R. Rao and Gopalakrishnan, "New Directions in Solid State Chemistry " Second Edition, Cambridge University Press.
31. Anthony R. West, "Solid State Chemistry and its Applications" Wiley India Edition.

Semester III

Practical-V (Code: 3P1)

Physical Chemistry Special

12 h /week Marks: 100

Thermodynamics:

1. Determination of partial molar volume of solute and solvent (ethanol-water, methanol-water, KCl-water mixture)

Solutions:

2. Study the variation of solubility of potassium hydrogen tartarate with ionic strength using a salt having a common ion and hence determine the mean ionic activity coefficients.
3. Determination of temp. dependence of the solubility of a compound in two solvents having similar intermolecular interactions(benzoic acid in water and DMSO – water mixture) and calculation of the partial molar heat of solution.

Phase equilibrium:

4. To study the effect of addition of an electrolyte such as NaCl, KCl,Na_2SO_4,K_2SO_4 etc. on the solubility of an organic acid(benzoic acid or salicylic acid).
5. To determine the heat of crystallization of $CuSO_4$,$5H_2O$
6. To determine the heat of reaction involving precipitation of a salt $BaSO_4$
7. To determine transition temperature of $CaCl_2$ by thermometric method and to determine transition temperature of $CaCl_2$, sodium bromide by solubility method

Kinetics:

8. To determine the activation energy of hydrolysis of an ester by acid.
9. Kinetics of reaction between sodium thiosulphate and KI. Determination of rate constant; study of influence of ionic strength
10. Kinetics of decomposition of H_2O_2 catalysed by iodide ion. Also determination of activation energy of reaction.

Conductometry:

11. Estimate the concentration of H_2SO_4, CH_3COOH, $CuSO_4.5H_2O$ in a given solution by carrying out conductometric titration against NaOH solution.
12. Determine the eq. conductance of strong electrolyte (KCl, NaCl, HCl, KNO_3) at several concentration and hence verify Onsager's equation.
13. Carry out the following precipitation titration conductometrically. a. 50 ml.0.02N $AgNO_3$ with 1N HCl; b.50 ml.0.02N $AgNO_3$ with 1N KCl; c. 50 ml 0.004 N $MgSO_4$ with 0.1 N Ba$(OH)_2$; d. 50 ml 0.002 N $BaCl_2$ with 1 N Li_2SO_4; e. 50 ml.0.02 N $BaCl_2$ with 1N K_2SO_4

Potentiometry:

14. To prepare calomel electrode and to determine the potential of calomel electrode by potentiometry.

15. To determine stability constant of Fe^{3+} with potassium dichromate in presence of dilute sulphuric acid by redox titration.
16. To determine solubility product of Silver chloride by potentiometric method.
17. Determination of redox potential of the couples(**Fe^{2+}/Fe^{3+}**,Co^{3+}/Co^{2+}**,Cr^{3+}/Cr^{2+}**,MnO_4^-/Mn2+(**any two**)** and equilibrium constant.
18. Study of complex formation by potentiometry e.g.Ag^+-$S_2O_3^{-2}$, Fe^{3+}-SCN^-,Ag^+-NH_3(any two) and calculation of stability constant.

Spectrophotometry:

19. To verify Beers law for solution of potassium permanganate and to find molar extinction coefficient.
20. To determine the indicator constant (**pK_{In}**) of methyl orange/red spectrophotometrically.

Polarography:

1. Determination of the half-wave potential of the cadmium ion in 1M potassium chloride solution.
2. Investigation of the influence of dissolved oxygen.
3. Determination of cadmium in solution.
4. Determination of lead and copper in steel.

List of Books

1. Vogel A : A Textbook Of Quantitative Inorganic Analysis, Longman
2. Das and Behra, Practical Physical Chemistry
3. Carl W. Garland, Joseph W. Nibler and David P. Shoemaker, Experiments in Physical Chemistry, Mc-Graw Hill, 8th Edition, 2009.
4. Farrington Daniels, Joseph Howard Mathews, John Warren Williams, Paul Bender, Robert A. Alberty, Experimental Physical Chemistry, Mc-Graw Hill, Fifth Edition, 1956.
5. John W. Shriver and Michael George, Experimental Physical Chemistry, Lab Manual and Data Analysis, The University of Alabama in Huntsville, Fall 2006
6. Day And Underwood :Quantitative Analysis
7. Merits And Thomas:Advanced Analytical Chemistry
8. Ewing, G. W. : Instrumental Methods of Chemical Analysis, Mcgraw-Hill
9. Drago, R.S:Physical Methoods In Inorganic Chemistry
10. Christain G.D:Analytical Chemistry
11. Khopkar S.M.:Basic Concept Of Analytical Chemistry
12. Koltath And Ligane:Polorography
13. Braun:Instrumental Methods Of Chemical Analysis
14. Willard, Merritt And Dean: Instrumental Methods Of Chemical Analysis ,Van Nostrand
15. Strouts,Crifi;Llan And Wisin: Analytiacl Chemistry
16. Skoog S.A. And West D. W.:Fundamental of Analytical Chemistry
17. Dilts R.V.: Analytiacl Chemistry
18. Jahgirdar D.V :Experiments In Chemistry
19. Chondhekar T.K: Systematic Experiments In Physical Chemistry, Rajbog S.W., Aniali Pubn.
20. Wlehov G. J: Standard Methods Of Chemicalanalysis 6th Ed

Semester III

ANALYTICAL CHEMISTRY SPECIALIZATION

Paper IX(Code: 3T1)

Special I-Analytical Chemistry

60h (4h/week) 15h/unit 80 Marks

Unit-I: Radioanalytical Chemistry-I 15h

Radioactivity-Radiation-Units-Curie, Becquerel, Gray, Rad, Sievert, RBE, REM, Half life, mixed half life, branching decay, different types of radiations and their interactions with matter, radioactive

equilibrium, Elementary principles of GM and proportional counters, Gamma Ray Spectrometer, Ionization chamber, HPGe detector, NaI(Tl) detector, calibration using standard sources, resolution, numericals.

Unit-II:Optical methods of analysis-III 15h

Atomic absorption spectroscopy: Principle. Atomic energy levels. Grotrian diagrams. Population of energy levels. Instrumentation. Sources: Hollow cathode lamp and electrodeless discharge lamp, factors affecting spectral width. Atomizers: Flame atomizers, graphite rod and graphite furnace. Cold vapour and hydride generation techniques. Factors affecting atomization efficiency, flame profile. Monochromators and detectors. Beam modulation. Detection limit and sensitivity. Interferences and their removal. Comparison of AAS and flame emission spectrometry. Applications of AAS.

Unit-III: Electrochemical methods of analysis-III 15h

Stripping Voltammetry: Principle and technique in anodic and cathodic stripping voltammetry, applications to metal ion analysis, limitations.

Adsorptive stripping voltammetry: Principle, technique, applications to metal ions and organic analysis. Advantages over anodic stripping voltammetry. Catalytic effects in voltammetry.

Working electrodes: Mercury electrodes, carbon electrodes, film electrodes.

Cyclic voltammetry: Principle and technique. Randles-Sevcik equation. Interpretation of voltammogram- reversible, irreversible and quasi-reversible systems. Applications of cyclic voltammetry in study of reaction mechanism and adsorption processes.

Electrochemical sensors (Chemically modified electrodes): Biosensors, catalytic sensors and gas sensors.Comparison of voltammetry with AAS and ICP-AES.

Unit-IV: Miscellaneous techniques-I 15h

Fluorometry and phosphorimetry: Principles of fluorescence and phosphorescence. Jablonski diagram. Concentration dependence of fluorescence intensity. Fluorescence quenching. Instrumentation. Applications.

Nephelometry and turbidimetry: Principle, instrumentation and applications.

*Photoacoustic spectroscopy:*Theory. Instrumentation. Advantages over absorption spectroscopy. Chemical and surface applications of PAS.

Electrogravimery: Theory of electrolysis. Electrode reactions. Decomposition potential. Overvoltage. Characteristics of deposits and completion of deposition. Instrumentation. Application in separation of metals.

Semester III

Paper X(Code: 3T2)

Special II-Analytical Chemistry

60h *(4h/week)* 15h/unit 80 Marks

Unit-I: Organoanalytical Chemistry 15h

Elemental analysis: Outline of macro, semi-micro, micro and ultra-micro analysis, semi-micro determination of carbon, hydrogen, halogen, sulphur, nitrogen, phosphorous, arsenic, boron and metals in organic compounds.

Functional group analysis: Semi-micro determination of the following functional groups in organic compounds- hydroxyl, amino, nitro, nitroso, azo, N-acetyl, O-acetyl, methyl, aldehydes, ketones, thio, disulphide, sulphonamide, unsaturation and active hydrogen.

KF reagent: Karl Fischer reagent and its use in analysis of water in organic compounds.

Unit-II: Analysis of ores and cement

15h

Ores: Composition and analysis of the followings ores- Bauxite, Pyrolusite, Dolomite, Chromite.
Portland cement: Composition, raw material, manufacturing processes, characteristics, analysis.

Unit III: 15h

Water pollution and analysis: Sources of water pollution, composition of potable water, importance of water analysis, sampling and sample preservation, physico-chemical analysis of water. Mineral analysis (temperature, pH, conductivity, turbidity, solids, alkalinity, chloride, fluoride, sulphates, hardness), Demand analysis (DO, BOD, COD, TOC), nutrients (nitrogen-total, nitrate, nitrite, phosphate) and heavy metals (As, Cd, Cr, Hg and Pb). A brief idea of coagulation and flocculation. Water treatment plants: Sand filters and other types of filters.

Unit-IV: Air pollution and analysis 15h

Air pollution and analysis-classification of air pollutants, sources of air pollution and methods of control, sampling of aerosols and gaseous pollutants and their effects, SO_2, NO_2, CO, CO_2, particulates-SPM, RSPM, High Volume Sampler, Fabric Filters, Cyclones (direct and Reverse), ESP, ozone layer, Green house effect, Heat Islands, Acid Rain.

List of books:

1. Essentials of Nuclear Chemistry: H. J. Arnikar (Willey Eastern Ltd)
2. Substoichiometry in Radioanalytical Chemistry: J. Ruzicka and J Stary (Pergamon Press)
3. Introduction to Radiation Chemistry: J. W. T. Spinks and R. J. Woods
4. Radiochemistry: A. N. Nesmeyanov (Mir Publications)
5. Instrumental Methods of Analysis: Willard, Meriit and Dean(Van Nostrand)
6. Instrumental Methods of Analysis: G. Chatwal and S. Anand (Himalaya Publishing House)
7. Vogel's Text Book of Quantitative Inorganic Analysis: Bassett, Denney, Jeffery and Mendham (ELBS)
8. Advanced Analytical Chemistry: Meites and Thomas (McGraw-Hill)
9. Atomic Absorption Spectroscopy: Robinson (Marcol Dekker)
10. Instrumental Methods of Chemical Analysis: Braun (Tata McGraw-Hill)
11. Analysis of Water: Rodier
12. Laboratory manual of water analysis: Moghe and Ramteke (NEERI)
13. Electroanalytical chemistry: Joseph Wang
14. Electroanalytical stripping methods: Brainina and Neyman (Wiley-Interscience)
15. Trace analysis: S. Lahiri (Narosa Publishing House)
16. Electroanalytical Chemistry: Bard (Marcel-Dekker)
17. Chemistry in Engineering and Technology- Vol I and II: J.C. Kuriacose and J. Rajaram (Tata-McGraw Hill)

Semester III

Practical-V (Code: 3P1)

Analytical Chemistry Special

12 h /week Marks: 100

pH-metry

1. Determination of percent Na_2CO_3 in soda ash by pH-metric titration.
2. Determination of isoelectric point of amino acid.
3. Determination of three dissociation constants of phosphoric acid.

Conductometry

1. Displacement titration of CH_3COONa with HCl.
2. Precipitation titration of $MgSO_4$ and $BaCl_2$.

3. Titration of mixture of CH_3COOH, H_2SO_4 and $CuSO_4$ with NaOH.

Potentiometry

1. Estimation of Cl^-, Br^- and I^- in a mixture.
2. Determination of percent purity of phenol by potentiometric titration with NaOH.
3. Estimation of acids in mixtures.

Coulometry

1. Estimation of nickel and cobalt by coulometric analysis at controlled potential.
2. Analysis of antimony (III) with I_3^- .

Polarography

1. Determination of $E_{1/2}$ of Cd^{2+} and Zn^{2+} at DME.
2. Estimation of Cd^{2+} and Zn^{2+} in respective solutions by calibration curve and standard addition methods.
3. Determination of composition /stability constant of complex.

Cyclic voltammetry

1. Study of cyclic voltammograms of $K_3[Fe(CN)_6]$.

Electrogravimetry

1. Estimation of nickel and copper individually as well as in mixture.

Polarimetry

1. Inversion of cane sugar in the presence of HCl.
2. Determination of percentage of two optically active substances (d-glucose and d-tartaric acid) in mixture.

Colorimetry**/**spectrophotometry

1. Simultaneous determination of chromium and manganese in given mixture.
2. Simultaneous determination of two dyes in a mixture.
3. Estimation of Mn in steel.
4. Estimation of Cu/Ni in alloys.
5. Estimation of iron in water sample using 1,10-phenanthroline.
6. Estimation of Fe(III) in given solution by photometric titration with EDTA (salicylic acid method).

Flame photometry

1. Estimation of Li, Na, K, Ca in rock/ soil / water samples.

Turbidimetry and nephelometry

1. To determine molecular weight of polymer.
2. Estimation of sulphate in water sample by turbidimetry.
3. Estimation of phosphate by nephelometry.

Radioanalytical techniques

1. GM-counter: Plateau, nuclear statistics, half thickness of aluminium absorbers, dead time.
2. Gamma ray spectrometer: Calibration using standard sources, determination of half life (Mn-56, I-128, In-116)
3. Experiments based on radiation chemistry: G-value-$G(NO_2^-)$.

Demonstrations

1. UV-spectrophotometry

Semester III

Paper XI **(**Code**:** 3T3**)**

Elective**-** Nuclear Chemistry

60 h (4 h per week): 15 h per unit 80 Marks

Unit**-I:** Radioactive decay 15h

Various modes of decay, natural radioactivity, successive radioactive decay and growth kinetics, radioactive equilibrium, half life, half life of mixed radioisotopes, decay schemes, its determination by experimental methods, statistical nature of nuclear radiation, treatment of nuclear data and calculation of standard deviation, probability

Unit-II: Nuclear structure 15h

mass-energy relationship, nuclear binding energy, semi-empirical mass formula, nuclear stability rules, nuclear properties, mass size, spin and parity, nature of nuclear forces, liquid drop model, shell model, its evidence and advantages, comparison of the two models, calculations based on above.Energetics of nuclear reaction, cross reaction, comparison with chemical reactions, various types of nuclear reactions, photonuclear, spallation and thermonuclear reaction

Unit-III: Interaction of radiations with matter,detectors 15h

Interaction with matter and detection of gamma rays with matter by photoelectric, Compton and pai production, interaction of beta particles, neutrons and heavy charged particles, various methods of detecting nuclear radiations, gas filled counters, ionization chamber, proportional and GM counters, scintillation detector and solid state detectors- Ge(Li), Si(Li) and HPGe.

Unit-IV: Nuclear fission and Fusion 15h

Probability, mass and charge distribution, release of energy and neutrons, spontaneous fission, nuclear reactors and their uses for power production, brief idea about thermal and fast breeder reactors, reprocessing of nuclear fuel, PUREX process, heavy water- manufacturing and use in reactors. accelerators, nuclear fusion. Production of isotopes by nuclear reactions, production of new elements, radioactive waste management and disposal

Semester III

Practical VI–Elective (Code: 3P3)

Nuclear Chemistry Practical

12 h per week Marks-100

1. Working of GM counter, plateau, statistics, geometry effects, dead time, energy of beta particle, back scattering
2. Working of gas flow proportional counter, plateau, statistics, geometry effects, dead time, energy of beta particle
3. Working with scintillation counter, gamma ray spectra, energy calibration and resolution, half life determination of single and composite nuclei.
4. Radiochemical separation of ^{234}Th from natural uranium salt and its half life determination
5. Experiment on Neutron Activation Analysis by non-destructive method
6. Dose measurement by Fricke and other chemical dosimeters
7. Radiolysis of potassium nitrate, methyl iodide, carbon tetrachloride-iodine systems
8. Szilard-Chalmers reactions with inorganic and organic systems, potassium permanganate and methyl iodide
9. Some trace experiments like partition coefficient, solubility product, isotopic exchange, isotope dilution analysis, radiochromatography, ion exchange.

List of books:

1. H. J. Arnikar - Essentials of Nuclear Chemistry (Willey Eastern Ltd)
2. G. Friendlander, J. W. Kennedy,E. S. Macias and J. M. Miller-Nuclear and Radiochemistry (Wiley Intersciences, New York)
3. G. R. Choppin and J. Rydberg- Nuclear Chemistry-Principles and Applications(Pergamon press, London)
4. B. G. Harvey-Introduction to Nuclear Physics and Chemistry(Prentice Hall of India)
A. N. Nesmeyanov - Radiochemistry- (Mir Publications)
5. M. N. Sastry-Introduction to Nuclear Science, Affiliated East-West Press, New Delhi
6. G. Hughes- Radiation Chemistry- Oxford University Press, London

7. V. Verschinskii and A. K. Pikeav-Introduction to Radiation Chemistry, Israel Publication, Jerusalem-Robinson (Marcol Dekker)
8. Farhat Aziz and M. A. J. Radgers-Radiation Chemistry-Principles and Applications, VCH Publishers FRC.
9. M. Hassinsky-Nuclear Chemistry and its application, Addison Wesley

Semester III

Paper XI (Code: 3T3)

Elective- Environmental Chemistry

60 h (4 h per week): 15 h per unit 80 Marks

Unit -I: Concept and scope of Environmental Chemistry 15 h

Biosphere, Lithosphere, Hydrosphere and Atmosphere, Ecological principles- aspects of ecology, classification,types of ecosystems. Biogeochemical cycles- carbon, nitrogen, phosphorous, oxygen, hydrogen, sulphur, iron, sodium, potassium, magnesium, cobalt, mercury, lead, zinc and cadmium.
Thermal pollution—sources, harmful effects and prevention of thermal pollution.
Noise pollution --- sources, effects and control of noise pollution.

Unit-II: Water 15 h

Origin, physico-chemical properties of water, sources of water, hydrological cycle, criteria ofwater quality, Water management- water shed management, rain water harvesting, waterpollution-sources, consequences and harmful effects of water pollution, strategies for waterpollution control.

Unit-III: Air 15 h

Major regions of the atmosphere, composition of the atmosphere, temperature inversionand air pollution episodes, photochemistry of the atmosphere, depletion of the stratosphericozone, green house effect, green house gases, remedial measures for reversion of green house effect, acid rain, photochemical smog, particulate matter.

Unit-IV: 15 h

Soil: Chemical and mineralogical composition of soil, classification of soil, types of soil- saline and alkaline, physical properties – texture, bulk density, permeability, chemical properties—Ion exchange capacity, soil pH and micro and macro nutrient availability. Soil management—Management of saline and alkaline soil, soil indicator plants,
Radioactive Pollution: Introduction to radiation chemistry, sources of radioactive pollution, effects of radioactivepollution, nuclear disasters in the two decades, protection from radiation, control of radiation.

Semester III

Practical VI–Elective (Code: 3P3)

Environmental Chemistry Practical

12h per week Marks-100

WATER ANALYSIS

1 Sampling of water-tap water, overhead storage tank water, pond water and lake water
2 Physico –chemical and organoleptic characteristics of the above water sample
3 Statistical evolution of the data obtained for optimization of result
4 Determination of total solids, total dissolved solids and total suspended solids and its significance
5 Determination and comparison of chlorine content in tap water, storage tank and swimming pool
6 Determination of acidity and alkalinity in water samples
7 Determination of total, permanent and temporary hardness of water sample
8 Determination of DO, COD, and BOD of water sample

9 Analysis of chemicals used in water and waste water treatment-alum, bleaching powder, activated carbon
10 Analysis iron and manganese in water sample by visual titrimetry
11 Analysis of copper and nickel in water sample by Spectrophotometry
12 Analysis of phenol in water sample by Spectrophotometry
13 Analysis of nitrite in water sample by Spectrophotometry
14 Analysis of chromium in water sample
15 Analysis of chloride in water sample
16 Analysis of sulphate in water sample
17 Determination of turbidity of a given water sample
18 Estimation of Na, K, by flame photometry in given water

AIR ANALYSIS

1 Determination of SOx and NOx and TSPM **(**total suspended particulate matter**)** and RSPM in ambient air

SOIL ANALYSIS

1 Analysis of different types of soil like pH, conductivity, alkalinity etc**.**
2 Determination of N,K, P of soil by flame photometry
3 Analysis of nutrients**-**nitrogen **(**total, ammonia, nitrite & nitrate **)**, phosphate total
4 Determination of macro &micro nutrients in soil

List of books

1. Water analysis : J. Rodier
2. A Text book of Inorganic Analysis : A.I.Vogel
3. Colorimetric Determination of metals : E.B.Sandell
4. Environmental Chemistry : Moore J W and Moore E A. Academic Press, New York, 1976.
5. Environment and Man Vol VII: The Chemical Environment Edited by J Lenihar and W Fleecher Vlackie Publication, 1977.
6. The Chemistry of Environment: R A Horne, Wiley Interscience Publication 1978.
7. Fundamentals of Air Pollution: A C Stern
8. Instrumental Methods of Analysis: Willard,Merrit and Dean
9. Analytical Chemistry: Meites and Thomas
10. Standard Methods for Examination of water and waste water: A E Greenberg, A D Eaton, APHA, AWWA,WEF
11. Chemistry for Environmental Engineering and Science: C N Sawyer, P L McCarty and G F Parkin
12. Laboratory Manual for the Examination of Water, waste water and soil: H H Rupa and H Krist, V C H Publication
13. Manual on Water and Waste water analysis: D S Ramteke and C A Moghe, NEERI
14. Environmental Chemistry: B K Sharma and H Kaur
15. Environmental Chemistry: A K De
16. Environmental Pollution- Management and control for sustainable Development: R K Khatoliya
17. Environmental Chemistry: A K Bhagi and G R Chatwal

Semester III

Paper XI **(**Code**:** 3T3**)**

Elective**-** Polymer Chemistry

60 h (4 h per week): 15 h per unit 80 Marks

Unit-I: Introduction to polymers 15h

Nomenclature and classification of polymers, Polymerization: condensation, addition, radical chain-ionic and co-ordination and co-polymerization and their mechanisms, Types of polymers- linear, branched, crosslinked, ladder, thermoplastic, thermosetting, fibres, elastomers, natural polymers, addition and condensation polymers.Stereoregular polymers- atactic, syndiotactic and isotactic.

Unit-II: Molar mass and its determination 15h

Molecular mass and molar distribution. Number average, mass average, viscosity, average molecular mass and relation between them. Molecular mass distribution. Determination of molecular mass- Osmometry (membrane and vapour phase), light scattering, gel permeation chromatography, sedimentation and ultracentrifuge, viscosity method and end-group analysis.

Unit III: Physical characteristics of polymers 15h

Morphology and order in crystalline polymers. Configuration of polymer chains, crystal structure of polymers. Morphology of crystalline polymers, strain-induced morphology, crystallization and melting. The glass transition temperature (Tg), relationship between T_g and T_T, Effect of molecular weight, dilments, chemical structure, chain topology, branching and cross linking. Methods of determination of glass transition and crystallinity of polymers.

Unit IV: Commercial polymers 15h

A) Organic polymers: Commercial polymers, synthesis and and application of polyethylene, Cellulose Acetate, PMMA, polyaimdes, polyesters, Urea resins and eposy resins.

B) Functional polymers: Fire retarding polymers and conducting polymers, biomedical polymers.

Semester III

Practical VI – Elective (Code: 3P3)

Polymer Chemistry Practical

12h per week Marks-100

1. Synthesis of polymers:
   a) Synthesis of Thiokol rubber (condensation)
   b) Urea-formaldehyde (condensation)
   c) Glyptal resin: glycerine phthalic acid (crosslinked Polymer Chemistry)
   d) Polyacryonitril (bulk polymerization)
   e) Polyacryonitril (emulsion polymerization)
   f) Polymethylomethacrylate (emulsion of suspension Polymer Chemistry)
   g) Nylon-66 (interfacial polycondensation)
   h) Coordination polymers
   i) Conducting polymer (electro- or peroxodisulphate oxidation)
2. Characterization of polymers:
   a) End-group analysis
   b) Viscosity and molecular mass
   c) Density of polymer by flotation methods
   d) IR spectra.
3. Purification and fractionation of polymer, polystyrene, Nylon 66, PMMA.
4. Magnetic and electrical properties of polymers, magnetic susceptibility and electrical conductivity of coordination and conducting polymers.
5. Thermal analysis and degradation of polymers:
   i. TGA: Isothermal and non-isothermal;
   ii. DTA: Glass transition temperature and melting point
6. Crystallinity of polymers by density measurement.
7. Swelling and solubility parameters of polymers.
8. Synthesis of Graft-Polymers and its characterization by density and IR spectra.
9. Dielectric behavior of polymers.
10. Kinetics of polymerization:
    a) Polycondensation
    b) Peroxide initiation polymerization.

List of books:

1. Textbook of polymer science: F.W. Billmayer Jr. Wiley.
2. Polymer science: V.R. Gowarikar, N. V. Viswanathan and J. Sreedhar, Wiley-Eastern.

3. Fractional monomers and polymers: K Takemoto, Y. Inaki, and R.M. Ottam Brite.
4. Contemporaty polymer chemistry: H.R. Alcock and F. W. Lambe, Prentice Hall.
5. Principles of polymer Chemistry: Flory, Cornell Univ. press.
6. Introduction to polymer chemistry: R. B. Seymour, McGraw Hill.
7. Principles of polymerization: Odian.
8. A first course in polymer chemistry: A. Strepikheyew, V. Derevistkay and G. Slonimasky, Mir Publishers, Moscow.
9. Laboratory preparation of macro chemistry: EMM effery, McGraw Hill Co.
10. A practical course in polymer chemistry: S.J. Punea , Pergamon Press.

Semester III

Paper XI Elective (Code: 3T3)

Medicinal Chemistry

60 h (4 h per week): 15 h per unit 80 Marks

UNIT-I: 15 h

Drug Design:

Development of new drugs, factors affecting development of new drugs, sources of lead compounds, serendipity and drug development. Concept of QSAR, QSAR methods and parameters, procedure followed in drug design, structure activity relationship (SAR) method, Free and Wilson analysis, Hansch analysis, concept of prodrugs and softdrugs, SOFT DRUGS, isosterism, bioisosterism, drug receptors, theories of drug action, types of reversible enzyme inhibitors, some special inhibitors and design of inhibitors.

UNIT-II: 15 h

A] **Pharmacokinetics and pharmacodynamics:** Indroduction drugs absorption, distribution and disposition of drugs, excretion and elimination, Pharmacokinetics of elimination and Pharmacokinetics in drug development process.
Pharmacodynamics: Introduction, enzyme stimulation, enzyme inhibition, membrane active drugs, drugs metabolism, biotransformation and significance of drug metabolism

B] **Diuretics:** Introduction, mode of action, loop diuretics. Synthesis of Bumetanide, Frusemide, Ethacrynic acid, clorexolone Quinethazone.

C] **Analgesics and Antipyretics:** Introduction, mode of action, evaluation of analgetic agents.Synthesis of: Aspirin, salsalate, phenacetin, phenylbutazone, Indomethacin, Analgin.

UNIT-III: 15h

A] **Cardiovascular Drugs:** Introduction, cardiovascular diseases, Synthesis and uses of cardiovascular drugs; amyl nitrate, diltiazem, varapamil, methyldopa, atenolol, sorbitrate, quinidine, oxyprenolol

B] **Antineoplastic Agent:** Introduction, mechanism of tumor formation, treatment of cancer, types of cancer chemotherapy, role of alkylating agents and antimetabolites in treatment of cancer, carcinolytic antibiotics, mitotic inhibitors, harmones, natural products. Synthesis of melphalan , thiotepa, lomustine

UNIT-IV: 15 h

A] **Psychoactive drugs:** Introduction, neurotransmitters, structure of nerve cell, chemical transmitters, CNS depressants, sedative and hypnotics, Synthesis of Barbiturates, Phenobarbital, thiopental sodium, diazepam, lorazepam, bromazepam, ethosuximide, general anaesthetic: Antianxiety drugs, synthesis of oxazepam, alprazolam, puspirone, antipsychotic drugs and antidepressant drugs, MAO inhibitors, antimanic drugs, synthesis of thiopental sodium, ethiosuxmide, glutethimide, trimethadione, phenytoin.

B] Coagulant and Anticoagulants: Introduction, factors affecting coagulant and anti-coagulant. Mechanism of Blood coagulation and Anticoagulation. Structure of Vitamin K1, Vitamin K2 and heparin. Synthesis of Coumarins and indanediones.

Semester III

Practical VI–Elective (Code: 3P3)

Medicinal Chemistry Practical

12 h per week Marks-100

1. Volumetric estimation of Ibuprofen.
1. Estimation of aspirin by volumetric and instrumental methods.
2. Analysis of ascorbic acid in biological/tablet sample.
3. Determination of paracetamol by colorimetry.
4. Analysis of ampicillin trihydrate.
5. Determination of vitamin B12 in commercial sample by spectrophotometry.
6. Determination of phenobarbitone in given cough syrup.
7. Determination of tetracycline in given capsule.
8. Determination of iron, calcium and phosphorus from milk or drug sample.
9. To perform I.P. monograph of tablet.
10. Estimation of chloride in serum and Urine.
11. Separation and determination of sulpha drugs in tablets or ointments.

Preparation of Drugs: Synthesis, purification and identification of (8-10) of the following drugs.

1. Benzocaine from p-nitrobenzoic acid.
2. Dapsone from diphenyl sulphone.
3. Paracetamol from p-nitro phenol.
4. Uracil from sulphanil amide.
5. Diphenyl hydantion from benzoin.
6. Aluminium asprin from salicylic acid.
7. 4,6-diphenyl-thiazine from chalcone.
8. 6/8 nitro coumarin from resorcinol.
9. Copper aspirin from salicylic acid.
10. N-acetyl parabanic acid.
11. Nerolin from 2-naphthol
12. Phenothiazine from diphenylamine
13. Umbelliferon from resorcinol
14. Benzylidene from benzaldehyde and aniline
15. 1-phenyl-1,2-pentadine-3-one from benzaldehyde
16. 1,5 diphenyl-1,3-pentadiene-2-one from benzaldehyde
17. 1,3-diphenyl-prop-2-ene-1-one
18. 3-methy pyrazol-5-one from ethylacetoacetate
19. 6-methyl uracil
20. Sulphanilamide from acetanilide

List of books:

1. Text book of organic medicinal chemistry-Wilson,Geswold
2. Medicinal chemistry Vil I and II-Burger
3. A textbook of pharmaceitical chemistry-Jayshree Ghosh
4. Introduction to medicinal chemistry-A Gringuadge
5. Wilson andGisvold text book of organic medicinal and pharmaceutical chemistry-Ed.Robert F Dorge
6. An introduction to drug design-S S Pandey,and JR Demmock
7. Goodman and Gilmans pharmacological basis of therapeutics- Stragies for organic drug sythesis and design-D Lednicer

8. Textbook of Medicinal Chemistry- A. Kar
9. Medicinal Chemistry – D Sriram and P. Yogeeswari

Semester III

Paper XII (Code: 3T4)

Foundation Course - IApplied Analytical Chemistry– I

60 h (4 h per week): 15 h per unit 80 Marks

Unit-I: Analysis of Pesticides and Fertilizers 15h

Pesticides: General introduction, analysis of pesticides in general with reference to DDT, Dieldrin, Malathion, Parathion, BHC by different analytical methods such as titrimetric, colorimetric, chromatography and electroanalytical methods.

Fertilizers: Sampling and sample preparation, determination of water, total nitrogen, urea, total phosphates, potassium, acid or base forming quality.

Unit-II: Forensic chemistry 15h

Introduction. Classification of poisons on the basis of physical states, mode of action and chemical properties with examples of each type. Methods of administration. Action of poisons in body. Factors affecting poisoning. Study of some common poisons used for suicide. Signs and symptoms of As, Pb, Hg and cyanide poisoning. Poisonous effects of kerosene and cooking gas.

Unit-III:Analysis of petroleum and petroleum products 15h

Introduction, determination of flash and fire point, Pensky Marten's apparatus, cloud and pour point, aniline point, drop point, viscosity and viscosity index, Redwood and Saybolt viscometer, API specific gravity, water and sulphur in petroleum products, carbon residue, corrosion stability, decomposition stability, emulsification, neutralization and saponification number.

Unit-IV: Analysis of alloys 15h

Definition of alloy. phase diagrams of Fe-C, Pb-Sn, Pb-Ag systems and their applications. Types of steel: hypoeutectic, hypereutectic steels, mild steel, and stainless steel. Uses of steel. Composition and uses of brass, bronze and soldering alloy. Analysis of iron, nickel, chromium and manganese in steel. Analysis of copper and zinc in brass, lead and tin in soldering alloy. Industrial applications of alloys.

OR

Semester III

Paper XII (Code: 3T4)

Core Subject Centric - I: Spectroscopy– I

60 h (4 h per week): 15 h per unit 80 Marks

Unit - I: Symmetry properties of molecules and group theory: 15h

Symmetry elements and symmetry operations. Properties of group. Point groups and Schoenflies symbols. Symmetry operations as a group. Matrix representations of groups. Multiplication table for C_{2v}, C_{3v} and C_{2h}. Reducible and irreducible representations. Similarity transformation. Classes of symmetry operations. Great Orthogonality Theorem. Derivation of character tables for H_2O and NH_3 using Great Orthogonality Theorem. Application of character tables in selection rules of IR, Raman and Electronic spectroscopy.

Unit - II: 15h

A] Mass spectrometry: Theory, ion production(EI, CI, FD, FAB), ion analysis, ion abundance, isotopic contribution, N-rule, types of fission processes, high resolution mass spectrometry, metastable peak, molecular ion peak, Mclaffferty rearrangement, mass spectral fragmentation of organic compounds alkanes, alkenes, alkynes, alcohols, amines, amides, acids, aldehydes, ketones, halides, Structure determination of organic molecules by mass spectrometry, problem based on mass spectral data

B] Mössbauer spectroscopy: Basic principle, experimental techniques, recoil emission and absorption, source, absorber, isomer shift, quadrupole interaction, magnetic hyperfine interaction,

applications in determining electronic structure, molecular structure, crystal symmetry, magnetic structure, surface studies, biological applications.

Unit **-** III**:** 15h

A**]** Microwave spectroscopy: Classification of molecules on the basis of M.I., rigid and non rigid rotor, effect of isotopic substitution on transition frequencies, stark effect, microwave spectrometer, application in deriving: molecular structure, dipole moment, atomic mass and nuclear quadrupole moment.

B**]** ESR spectroscopy: Introduction, principle of ESR, ESR spectrometer, hyperfine coupling, zero field splitting, factors affecting g values, Kramer's degeneracy, application of ESR spectra to study free radicals like hydrogen, methyl radical, 1,4-semibenzoquinone, naphthalene, transition metal complexes, biological systems.

Unit IV**:** 15h

A**]** Infrared spectroscopy: Diatomic molecules: 1) Molecules as harmonic oscillator, Morse potential energy function, vibrational spectrum, fundamental vibrational frequencies. Force constant, zero point energy, isotope effect. The Anharmonic oscillator, the interactions of rotations and vibrations. P,Q,R branches, vibration of polyatomic molecules, selection rules, normal modes of vibration, group frequencies, overtone and combination frequencies. Structure determination of organic molecules by IR spectroscopy, problem based on IR spectral data

B**]** Raman Spectroscopy: Rayleigh scattering. Raman Scattering, classical and quantum theories of Raman effect. Rotational Raman Spectra for linear and symmetric top molecules. Vibrational Raman Spectra, rotational fine structure. Selection rules, coherent antiStokes Raman spectroscopy, Structure determination from Raman and Infra-red spectroscopy.

List of books

1] Spectroscopic identification of organic compound-RM Silverstein,GC Bassler and TC Morril, John Wally
2] Introduction to NMR spectroscopy-R. J. Abraham, J. Fisher and P Loftus Wiely
3] Application of Spectroscopy to Organic Compound-J. R. Dyer, Printice Hall
4] Organic Spectroscopy-William Kemp, ELBS with McMillan
5] Spectroscopy of Organic Molecule-PS Kalsi, Wiley, Esterna, New Delhi
6] Organic Spectroscopy-RT Morrison and RN Boyd
7] Practical NMR Spectroscopy-ML Martin, JJ Delpench, and DJ Martyin
8] Spectroscopic Methods in Organic Chemistry-DH Willson, I Fleming
9] Fundamentals of Molecular Spectroscopy-CN Banwell
10] Spectroscopy in Organic Chemistry-CNR Rao and JR Ferraro
11] Photoelectron Spectroscopy-Baber and Betteridge
12] Electron Spin Resonance Spectroscopy-J Wertz and JR Bolten
13] NMR –Basic Principle and Application-H Guntur
14] Interpretation of NMR spectra-Roy H Bible
15] Interpretation of IR spectra-NB Coulthop
16] Electron Spin Resonance Theory and Applications-W gordy
17] Mass Spectrometry Organic Chemical Applications, JH Banyon

Semester III

Seminar**-**III **(**Code**:** 3S1**)**

2 h /week Marks: 25

Seminar of 30 minutes duration will be a part of internal assessment for 25 marks (1 Credit). Seminar should be delivered by the student under the guidance of concerned teacher on the topic allotted by the teacher. The topic will be related to the syllabus. Marks will be allotted by a group of teachers.

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M.Sc. Chemistry Semester IV
INORGANIC CHEMISTRY SPECIALIZATION
Paper XIII(Code: 4T1)
Special I-Inorganic Chemistry

60h (4h/week) 15h/ unit 80 Marks

Unit-I 15h

A) Nanoparticals & Nanostructural materials :Introduction, methods of preparation, physical properties, and chemical properties. Molecular Precursor routes to inorganic solids:- Introduction, sol-gel chemistry of metal alkoxide, hybrid organic-inorganic compounds. Nanoporous Materials: Introduction, Zeolites & molecular sieves, determination of surface acidity, porous lamellar solids, composition-structure, preparation & applications.

B) Solid State Reaction: General principles, reaction rates, reaction mechanism, reaction of solids, factors influencing reactivity, photographic process.

Unit-II 15h

A) Coordination Polymers:Coordination polymers and their classification. Synthesis and applications of coordination polymers. Use of polymeric ligands in synthesis of coordination polymers. Organosilicon polymers. Synthesis and their uses.

B) Characterization of coordination polymers on the basis of:
i) Spectra (UV, Visible, IR and NMR)
ii) Magnetic and thermal (TGA,DTA and DSC) studies

Unit-III 15h

Catalysis: Basic principles, thermodynamic and kinetic aspects, industrial requirements, classification, theories of catalysis, homogeneous and heterogeneous catalysis .Introduction, types & characteristics of substrate-catalyst interactions, kinetics and energetic aspects of catalysis, selectivity, stereochemistry, orbital symmetry and reactivity. Catalytic reactions of coordination and Organometallic compounds including polymerization activation of small molecules, addition to multiple bonds, hydrogenation Zeigler-Natta polymerization of olefins, hydroformylations, oxidations, carbonylations and epoxidation.

Name organic reaction involving inorganic compounds: Suzuki Coupling, Heck Reaction, Negishi reaction and Sonogirhra reaction

Unit-IV 15h

A) Optical sensor for metal Ions: Chelates ligand (Multidentates, Ruthenium bipyridyls, calixarenes, Lanthanide ion); Macrocyclic ligands (Flexible Macrocycles, Azamacrocycles, Cryptands, porphyrins); Crown ether and Cryptands(Napthalene and Anthracene crowns, Cryptands, structural features)

B) Thin films and languir-Biodgett films: Preparation technique, evaporation/spultering, chemical processe MOCVD, solgel etc. Languir-Biodgett(LB) film, growth techniques, photolithography properties and applications of thin and LB films.

List of books:

1. Barsoum ,M.W.,Fundamentals of Ceramics,McGraw Hill ,New Delhi
2. Ashcroft ,N.W. and Mermin,N.D.,SolidStaePhysics,Saunders College
3. CallisterW.D.,Material Science and Engineering, An Introduction,Wiley
4. Keer,H.H,Principals of Solid State,Wiley Eastern
5. Anderson J.C.,LeverK.D.,Alexander J.M and Rawlings,R.D.,ELBS
6. GrayG.W.Ed.Thermotropic Liquid Crystals,John Wiley
7. Kelkar and Hatz Handbook of Liquid Crystals,ChemieVerlag.
8. Kalbunde K.I.,Nanoscale Materials in Chemistry,JohnWiley,NY.
9. Shull R.D.,McMichael R.D. and SwartzendrubL.J.,Studies of Magnetic Properties of Fine particles and their relevance to Mataerials Science, Elsevier Pub. Amsterdam

10. Optoelectronic Properties of Inorganic Compounds, D. Max Roundhill and John P. Fakler, Jr. Plenum Press, New York

Semester IV

Paper XIV(Code: 4T2)

Special II-Inorganic Chemistry

60h (4h/week) 15h/ unit 80 Marks

Unit-I 15 h

A) Basics of Photochemistry: Absorption, excitation, photochemical laws, quantum yield, electronically excited states-life times-measurements of the times. Flash photolysis, stopped flow techniques, Energy dissipation by radiative and no-radiative processes, absorption spectra Frank-Condon principles; photochemical stages-primary & secondary processes.

B) Properties of excited states: Photochemical kinetics,Calculation of rates of radiative processes.

C) Excited States of Metal Complexes: Electronically excited states of metal complexes, charge transfer spectra, charge transfer excitations, metods for obtaining charge transfer spectra.

Unit-II 15h

A] Photophysical and photochemical properties of Gold(I) complexes: Introduction, Binuclear and trinuclear complexes, Mixed metal Systems, Photochemical reactivity, Solid state studies, Mononuclear Gold(I) complexes, Mononuclear three coordinate Gold(I) complexess

B) Redox reactions by Excited Metal Complexes: Energy transfer under conditions of weak interaction & strong interaction – exciplex formation, conditions of excited states to be useful as redox reactants, excited electron transfer, metal complexes as attractive candidates (2,2-bipyridine & 1,10-Phenanthroline complexes.), illustration of reducing and oxidizing character of ruthenium (II); role of spin-orbit coupling, lie time of these processes. Application of redox processes of electronically excited states for catalytic purposes, transformation of low energy reactants in to highenergy products, chemical energy in to light.

Unit-III 15h

Organotransition Metal Chemistry: Alkyls and Aryls of Transition Metals: Types, routes of synthesis, stability &decomposition pathways of alkyls & aryls of transition metals. Organocopper in Organic synthesis. Compounds of Transition Metal –Carbon Multiple bonds: Alkylidenes, alkylidynes, low valent carbenes & carbynes–synthesis, nature of bond, structural characteristics, nucleophilic & electrophilic reactions on ligands, role inorganic synthesis.

Unit-IV 15h

Transition Metal Pi Complexes-Carbon multiple bonds. Nature of bonding, structural characteristics & synthesis, properties of transition metal pi- Complexes with unsaturated organic molecules, alkenes alkynes, allyl, diene, dienyl, arene & trienyl complexes. Application of transition metal, organometallic intermediates in oraganic synthesis relating to nucleophilic & electrophilic attack on ligands, role in organic synthesis.

List of books:

1. ElschenbroichCh.andSalzer A.: Organometallics, VCH,Weinheim, NY.
2. BalzaniVandCavassitiV.:Photochemistry of Coordination compounds,AP,London
3. Purcell K.F.andKotzJ.C., An Introduction to Inorganic Chemistry,HoltSounder,Japan.
4. RohtagiK.K.andMukharjee,Fundamentals of Photochemistry,Wiley eastern
5. CalvertsJ.G.and Pits.J.N., Fundamental of Photochemistry, John Wiley
6. Wells, Inorganic Solid State Chemistry, Oxford University, Vth , Edition
7. Paulson,OrganometallicChemistry,Arnold
8. Rochow,OrganometallicChemistry,Reinhold
9. Zeiss,OrganometallicChemistry,Reinhold
10. Gilbert A.andBaggott,J,Essential of Molecular Photochemistry,BlackwellSci.Pub.
11. TurroN.J.and Benjamin W.A.,Molecular Photochemistry

12. CoxAandCamp,T.P.IntroductoryPhotochemistry,McGraw-Hill
13. KundallR.P.andGilbertA,Photochemistry, Thomson Nelson Coxon J and HaltonB.,Organic Photochemistry, Cambridge University Press.
14. Optoelectronic Properties of Inorganic Compounds, D. Max Roundhill and John P. Fakler, Jr. Plenum Press, New York

Semester IV

Practical-VII (Code: 4P1)

Inorganic Chemistry SpecialPractical

12 h /week Marks: 100

A Preparation and characterization of following complexes/organometallic compound including their structural elucidation by the available physical methods.(element analysis molecular weight determination, conductance and magnetic measurement and special studies)

1 Preparation of mercury tetrathiocyanotocobaltate(II)
2 Preparation of Iron (II) oxalate & potassium trioxalatoferrate (III) trihydrate
3 Preparation of cis & trans potassium dioxalatodiaquochromate (III)
4 Preparation of hexa-aminecobalt(III) chloride
5 Preparation of hexa-aminenickel(II) chloride
6 Preparation of tris (acetylacetonato) manganese (III)
7 Preparation of N-N bis (salicyldehyde) ethylene diaminonato nickel (II)
8 Preparation of trinitrotriaminocobalt(III)
9 Preparation of chloropentammine cobalt (III) chloride
10 Preparation of potassium trioxalatochromate (III)
11 To prepare copper (II) acetylacetonate complex
12 To prepare cis and trans bis (glycinato) Cu II monohydrate complex
13 To prepare dipyridineiodine (I) nitrate
14 Preparation of ammonium nickel(II) sulphate

B SOLID STATE

1 Preparation of oxides and mixed oxides(MnO_2 , NiO, Cu_2O,Fe_3O_4,$ZnFe_2O_4$,$ZnMn_2O_4$,$CuMnO_4$and $NiFe_2O$)
2 Preparation of silica and alumina by sol –gel technique
3 To study the electrical conductivity of ferrites, magnetite's, doped oxides and pure samples and determine band gap

C SEPARTION AND QUANTITATIVE ESTIMATION OF BINARY AND TERNARY MIXTURE BY THE USE OF FOLLOWING TECHNIQUES:

1 Paper and thin layer chromatography
2 Ion exchange
3 Solvent extraction

D INORGANIC PHOTOCHEMISTRY

1. Synthesis of potassium ferrioxalate and determination of intensity of radiation
2. Photo oxidation of oxalic acid by UO^{2+}sensitization
3. Photo decomposition of HI and determination of its quantum yield

List of books:

1. Practical Inorganic Chemistry - Pass
2. Practical Inorganic Chemistry - Marr & Rocket
3. Basic Concept Of Analytical Chemistry - Khopkar S. M.
4. Synthesis And Characterisation Of Inorganic Compounds – W. L. Jolly, Prentice Hall
5. Inorganic Experiments – J. Derck Woollins, Vch.
6. Practical Inorganic Chemistry – G. Marrand, B.W. Rockett, Van Nostrand
7. A Text Book Of Quantitative Inorganic Analysis – A.I. Vogel, Longoman.
8. Edta Titration – F. Laschka

9. Instrumental Methods Of Analysis – Willard, Merit And Dean (Cbs, Delhi)
10. Inorganic Synthesis – Jolly
11. Instrumental Methods Of Chemical Analysis – Yelri Lalikov
12. Fundamental Of Analytical Chemistry- Skoog D .A. And West D. M. Holt Rinehart And Winston Inc.
13. Experimental Inorganic Chemistry7 – W.G. Palmer, Cambridge
14. Solid Stst Chemistry – N.B. Hanney
15. Introduction To Thermal Analysis , Techniques And Applications – M. E. Brown, Springer
16. Preparation And Properties Of Solid State Materials – Wilcox, Vol I&Ii, Dekker
17. The Structure And Properties Of Materials – Vol Iv, John Wulff,Wiley Eastern

Semester IV

ORGANIC CHEMISTRY SPECIALIZATION

Paper XIII (Code: 4T1)

Special I-Organic Chemistry

60h (4h/week) 15h/ unit 80 Marks

Unit I:

A] Carbanions in organic Chemistry 15 h

Ionization of carbon hydrogen bond and prototopy, Base and acid catalysed halogenation of ketones, keto-enol equilibria, structure and rate in enolisation, concerted and carbanion mechanism for tautomerism, geometry of carbanions, kinetic and thermodynamic control in the generation of enolates, LDA, hydrolysis of haloforms, use of malonic and acetoacetic esters, Aldol, Mannich, Cannizzaro, Darzens, Dieckmann, Claisen Baylis-Hillman reactions, Knoevenagel, benzoin condensation, Julia olefination, alkylation of enolates and stereochemistry thereof, Conjugate additions, enamines in organic synthesis

B] Organometallic reagents -I

Synthesis and applications of organo Li and Mg reagents, nucleophilic addition to aldehyde, ketones, ester, epoxide, CO_2, CS_2, isocyanates, ketenes, imines, amides, lactones, Stereochemistry of Grignard addition to carbonyl compounds, *o*-metallation of arenes using organolithium compounds.

Unit II: 15 h

A] Organometallic reagents-II:Organozinc reagents: Preparation and applications, Reformatsky reaction, Simon-Smith reaction.

Organocopper reagents: Preparation and applications in C-C bond forming reaction, mixed oragnocuprates, Gilman's reagent. Organo Hg and Cd reagents in organic synthesis.

B] Transition metals in organic synthesis: Transition metal complexes in organic synthesis-Introduction-oxidation states of transition metals, 16-18 rule, dissociation, association, insertion, oxidative addition, reductive elimination of transition metal

Organopalladium in organic synthesis-Heck reaction, carbonylation, Wacker oxidation, coupling reactions: Kumada Reaction, Stille coupling, Sonogashira, Negishi and Suzuki coupling reactions and their importance

Applications of $Co_2(CO)_8$, $Ni(CO)_4$, $Fe(CO)_5$ in organic synthesis. Wilkinson catalyst of Ruthenium and Rhodium – synthesis and uses its use in hydrogenation reactions-deallylation, C-C, C-O, C-N bond cleavages. Olefin metathesis by I^{st} and II^{nd} generation catalyst, reaction mechanism and application in the synthesis of homo and heterocyclic compounds

Unit III: 15 h

A] Advanced Stereochemistry: Conformation of sugars,monosaccharides, disaccharides, mutorotation, Recapitulation of Stereochemical concepts- enantiomers, diastereomers, homotopic and heterotopic ligands, Chemo-, regio-, diastereo- and enantio-controlled approaches; Chirality transfer, Stereoselective addition of nucleophiles to carbonyl group: Re-Si face concepts, Cram's rule, Felkin Anh rule, Houk model, Cram's chelate model. Asymmetric synthesis use of chiral auxiliaries, asymmetric hydrogenation, asymmetric epoxidation and asymmetric dihydroxylation,

B] Protection and Deprotection of functional groups: Protection and deprotection of functional groups like, hydroxyl, amino, carbonyl and carboxylic acids groups, Solid phase peptide synthesis.

Unit IV: Designing the synthesis based on retrosynthetic analysis 15 h

A) Disconnection Approach: An introduction to synthons and synthetic equivalents, disconnection approach, functional group inter-conversions, the importance of the order of events in organic synthesis, one group C-X and two group C-X disconnections, chemoselectivity, reversal of polarity, cyclisation reactions, amine synthesis

B) One Group C-C Disconnections: Alcohols andcarbonyl compounds, regioselectivity, alkene synthesis, use of acetylenes and aliphatic nitro compounds in organic synthesis

C) Two Group C-C Disconnections: Diels-Alder reaction, 1,3-difunctionalised compounds, α,β-unsaturated carbonyl compounds, control in carbonyl condensations, 1,5-difunctionalised compounds, Michael addition and Robinson annelation, Methods of ring synthesis, Linear and convergent synthesis

List of books

1] Principle of Organic Synthesis R. O. C. Norman and J. M. Coxon
2] Modern Synthetic Reaction. H. O. House and W. A. Benjamin
3] Organic Synthesis: The Disconnection Approach-S. Warren
4] Designing Organic Synthesis-S. Warren
5] Some Modern Methods of Organic Synthesis-W. Carruthers
6] Advance Organic Reaction. Mechanism and Structure-Jerry March
7] Advance Organic Chemistry Part-B-F. A. Caray and R. J. Sundberg Plenum Press
8] Organic Reaction and their Mechanism-P. S. Kalsi
9] Protective Groups in Organic Synthesis-T. W. Greene
10] The Chemistry of Organo Phosphorous-A. J. Kirbi and S. G. Warren
11] Organo Silicon Compound-C. Eabon
12] Organic Synthesis via Boranes-H. C. Brown
13] Organo Borane Chemistry-T. P. Onak
14] Organic Chemistry of Boron-W. Gerrard

Semester IV

Paper XIV(Code: 4T2)

Special II-Organic Chemistry

60h (4h/week) 15h/ unit 80 Marks

Unit I: Enzyme chemistry 15h

A] Enzymes: Introduction, chemical and biological catalysis, remarkable properties of enzymes like catalytic power, specificity and regulation. Cofactors as derived from vitamins, coenzymes, prosthetic groups, apoenzymes. Nomenclature and classification, Fischer's lock and key and Koshland's induced fit hypothesis, concept and identification of active site by the use of inhibitors, affinity labeling and enzyme modification by site-directed mutagenesis. Baker's yeast catalyzed reactions

B] Mechanism of Enzyme Action: Transition-state theory, orientation and steric effect, acid-base catalysis, covalent catalysis, strain or distortion. Enzyme mechanisms for chymotrypsin, ribonuclease, lysozyme and carboxypeptidase A.

C] Co-Enzyme Chemistry: Structure and biological functions of coenzyme A, thiamine pyrophosphate, pyridoxal phosphate, NAD^+, $NADP^+$, FMN, FAD, lipoic acid, biotin as CO_2 carrier. Mechanisms of reactions catalyzed by the above cofactors.

Unit II: Heterocycles 15h

A*]* Azoles**:** Structural and chemical properties; Synthesis of pyrazole, isothiazole and isoxazole; Synthesis of imidazoles, thiazoles and oxazoles; Nucleophilic and electrophilic substitutions; Ring cleavages, Carbonyldiimidazole as coupling agent

B*]* Benzofused heterocycles**:** Synthesis of indole, benzofuran and benzo-thiophene, quinoline and isoquinoline Nucleophilic, electrophilic and radical substitutions; Addition reactions; Indole rings in biology.

C*]* Diazines**:** Structural and chemical properties; Synthesis of pyridazines, pyrimidines, pyrazines; Nucleophilic and electrophilic substitutions.

D**]** Synthesis of following bioactive compounds**:** Vitamin B_6, Ondansetron, Serotonin, Indometacin, Cyanamid, fentiazac, trimethoprim, papaverine

Unit III**:** 15h

A*]* Nucleic Acids**:** Primary, secondary and tertiary structure of DNA; DNA replication and heredity; Structure and function of mRNA, tRNA and rRNA. Purines and pyrimidine bases of nucleic acids and their preparation.

B**]** Lipids**:** Fatty acids, essential fatty acids, structures and functions of triglycerols, glycerophospho lipids, spingolipids, lipoproteins, composition and function, role in atherosclerosis
Properties of lipid aggregates, micells, bilayers, liposomes and their biological functions, biological membranes, fluid mosaic model of membrane structure, Lipid metabolism, β-Oxidation of fatty acids

C**]** Vitamins**:** Structure determination, and synthesis of vitamin A, E and H.

Unit IV**:** 15h

A**]** Dyes**:** General Introduction, classification on the basis of structure and methos of application dying mechanism, methods of dying, such as direct dying, vat dying, dispersive dying, formation of dye in fibre, dying with reactive dyes, study of quinoline yellow, cyamine dye, ethyl red, methylene blue, Alizarin, cyamine-green, fluorescein, cosin, erythrosine, Rhodomines and Indigo.

B**]** Pharmaceutical chemistry**:**
History, medical terms in pharmaceutical chemistry, classification of drugs, antibacterial and antifungal drugs, specific clinical applications, Synthesis and applications of: Benzocaine, Methyl dopa, dilantin, ciprofloxacin, acyclovir, terfenadine, salbutamol

C**]** Polymer chemistry**:** Importance of polymers, Basic concepts: monomers, repeat units, degree of polymerization. Linear, branched and network polymers. Classification of polymers. Polymerization: condensation, addition, radical chain-ionic and co-ordination and co-polymerization and their mechanisms, Polymerization in homogeneous and heterogeneous systems. Ziegler-Natta polymerization with mechanism, Stereo regulated polymers, syndiotactic, isotactic and atactic polymers

List of books

1] Textbook of Polymer Science, F. W. Billmeyer Jr, Wiley
2] Polymer Science, V. R. Gowarikar, N. V. Viswanathan and J. Sreedhar, Wiley-Eastern
3] Functional Monomers and Polymers, K. Takemoto, Y. Inaki and R. M. Ottanbrite
4] Bioorganic Chemistry: A Chemical Approach to Enzyme Action, Hermann Dugas and C. Penny, Springer-Verlag
5] Understanding Enzymes, Trevor Palmer, Prentice Hall
6] Enzyme Chemistry: Impact and Applications, Ed. Collin J. Suckling, Chapman and Hall
7] Enzyme Structure and Mechanism, A. Fersht, W. H. Freeman
8] Introduction to Medicinal Chemistry, A. Gringuage, Wiley-VCH
9] Wilson and Gisvold's Text Book of Organic Medical and Pharmaceutical Chemistry, Ed Robert F. Dorge
10] Burger's Medicinal Chemistry and Drug Discovery, Vol-1, Ed. M. E. Wolff, John Wiley
11] Strategies for Organic Drug Synthesis and Design, D. Lednicer, John Wiley
12] The Organic Chemistry of Drug Design and Drug Action, R. B. Silverman, Academic Press

Semester IV
Practical-VII (Code: 4P1)
Organic Chemistry Special Practical

12 h /week Marks: 100

A] Quantitative Analysis based on classical and instrumental technique (any 9-10)

1] Estimation of nitrogen.
2] Estimation of halogen.
3] Estimation of sulphur.

Spectrophotometric/calorimetric and other instrumental methods of estimation

1] Estimation of streptomycin sulphate.
2] Estimation of vitamin B-12.
3] Estimation of amino acids.
4] Estimation of proteins.
5] Estimation of carbohydrates.
6] Estimation of Ascorbic acid.
7] Estimation of Aspirin.
8] Solvent extraction of oil from oil seeds and determination of saponification value, iodine value of the same oil.

B] Organic multi-step preparations (Two/Three steps): Minimum 10-12 preparations

[1] Aniline → Diaminoazobenzene → p-aminoazobenzene
[2] Benzoin → Benzyl → Dibenzyl
[3] Aniline → acetanilide →*p*-bromoacetanilide →*p*-bromoaniline
[4] Aniline → Acetanilide →*p*-nitroacetanilide →*p*-nitroaniline
[5] Benzaldehyde (thiamine hydrochloride) → benzoin → benzil → benzilic acid
[6] *p*-Nitrotoluene →*p*-nitrobenzoic acid→ PABA →*p*-iodobenzoic acid
[7] *p*-Cresol →*p*-cresylacetate → 2-hydroxy-5-methyl acetophenone → 2-hydroxy chalcone
[8] Benzaldehyde → benzilidene acetophenone → 4,5-dihydro-1,3,5-triphenyl-1*H*-pyrazole
[9] Aniline → phenylthiocarbamide → 2-aminobenzthiazole (Microwave in step I)
[10] Chlorobenzene → 2,4- Dinitrochlorobenzene → 2,4- Dinitrophenylhydrazine.
[11] Acetophenone → acetophenone phenyl hydrazone → 2-phenylindole
[12] Benzion → benzoin benzoate → 2,4,5-triphenyl oxazole
[13] Benzophenone → benzpinacol → benzopinacolone (Photochemical preparation)
[14] Benzophenone → Benzophenone oxime → Benzanilide → Benzoic acid + aniline
[15] Aniline → aniline hydrogen sulphate → sulphanilic acid → Orange II
[16] Aniline → N-arylglycine → indoxyl → indigo
[17] Phthalimide → Anthranilic acid → Phenyl glycine-o-carboxylic acid → Indigo
[18] Phalic anhydride → Phthalimide → Anthranilic acid → o-chlorobenzoic acid
[19] Phalic anhydride → Phthalimide → Anthranilic acid →Diphenic acid
[20] Ethyl acetoacetate → 3-methyl-pyrazol-5-one → 4,4-dibromo-3-methyl-pyrazol-5-one Butanoic acid
[21] Biosynthesis of ethanol from sucrose
[22] Enzyme catalyzed reactions

[C] SPECTRAL INTERPRETATION

Structure Elucidation of organic compounds on the basis of spectral data (UV, IR, ^{1}H and $^{13}CNMR$ and Mass) (Minimum 12 compounds are to be analysed during regular practicals).

Semester IV
PHYSICAL CHEMISTRY SPECIALIZATION

Paper XIII(Code: 4T1)
Special I-Physical Chemistry)

60h (4h/week) 15h/unit 80 Marks

UNIT-I CHEMICAL DYNAMICS - II 15h

A] Overview of Arrhenius rate law, Non-conventional equilibrium between reactants and activated complexes. Potential energy surfaces and reaction coordinate. Derivation of transition state theory based equation for rate constant of bimolecular reaction. Prediction of rate constant using partition function and comparison with that given by collision theory. Arrhenius equation and activated complex theory. Transmission coefficient, quantum mechanical tunneling,

B] Reactions in solution: Cage effect, diffusion controlled reactions, volume of activation its determination and correspondence with entropy of activation, Ionic reactions: Primary (Ionic strength) and Secondary salt effect and their nature.

UNIT II CORROSION AND CORROSION ANALYSIS 15h

A] Scope and economics of corrosion, causes (Change in Gibbs free energy), Electrochemical Series and Galvanic series, dry (atmospheric) and wet (electrochemical) corrosion, other types of corrosion- Pit, Soil, chemical and electrochemical, inter-granular, waterline, microbial corrosion, measurement of corrosion by different methods, factors affecting corrosion, passivity, galvanic series, protection against corrosion, design and material selection.

B] Thermodynamics of corrosion, corrosion measurements (Weight loss, OCP measurements, polarization methods), passivity and its breakdown, corrosion prevention (electrochemical inhibitor and coating methods).

UNIT – III: RADIATION CHEMISTRY 15h

A] Interaction of radiation with matter, radiation track spurs and □-rays. Linear energy transfer, Bathe's equation for linear energy transfer, Bresstrahlung effect, Passage of neutron through matter, Interaction of □-radiation with matter, photoelectric effect and Compton effect, pair production phenomena, units of measuring radiation absorption, Radiolysis of water, Radiolysis of some aqueous solutions. Effect of radiation on biological substances, genetic effects, Radiation effects on organic compounds and Polymers.

UNIT IV: ELECTRICAL AND THERMAL PROPERTIES OF SOLIDS 15h

A] Classical free electron theory, electrical conductivity, thermal conductivity, Wiedemann-Franz Law, Lorenz number, Electronic distribution in solids using Fermi Dirac Statistics, The Fermi Distribution function and effect of temperature, Quantum theory of free electrons, periodic potential, The Kronig-Penney Model, Brillouin Zones, Distinction between metals, insulators and intrinsic semiconductors based on above theory.

B] Thermal Properties: Specific heat of solids, Classical theory, Einstein's theory of heat capacities, Debye theory of heat capacities or Debye T-cubed law

Books Sugggested:

1. G.M.Panchenkov and V.P.Labadev, " Chemical Kinetics and catalysis", MIR Publishing
2. E.A. Moelwyn- Hughes, " Chemical Kinetics and Kinetics of Solutions", Academic
3. K.J.Laidler, Chemical Kinetics, Third Edition (1987), Harper and Row, New York
4. J.Raja Ram and J.C.Kuriacose, Kinetics and Mechanism of Chemical Transformations MacMilllan IndianLtd., New Delhi (1993)
5. C. H. Bamford and C. F. H. Tipper, Comprehensive Chemical Kinetics, Vol 1., Elsevier Publications, New York, 1969.
6. C. H. Bamford and C. F. H. Tipper, Comprehensive Chemical Kinetics, Vol 2., Elsevier Publications, New York, 1969.

7. S. Glasstone, K. J. Laidler and H. Eyring, The Theory of Rate Processes, Mc-Graw Hill, New York, 1941.
8. Santosh Kumar Upadhyay, Chemical Kinetics and Reaction Dynamics, Springer 2006.
9. D. Mcquarie and J. Simon, Physical Chemistry – A Molecular Approach, University Press, 2000
10. G. M. Barrow, Physical Chemistry, Tata Mc-Graw Hill, V edition 2003.
11. H. K. Moudgil, Text Book of Physical Chemistry, Pretice Hall of India, New Delhi, 2010.
12. S. O. Pillai, Solid State Physics, New Age International, New Delhi, 2102.
13. C.Kittel, " Introduction to solid state Physics",Wiley
14. L.V.Azaroff, " Introduction to solids", McGraw Hill
15. Santosh Kumar Upadhyay, Chemical Kinetics and Reaction Dynamics, Springer 2006.
16. N. B. Hanny, Treaties in Solid State Chemistry, 4th Edn,
17. N. B. Hanny, "Solid State Chemistry"
18. M. C. Day and J Selbin, Theoretical Inorganic Chemistry, Reinhold Pub. Corp., New York,
19. C.N.Rao. Nuclear Chemistry
20. B. G. Harvey, *Introduction to Nuclear Physics and Chemistry,* Prentice Hall, Inc. (1969).
21. H.J. Arnikar, *Essentials of Nuclear Chemistry*, 4th Edition (1995), Wiely-Eastern Ltd., New Delhi.
22. W. Loveland, D. Morrissey and G. Seaborg, Modern Nuclear Chemistry, Wiley-Interscience, 2006.
23. P. P. Milella, Fatigue and Corrosion in Metals, Springer, 2013.
24. Corrosion- Understanding the Basics, asminternational.org, 2000.
25. H. H. Uhlig, Corrosion and Corrsion Control – 3rd edn, John Wiley & sons, New York.
26. J. W. T. Spinks and R. J. Woods, An Introduction to Radiation Chemistry, John Wiley and sons., New Yoek, 1975.
27. K. L. Kapoor, Text Book of Physical Chemistry, Vol – I to Vol-VI, 2011.

Semester IV

Paper XIV (Code: 4T2)

Special II-Physical Chemistry

60h *(4h/week)* 15h/unit 80 Marks

UNIT I: SOLID STATE AND THEIR MAGNETIC PROPERTIES 15h

A] Solid State Chemistry: Metals, Insulators and Semiconductors, Electronic structure of solids—band theory. Band structure of metals, Insulators and Semiconductors, Intrinsic and Extrinsic Semiconductors, p-n junction, energy band formation, forward bias and reversed bias p-n junction, their applications, Superconductors— types, Meissner effect, BCS theory, Low Temperature Superconductor (LTSC) and High Temperature Superconductor (HTSC), Conventional and organic Superconductors, their applications.

B] Magnetic Properties: Behaviour of substances in magnetic field, effect of temperature, Curie and Curie-weiss law, calculation of magnetic moments, magnetic materials, their structure and properties, Applications, structure/ property relations, numericals.

UNIT II: ELECTRICAL PROPERTIES OF MOLECULES 15h

Dipole moments of molecules, basic ideas of electrostatic interactions, polarizability, orientation polarization, Debye equations, limitation of the Debye theory, Clausius-Mossotti equation. electrostatic of dielectric medium, molecular basis of dielectric behavior, structural information from dipole moment measurements, use of individual bond dipole moments, application to disubstituted benzene derivatives, dipole moment and ionic character of a molecule, determination of dipole moment from dielectric measurements in pure liquids and in solutions. The energies due to dipole-dipole, dipole induced dipole and induced dipole-induced dipole interaction. Dispersion, dielectric loss and refractive index. Lennard-Jones potential.

Unit III: LIQUID STATE AND INTERFACES 15h

A] Theory of liquids: - Theory of liquids, partition function method or model approach, single cell models, communal energy and entropy, significant structure model.

B] Liquid gas and liquid interfaces: Surface tension, methods of determination of surface tension, surface tension across curved surfaces, vapor pressure of droplet (Kelvin equation), surface spreading, spreading coefficient, cohesion and adhesion energy, contact angle, constant angle hystereis, wetting and detergency.

Unit IV: IONIC LIQUIDS AND BATTERY TECHNOLOGY 15h

A] Supercooled and ionic liquids: Supercooled and ionic liquids, theories of transport properties, non Arrhenius behavior of transport properties, Cohen-Turnbull free volume model, configurational entropy model, Macedo- litovitz model, glass transition in supercooled liquids.

B] Battery Technology: basic concept, classification of batteries, primary, secondary and reserve batteries, Construction, working and application of Acid Storage batteries, Lithium - MnO_2 batteries, Nickel- Metal hydride batteries, Fuel Cells, Construction and working of $H_2O_2$and methanol-O_2 Cell.

List of books

1. S. O. Pillai, Solid State Physics, New Age International, New Delhi, 2102.
2. D. Mcquarie and J. Simon, Physical Chemistry – A Molecular Approach, University Press, 2000
3. G. M. Barrow, Physical Chemistry, Tata Mc-Graw Hill, V edition 2003.
4. H. K. Moudgil, Text Book of Physical Chemistry, Pretice Hall of India, New Delhi, 2010.
5. M. C. Day and J Selbin, Theoretical Inorganic Chemistry, Reinhold Pub. Corp., New York,
6. A. Kokorin, Ionic Liquids: Theory, Properties and New Approaches, Intech, Croatia, 2011.
7. Gholam-Abbas Nazri, Gianfranco Pistoia, Lithum Batteries-Science and Technology, Springer, 2003.
8. N. H. March and M. P. Tosi, Introduction to Liquid State Physics, World Scientific, London, 2002.
9. George Kackson, Liquid State Theory,
10. C.Kittel, " Introduction to solid state Physics",Wiley
11. L.V.Azaroff, " Introduction to solids", McGraw Hill
12. Santosh Kumar Upadhyay, Chemical Kinetics and Reaction Dynamics, Springer 2006.
13. N. B. Hanny, Treaties in Solid State Chemistry, 4th Edn,
14. N. B. Hanny, Solids,
15. H. Y. Erbil, Surface Chemistry of Solid and Liquid Interfaces, Blackwell Publishing, 2013.
16. N. B. Hanny, "Solid State Chemistry"

Semester IV

Practical-VII (Code: 4P1)

Physical Chemistry Special Practical

12 h /week Marks: 100

Adsorption:

1. To verify Freundlich adsorption isotherm.
2. To verify Langmuir adsorption isotherm.
3. To verify Gibbs adsorption isotherm and to find surface excess concentration of solute.
4. Study of variation of surface tension of solution of n-propyl alcohol with concentration and hence determine the limiting cross section area of alcohol molecule.

Kinetics:

5. Clock reaction- activation energy of bromide-bromate reaction.
6. Temp dependence of persulfate-iodide reaction by iodine clock method and calculation of thermodynamic and Arrhenius activation parameters. Study of ionic strength effect on persulfate-iodide reaction.
7. Kinetics of B-Z reaction; Kinetics of modified B-Z reaction
8. Investigate the Autocatalytic reaction between potassium permanganate and oxalic acid.
9. Determination of pKa value of a weak acid by chemical kinetic method (formate-iodine reaction)

Potentiometry:

10. Transport number by potentiometry.

11. To determine degree of hydrolysis of aniline hydrochloride and hence to determine the hydrolysis constant of salt by potentiometry method.
12. To determine pK of weak acids, succinic acid, acetic acid, Malonic acids, (dibasic acids).
13. Complexation between Hg^{2+} and I^- conductometrically.

Conductometry:

14. To determine degree of hydrolysis of aniline hydrochloride and hence to determine the hydrolysis constant of salt by conductometric method.
15. To determine pK of weak acids, succinic acid, acetic acid, Malonic acids, (dibasic acids).
16. Complexation between Hg^{2+} and I^- conductometrically.
17. To determine solubility product of lead chromate.
18. Kinetic study of saponification ethyl acetate by conductometry.

Spectrophotometry:

19. To determine the stability constant of reaction between Ferric ion solution and SCN^- ion solution by Job's method.
20. To determine the stability constant between Fe^{3+} and SCN^- ion solution by Ostwald & Frank method.

Transport Number:

21. To determine transport number by Hittorff's method
22. To determine the transport number by moving boundary method

List of Books

1. Vogel A, 3rd Edition : A Textbook Of Quantitative Inorganic Analysis, Longman
2. Das and Behra, Practical Physical Chemistry
3. Carl W. Garland, Joseph W. Nibler and David P. Shoemaker, Experiments in Physical Chemistry, Mc-Graw Hill, 8th Edition, 2009.
4. Farrington Daniels, Joseph Howard Mathews, John Warren Williams, Paul Bender, Robert A. Alberty, Experimental Physical Chemistry, Mc-Graw Hill, Fifth Edition, 1956.
5. John W. Shriver and Michael George, Experimental Physical Chemistry, Lab Manual and Data Analysis, The University of Alabama in Huntsville, Fall 2006
6. Day And Underwood :Quantitative Analysis
7. Merits And Thomas:Advanced Analytical Chemistry
8. Ewing, G. W. : Instrumental Methods Of Chemical Analysis, Mcgraw-Hill
9. Drago, R.S:Physical Methoods In Inorganic Chemistry
10. Christain G.D:Analytical Chemistry
11. Khopkar S.M.:Basic Concept Of Analytical Chemistry
12. Koltath And Ligane:Polorography
13. Braun:Instrumental Methods Of Chemical Analysis
14. Willard, Merritt And Dean: Instrumental Methods Of Chemical Analysis ,Van Nostrand
15. Strouts,Crifi;Llan And Wisin: Analytiacl Chemistry
16. Skoog S.A. And West D. W.:Fundamental Of Analytical Chemistry
17. Dilts R.V.: Analytiacl Chemistry
18. Jahgirdar D.V :Experiments In Chemistry
19. Chondhekar T.K: Systematic Experiments In Physical Chemistry, Rajbog S.W., Aniali Pubn.
20. Wlehov G. J: Standard Methods Of Chemicalanalysis 6th Ed
21. Ramesh Rand Anbu M, Chemical Methods For Envirnmental Analysis : Watewr And Sedient , Macmillion India

Semester IV

ANALYTICAL CHEMISTRY SPECIALIZATION

Paper XIII(Code: 4T1)

Special I-Analytical Chemistry

60h (4h/week) 15h/unit 80 Marks

Unit-I: Radioanalytical Chemistry-II 15h

Preparation of some commonly used radioisotopes (^{22}Na, ^{60}Co, ^{131}I, ^{65}Zn, ^{32}P), Use of radioactive isotopes in analytical and physico-chemical problems, Industrial applications, Neutron sources, Neutron Activation Analysis, Isotope Dilution Analysis, Radiometric titrations (Principle, Instrumentation, applications, merits and demerits), Radiochromatography, Carbon dating, Numericals based on above.

Unit-II: Optical methods of analysis-IV 15h

Inductively coupled plasma-atomic emission spectroscopy: Principle, atomization and excitation. Plasma source and sample introduction. Instrumentation. Comparison of ICP-AES with AAS. Applications.

X-ray fluorescence spectroscopy: Principle. Instrumentation: wavelength and energy dispersive devices. Sources and detectors. Comparison between wavelength and energy dispersive techniques. Sample preparation for XRF. Matrix effects in XRF. Applications in qualitative and quantitative analysis.

*Particle induced X-ray emission (PIXE):*Basic principle, Instrumentation and applications.

*Electron microscopy:*Principle, instrumentation and applications of scanning electron microscopy (SEM) and transmission electron microscopy (TEM)

Unit-III:Electrochemical methods of analysis-III 15h

Ion selective electrodes: Theory of membrane potential. Types of ion-selective electrodes. Construction of solid state electrodes, liquid membrane electrodes, glass membrane electrodes and enzyme electrodes, Selectivity coefficients, Glass electrodes with special reference to H^+, Na^+ and K^+ ions. Applications of ISE in analysis of environmentally important anions like F^-, Cl^-, Br^-, I^-, NO_3^- and CN^-. Advantages of ISE.

Coulometry: Principle. Coulometry at constant potential and constant current. Instrumentation. Applications and advantages of coulometric titrations.

Electrochemical microscopy: Introduction to scanning probe microscopy (SPM), scanning tunneling microscopy (STM), atomic force microscopy (AFM) and scanning electrochemical microscopy (SECM).

Unit-IV: Thermal methods of analysis 15h

Introduction to different thermal methods, Thermogravimetry (TG and DTG), Static thermogravimetry, quasistatic thermogravimetry and dynamic thermogravimetry, Instrumentation-Balances, X-Y recorder, Stanton-Redcroft TG-750, Thermogram, Factors affecting thermogram, Applications of thermogravimetry, Differential Thermal Analysis (DTA)- Theories, DTA curves, Factors affecting DTA curve, Applications of DTA, simultaneous determination in thermal analysis, Differential Scanning Calorimetry (DSC)- Introduction, Instrumentation, DSC curves, factors affecting DSC curves, applications, Thermogravimetric titration-Theory, Instrumentation and applications.

Semester IV

Paper XIV(Code: 4T2)

Special II-Analytical Chemistry

60h (4h/week) 15h/ unit 80 Marks

Unit-I: Pharmaceutical and clinical analysis 15h

Requirements of a quality control laboratory for pharmaceutical units.

Structures, category, identification (qualitative) and assay (quantitative) of following drugs

1. Antibiotics: Amoxycillin, Azithromycin, Cefixime, Levofloxacin

2. Antihistamine: Cetirizine, Cinnarizine
3. Vitamins: Thymine hydrochloride (Vitamin-B_1) Riboflavin (Vitamin-B_2), Ascorbic acid (Vitamin-C)
4. Analgesics: Diclofenac, paracetamol, Aspirin.

Composition of blood, sample collection for blood and urine, clinical analysis, Immuno Assay-RIA, Setting up of RIA and applications, Fluorescence Immunoassay, Enzyme immunoassay, Blood gas analyzer, Trace elements in the body.

Unit-II: Soil analysis and coal analysis 15h

Soil analysis- Classification and composition, pH and conductivity, analysis of constitutents such as nitrogen, phosphorous, potassium and microconstitutents (Zn and Cu).

Coal analysis- Proximate analysis (moisture content, ash content, volatile matter, fixed carbon). Ultimate analysis (carbon, hydrogen, sulphur, nitrogen, oxygen content). Combustion of carbonaceous fuel- Flue gas. Calorific value and its units, Bomb calorimeter.

Unit-III: Corrosion and corrosion analysis 15h

Definition, draw backs and theories of corrosion-dry and wet corrosion, Different types of corrosion-Pit, Soil, chemical and electrochemical, intergrannular, waterline, microbial corrosion, measurement of corrosion by different methods, factors affecting corrosion, passivity, galvanic series, protection against corrosion, design and material selection.

Unit-IV: Automation in analytical chemistry 15h

Automation in the laboratory, Principle of automation, automated instruments, classification, continuous analyzer, automatic instruments, semiautomatic instruments GeMSAEC Analyzer, Flow Injection Analysis (FIA), Dispersion coefficient, Factors af fecting Peak Height, microprocessor based instruments, Numericals based on above.

Hyphenated techniques: Introduction to GC-MS, LC-MS, ICP-MS and MS-MS (Tandem) spectrometry.

Semester IV

Practical-VII (Code: 4P1)

Analytical Chemistry Special Practical

12 h /week Marks: 100

A. Organoanalytical chemistry

1. Estimation of sulphur, nitrogen, phosphorous,chlorine in organic compound.
2. Estimation of phenol.
3. Estimation of aniline.

B. Separation techniques

Ion exchange

1. Separation and estimation of zinc and magnesium/cadmium in a mixture on anion exchanger.
2. Separation and estimation of chloride and iodide in a mixture on anion exchanger.
3. Determination of total cation concentration in water.

Solvent extraction

1. Estimation of Copper using Na-DDC.
2. Estimation of Iron using 8-hydroxyquinoline.
3. Estimation of Nickel using DMG.
4. Estimation of Cobalt using 8-hydroxyquinoline.
5. Estimation of Nickel by synergistic extraction with 1,10-phenanthroline and dithizone.

Paper chromatography

1. Separation and estimation of copper and nickel in a mixture.
2. Separation and estimation of cobalt and nickel in a mixture.

Thin layer chromatography

1. Separation and estimation of bromophenol blue, congo red and phenol red in a mixture.

2. Separation and estimation of metal ions in mixture.

C. Water analysis

1. *Mineral analysis*: Ttemperature, pH, conductivity, turbidity, solids, alkalinity, chloride, fluoride, sulphate, hardness
2. *Demand analysis*: DO, COD
3. *Heavy metals*: Fe, Cd and Pb

D. Demonstrations

1. Gas chromatography
2. HPLC

List of books:

1. Essentials of Nuclear Chemistry: H. J. Arnikar (Willey Eastern Ltd)
2. Substoichiometry in Radioanalytical Chemistry: J. Ruzicka and J Stary (Pergamon Press)
3. Thermal analysis: Blazek (translated by J. F. Tyson, Van Nostrand)
4. Instrumental Methods of Analysis: Willard, Meriit and Dean(Van Nostrand)
5. Instrumental Methods of Analysis: G. Chatwal and S. Anand (Himalaya Publishing House)
6. Vogel's Text Book of Quantitative inorganic Analysis: Bassett, Denney, Jeffery and Mendham (ELBS)
7. Advanced Analytical Chemistry: Meites and Thomas (McGraw-Hill)
8. Atomic Absorption Spectroscopy: Robinson (Marcel Dekker)
9. Instrumental Methods of chemical Analysis: Braun (Tata McGraw-Hill)
10. Radiochemistry: A. N. Nesmeyanov (Mir Publications)
11. Analysis of Water: Rodier
12. Ion selective electrods: Koryta (Cambridge University Press)
13. Instrumentation in analytical chemistry: Borman (American Chemical Society)
14. Industrial Chemistry: Arora and Singh (Anmol Publications)
15. Diffraction Methods: John Wormald (Clarendon Press)
16. Electroanalytical Chemistry: Bard (Dekker)
17. Analytical Chemistry by Open Learning (Wiley)
18. An Introduction to Electron Diffraction: Beeston (North Holand Publishing Co.)
19. Material Science and Engineering: V. Raghavan (Printice-Hall of India)
20. Practical Physical Chemistry: J. B. Yadav (Goel Publishing House)
21. Indian Pharmacoepia, Vol-I, II and III.

Semester IV

Paper XV (Code: 4T3)

Elective- Nuclear Chemistry

60 h (4 h per week): 15 h per unit — 80 Marks

Unit-I: Radiation Chemistry, Radiolysis — 15h

Measurement of dose. Dosimetric terms and units (Roentgen, REM, Rad, Gray, Sievert), inter conversions, calculation of absorbed dose-various types of dosimeters, chemical dosimeters (Fricke, Ceric sulphate and FBX), experimental methods, TLD badges, Radiolysis-definition, process, Radiolysis of water and aqueous solutions, hydrated electron,

Effect of radiation on biological substances, genetic effects, radiation effects on organic compounds (Halides-carboxylic acids), polymers, nitrates and solid thermoluminescence.

Unit-II: Hot Atom Chemistry and Radiochemistry — 15h

Recoil energy and calculations, Szilard Chalmers effects, Kinetics, primary and secondary retention-effect of various factors on retention and its uses, Mossbauer effect- principle, instrumentation and chemical applications,

Unit-III: Radioanalytical techniques — 15h

Neutron sources, Neutron activation analysis, principle, methodology and application for trace analysis, Isotope dilution analysis-principle and application, Isotopic exchange reaction, mechanism

and application in use of radioisotopes and tracers, radioactive dating based on carbon-14 and lead isotopes.

Unit-IV: Radiopharmaceuticals 15h

Radioimmunoassay (RIA), discovery, principle, set up of RIA, Principle of Immunoradiometric assay (IRMA), principle and set up, Radiopharmaceuticlas, classification of products, preparations, quality control aspects, ^{99}Mo-^{99m}Tc generator, Cylotron based products, PRT studies, Therapeutic applicatyions , Radiotherapy

Semester IV

Paper XV (Code: 4T3)

Elective- Environmental Chemistry

60 h (4 h per week): 15 h per unit 80 Marks

Unit-I: Water Pollution 15h

Pollutants- Types of pollutants, sources of water pollution, sampling, preservation and storageof water sample, physico –chemical, organoleptic and chemical analysis of water, electro-analytical,optical (UC-visible spectrophotometry, AAS, flame photometry, XRF, ICPAES), chromatographic (GC and HPLC) and neutron activationmethods of analysis of Co, Ni, Cu, Fe, Mn, Zn, Cd, Pb, Hg, As, Cl^- ,F^-, $SO4^{--}$,PO_4^-, NO_3^-. Historical development of detergents, chemistry of soaps and detergents.

Unit-II: Air Pollution 15h

Natural versus polluted air, air quality standards, air sampling, analysis and control of Particulates, Chemistry and analysis of SOx, NOx, CO, ozone, hydrocarbons, CFCs.Chemistry of gaseous, liquid and solid fuels- gasoline and additives, antiknock agents.Air pollution control—control of automobile emission and control measures in thermal power stations.

Unit-III: Soil Pollution 15h

Types and sources of soil pollution, classification of soil pollutants, impact of soil pollutionon air quality, Specifications for disposal of sewage and effluent on land for irrigation andground water recharge. Methodology of waste water disposal on land in India. Impact of usage of land for solid waste disposal both municipal solid waste and industrial solid wastes (fly ashfrom thermal power station, lime sludge from paper and pulp industry), cause of soil erosion,effects of soil erosion, conservation of soil, control of soil pollution.

Unit-IV: Solid waste pollution 15h

Sources, types and consequences, classification of wastes- domestic, industrial, municipal, hospital, nuclear and agricultural and their methods of disposal. Transfer and transport,Recycle, reuse, recovery, conversion of solid wastes -energy / manure.Analysis and monitoring of pesticides.

Impact of toxic chemicals on enzymes, Biochemical effects of As, Cd, Pband Hg, their metabolism, toxicity and treatment.

Semester IV

Paper XV (Code: 4T3)

Elective- Polymer Chemistry

60 h (4 h per week): 15 h per unit 80 Marks

Unit I: Polymerization 15h

Types of polymerization, addition-chain, free radical, ionic polymerization, step polymerization, electropolymerization, ring-opening polymerization.

Unit II: Techniques of polymerization 15h

Techniques of polymerization-suspension, emulsion and bulk polymerization, coordination, polymerization mechanism of Ziegler Natta polymerization, stereospecific polymerization, interfacial polycondensation, mechanism of polymerization.

Unit III: Characterization of polymers 15h

Electronic, IR and NMR spectral methods for characterization of polymers (Block and Graft)

Thermal methods-TGA, DTA, DSC, thermomechanical and X-ray diffraction study, Block and Graft copolymers, random, block, graft co-polymers, methods of copolymerization.

Unit IV: Specific polymers 15h

A) Biomedical polymers: Contact lens, dental polymers, artificial heart, kidney and skin.

B) Inorganic polymers: Synthesis and application of silicon, phosphorous and sulphur containing polymers.

C) Coordination polymers: Synthesis and applications of coordination polymers.

Semester IV

Paper XV (Code: 4T3)

Elective- Medicinal Chemistry

60 h (4 h per week): 15 h per unit 80 Marks

UNIT-I: 15 h

A] Drug rules and drug acts, Overview of Intellectual property right, Indian and International framework for patent protection.

B] Statastical method: For sampling and interpretation of results, Statastic in quality control, T-Test, F-Test, Validation of analytical methods as defined proceeding USP Radio immune analysis, Investigational drugs.

C] Antidiabetic Agents- Type-I and Type-II diabetes, Insulin, thiazolidinediones, Synthesis of ciglitazone.

UNIT-II: 15 h

A] Anti-Viral agents: Inroduction, viral diseases, viral replication, and transformation of cells, investigation of antiviral agents,. Chemotherapy for HIV. Synhesis of: Idoexuidine, acyclovir ,amantadine and cytarabin.

B] Anti-malarial agents: Introduction, malarial parasite, and its life cycle, development of antimalarials, chemotherapy of malaria. Synthesis of: Chloroquin, primaquin, proguanil, and Quinacrine

C] Local Anti-infective drug: Introduction and general mode of action. Synthesis of sulphonamides, ciprofloxacin, norfloxacin, dapsone ,amino salicylic acid, isoniazid, ethionamide, ethambutal, econozole, griseofulvin.

UNIT-III: 15 h

A) Histamines and Antihistamic agents: Introduction, histamine H1-receptor antagonists. Inhibitors of histamine release. Synthesis of: alkyl amines, phenothiazines, piperzines derivatives.

B) Antibiotics: Introduction, β-lactam antibiotics, classification, SAR and chemical degradation of penicillin, cephalosporins-classification , tetracycline antibiotics-SAR,miscellaneous antibiotics. Synthesis of ampicillin, cephradine, methacycline,chloramphenicol

UNIT-IV: 15 h

A) Anthelminitics and antiamoebic drugs: Introduction to Helminthiasis, Anthelminitics, drugs used in cestode infection, drugs used in trematode infection, origin of antiamoebic drug, drugs used in nematode infection. Synthesis of: Clioquinol, Iodoquinol, Haloquinol, Dichlorphen, Niclosamide.

B) Anti-inflammatory drugs: Introduction, etiology of inflammatory diseases. The inflammatory response, biochemical response. Synthesis of: Phenyl butazone and its derivatives, pyrazolone derivatives, pyrole and indole acetic acid derivatives.

Semester IV

Paper XVI (Code; 4T4)

Foundation Course–IIApplied Analytical Chemistry-II

60 h (4 h per week): 15 h per unit 80 Marks

Unit-I: Water treatment 15h

Hardness of water and types of hardness. Problems due to hardness. Removal of hardness by lime-soda process, Zeolite process and synthetic ion-exchange resins. Principle, instrumentation and comparison of these three processes. Numericals based on hardness removal. Desalination of sea-water.

Unit-II: Polymer chemistry and leather analysis 15h

Polymer chemistry: Definition, classification, co-polymers, conducting polymers, determination of acid value, saponification value, iodine value, molar mass by end group analysis- amide and hydroxyl, molecular weight by viscosity method, glass transition temperature of polymers, TGA and DTA studies of polymers.

Analysis of leather: Determination of moisture, acid, free sulphur, total ash, chromic oxide in leather, tensile strength and stretch of leather.

Unit-III: Metallurgy

Ores and minerals, General principles of extraction of metals from ores. Steps involved in metallurgical extraction. Purification and concentration of ores. Extraction of crude metal from concentrated ore-pyrometallurgy, hydrometallurgy and electrolytic processes. Refining of metal. Thermodynamic aspects of metallurgical processes and Ellingham diagram. Furnaces in metallurgy. Metallurgy of Cu, Ag, Au, Al and Fe.

Unit-II: Clinical analysis 15h

General composition of blood, Collection and storage of blood samples, Estimation of chloride, calcium, sodium, potassium and bicarbonate in blood sample. Qualitative tests for reducing sugar. Estimation of blood glucose, urea, uric acid, blood urea-nitrogen, total serum protein, serum albumin, serum creatinine, serum phosphate, serum bilirubin, serum cholesterol. Radioimmunoassay (RIA).

OR

Semester IV

Paper XVI (Code: 4T4)

Core Subject Centric –IISpectroscopy – II

60 h (4 h per week): 15 h per unit 80 Marks

Unit I: 15 h

A] Ultraviolet and visible spectroscopy: Natural line width, line broadening, transition probability, Born-Oppenheimer approximation, rotational, vibrational and electronic energy levels. General nature of band spectra. Beer- Lambert Law, limitations, Frank-Condon principle, various electronic transitions, effect of solvent and conjugation on electronic transitions, Fiesher Wooodward rules for dienes, aldehydes and ketones. Structure differentiation of organic molecules by UV Spectroscopy

B] Photoelectron spectroscopy: Basic principles, photoelectric effect, ionization process, Koopman theorem, PES and XPES, PES of simple molecules, ESCA, chemical information from ESCA, Auger electron spectroscopy.

Unit II: Nuclear magnetic Resonance Spectroscopy 15 h

Magnetic properties of nuclei, resonance condition, NMR instrumentation, chemical shift, spin spin interaction, shielding mechanism, factors affecting chemical shift, PMR spectra for different types of organic molecules, effect of deuteration, complex spin spin interaction(1^{st} order spectra), stereochemistry, variations of coupling constant with dihedral angle, electronegativity, Karplus equation etc., classification of molecules as AX, AX_2, AMX, A_2B_2, Shift reagents. NMR studies of ^{13}C, chemical shift in aliphatic, olefinic, alkyne, aromatic, heteroatomic and carbonyl compounds, ^{19}F, ^{31}P. Structure determination of organic molecules by NMR spectroscopy

Unit III: 15 h

A] Application of NMR spectroscopy: FT-NMR, advantages of FT-NMR, two dimensional NMR spectroscopy-COSY, HETCOR, NOSEY, DEPT, INEPT, APT, INADEQUATE techniques, Nuclear overhauser effect, use of NMR in medical diagnosis

B] Problems based on structure determination of organic molecules by using NMR (^{1}H and ^{13}C nuclei) data, Structure elucidation using combined techniques including UV, IR, NMR and mass spectrometry (based on data and copies of the spectra)

Unit IV**:** Diffraction techniques 15 h

X ray diffraction: Braggs condition, Miller indices, Laue method, Bragg method, Debye Scherrer method, identification of unit cells from systematic absences in diffraction pattern, structure of simple lattices and x-ray intensity, structure factor and its relation to intensity and electron density, absolute configuration of molecules.

Electron diffraction: scattering intensity vs scattering angle, Wierl equation, measurement techniques, elucidation of structure of simple gas phase molecules, low energy electron diffraction and structure of surfaces.

Neutron diffraction: Scattering of neutrons by solids and liquids, magnetic scattering, measurement techniques, elucidation of structure of magnetically ordered unit cell.

List of books

1] Spectroscopic identification of organic compound-RM Silverstein,GC Bassler and TC Morril, John Wally
2] Introduction to NMR spectroscopy-R. J. Abraham, J. Fisher and P Loftus Wiely
3] Application of Spectroscopy to Organic Compound-J. R. Dyer, Printice Hall
4] Organic Spectroscopy-William Kemp, ELBS with McMillan
5] Spectroscopy of Organic Molecule-PS Kalsi, Wiley, Esterna, New Delhi
6] Practical NMR Spectroscopy-ML Martin, JJ Delpench, and DJ Martyin
7] Spectroscopic Methods in Organic Chemistry-DH Willson, I Fleming
8] Fundamentals of Molecular Spectroscopy-CN Banwell
9] Spectroscopy in Organic Chemistry-CNR Rao and JR Ferraro
10] Photoelectron Spectroscopy-Baber and Betteridge
11] Electron Spin Resonance Spectroscopy-J Wertz and JR Bolten
12] NMR –Basic Principle and Application-H Guntur
13] Interpretation of NMR spectra-Roy H Bible
14] Interpretation of IR spectra-NB Coulthop
15] Electron Spin Resonance Theory and Applications-W gordy
16] Mass Spectrometry Organic Chemical Applications, JH Banyon
17] Spectroscopy- H. Kaur

Semester IV

Practical VIII **(**Code**:** 4PROJ1**)**

Project

12 h/week 100 Marks

Project is a part of practical examination. Project should be carried out by the student under the supervision of Guide/Teacher. The examination shall be conducted by External and Internal Examiners. Students are supposed to present their work either on LCD Projector / OHP or blackboard.

The division of marks will be as follows**:**

For written Project Work	: 40 Marks	- Evaluated jointly by External and Internal Examiners
Presentation	: 20 Marks	- Evaluated jointly by External and Internal Examiners
For Viva-Voce	: 20 Marks	- Evaluated by External Examiner
Internal Assessment	: 20 Marks	- Evaluated by Internal Examiner

Note**:** One external examiner shall be appointed for evaluation of group of 6 students**.**

Semester IV

Seminar**-**IV **(**Code**:** 4S1**)**

2 h /week Marks: 25

Seminar of 30 minutes duration will be a part of internal assessment for 25 marks (1 Credit). Seminar should be delivered by the student under the guidance of concerned teacher on thetopic allotted by the teacher. The topic will be related to the syllabus. Marks will be allotted by a group of teachers.

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SYLLABUS for M. Sc. BIOTECHNOLOGY
Choice Based Credit System (Semester Pattern)
Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur
Effective from 2018-2019

Candidates opting for this course are advised to go through the direction relating to the course "DIRECTION RELATING TO THE EXAMINATION LEADING TO THE DEGREE OF MASTER OF SCIENCE, SEMESTER PATTERN (CHOICE BASED CREDIT SYSTEM) AND DEGREE OF MASTER OF SCIENCE AND TECHNOLOGY (APPLIED GEOLOGY). SEMESTER PATTERN, (CHOICE BASED CREDIT SYSTEM) (FACULTY OF SCIENCE & TECHNOLOGY)" which is available on R. T. M. Nagpur University website.
The direction will provide details on admission criteria, rules for ATKT, scheme of examination, absorption scheme for CBS students into CBCS pattern, elective papers, foundation course papers, subject centric papers, coding pattern, pattern of question papers, practicals, distribution of marks, seminars, project work, internal assessment, calculation of SGPA and CGPA, etc.

Scheme of teaching and examination under semester pattern Choice Based Credit System (CBCS) for M.Sc. Program in Biotechnology

M. Sc. Biotechnology Semester I												
Code	Theory / Practical	Teaching scheme (Hours / Week)			Credits	Examination Scheme						
						Duration in hrs.	Max. Marks		Total Marks	Minimum Passing Marks		
		Th	Pract	Total			External Marks	Internal Ass		Th	Pract	
Core 1 **(1T1)**	Paper 1: **Cell Biology and Enzymology**	4	-	4	4	3	80	20	100	40		
Core 2 **(1T2)**	Paper 2: **Molecular Biology**	4	-	4	4	3	80	20	100	40		
Core 3 **(1T3)**	Paper 3: **Biomolecules**	4	-	4	4	3	80	20	100	40		
Core 4 **(1T4)**	Paper 4: **Biophysical Techniques**	4	-	4	4	3	80	20	100	40		
Pract. Core 1 & 2 **(1P1)**	Practical 1: **Cell Biology and Enzymology**	-	8	8	4	3-8*	100**	-	100		40	
Pract. Core 3 & 4 **(1P2)**	Practical 2: **Macromolecules & Analytical Techniques**	-	8	8	4	3-8*	100**	-	100		40	
Seminar 1 **(1S1)**	Seminar 1	2	-	2	1			25	25	10		
	TOTAL	**18**	**16**	**34**	**25**		**520**	**105**	**625**	**170**	**80**	

M. Sc. Biotechnology Semester II											
Code	Theory / Practical	Teaching scheme (Hours / Week)			Credits	Examination Scheme					
						Duration in hrs.	Max. Marks		Total Marks	Minimum Passing Marks	
		Th	Pract	Total			External Marks	Internal Ass		Th	Pract
Core 5 **(2T1)**	Paper 5: **Microbiology**	4	-	4	4	3	80	20	100	40	
Core 6 **(2T2)**	Paper 6: **Immunology**	4	-	4	4	3	80	20	100	40	
Core 7 **(2T3)**	Paper 7: **Fundamentals of Genetic Engineering**	4	-	4	4	3	80	20	100	40	
Core 8 **(2T4)**	Paper 8: **Applied Molecular Biology**	4	-	4	4	3	80	20	100	40	
Pract. Core 5 & 6 **(2P1)**	Practical 3: **Microbiology & Immunology**	-	8	8	4	3-8*	100**	-	100		40
Pract. Core 7 & 8 **(2P2)**	Practical 4: **Genetic Engineering & Applied Molecular Biology**	-	8	8	4	3-8*	100**	-	100		40
Seminar 2 **(2S1)**	Seminar 2	2	-	2	1			25	25	10	
	TOTAL	**18**	**16**	**34**	**25**		**520**	**105**	**625**	**170**	**80**

M. Sc. Biotechnology Semester III											
Code	Theory / Practical	Teaching scheme (Hours / Week)			Credits	Examination Scheme					
						Duration in hrs.	Max. Marks		Total Marks	Minimum Passing Marks	
		Th	Pract	Total			External Marks	Internal Ass		Th	Pract
Core 9 **(3T1)**	Paper 9: **Genetic Engineering & its Applications**	4	-	4	4	3	80	20	100	40	
Core 10 **(3T2)**	Paper 10: **Plant Biotechnology**	4	-	4	4	3	80	20	100	40	
Core Elective 1 **(3T3)**	**Paper 11: A) Industrial Biotechnology I (3T3A) OR B) Environmental Biotechnology I (3T3B)**	4	-	4	4	3	80	20	100	40	
Foundation Course 1 / Core Subject Centric 1 **(3T4)**	Paper 12: **Introductory Biotechnology (3T4A) / Diagnostic Medical Biotechnology (3T4B)**	4	-	4	4	3	80	20	100	40	
Pract. Core 9 & 10 **(3P1)**	Practical 5: **Genetic Engineering & Plant Biotechnology**	-	8	8	4	3-8*	100**	-	100		40
Pract. Core Elective 1 **(3P2)**	**Practical 6: A) Industrial Biotechnology OR B) Environmental Biotechnology**	-	8	8	4	3-8*	100**	-	100		40
Seminar 3 **(3S1)**	Seminar 3	2	-	2	1			25	25	10	
	TOTAL	**18**	**16**	**34**	**25**		**520**	**105**	**625**	**170**	**80**

M. Sc. Biotechnology Semester IV											
Code	Theory / Practical	Teaching scheme (Hours / Week)			Credits	Examination Scheme					
						Duration in hrs.	Max. Marks		Total Marks	Minimum Passing Marks	
		Th	Pract	Total			External Marks	Internal Ass		Th	Pract
Core 11 **(4T1)**	Paper 13: **Animal Biotechnology**	4	-	4	4	3	80	20	100	40	
Core 12 **(4T2)**	Paper 14: **Biostatistics, Bioinformatics, Ethics & Patenting**	4	-	4	4	3	80	20	100	40	
Core Elective 2 **(4T3)**	**Paper 15: A) Industrial Biotechnology II (4T3A) OR B) Environnemental Biotechnology II (4T3B)**	4	-	4	4	3	80	20	100	40	
Foundation Course 2 / Core Subject Centric 2 **(4T4)**	Paper 16: **Basic rDNA Technology (4T4A)/ Therapeutic Medical Biotechnology (4T4B)**	4	-	4	4	3	80	20	100	40	
Pract. Core 11, 12 & Elective 2 **(4P1)**	**Practical 7: Animal Biotechnology, Biostatistics, Bioinformatics, Ethics & Patenting And A) Industrial Biotechnology II OR B) Environmental Biotechnology**	-	8	8	4	3-8*	100**	-	100		40
Project **(4PROJ 1)**	Project	-	8	8	4	3-8*	100**	-	100		40
Seminar 4 **(4S1)**	Seminar 4	2	-	2	1			25	25	10	
	TOTAL	**18**	**16**	**34**	**25**		**520**	**105**	**625**	**170**	**80**

Note: Th = Theory; Pr = Practical/lab, * = If required, for two days.

** = The Practical and Project shall be evaluated by both the External and Internal Examiner in the respective Department / Center / Affiliated College.

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SYLLABUS for M. Sc. BIOTECHNOLOGY
Choice Based Credit System (Semester Pattern)
Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur
Effective from 2018-2019

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M. Sc. BIOTECHNOLOGY
Semester I
Paper – I (Code: 1T1)
Cell Biology and Enzymology

UNIT I:
Structure and function of cell organelles:
Plasma membrane: transport of nutrients, ions and macromolecules.
Cell walls: Archaea, Bacteria, plant cells.
Mitochondria: Electron Transport Chain and Oxidative Phosphorylation.
Chloroplasts: Chlorophyll, carotenoids and photosynthesis.
Golgi complex: Endoplasmic reticulum, lysosomes, peroxisomes (functions).

UNIT II:
Cell cycle: Molecular events in S. cerevisiae.
Cell signaling: Signal transduction in animal and plant cells (tyrosine kinase, light induced signaling)

UNIT III:
Basic Enzymology
Basics: Enzyme nomenclature, classification and specificity. Concept of coenzymes.
Mechanism of enzyme action: Models, catalysis by proximity effect, acid-base catalysis, electrostatic interaction, metal ion catalysis, nucleophilic and electrophilic catalysis,
Concept of multienzyme complexes: fatty acid synthase and pyruvate dehydrogenase complexes.
Concept of enzyme regulation: Allosteric (example ATCase), chemical modification and calmodulin mediated regulation.

UNIT IV:
Basic aspects of enzyme kinetics: Michaelis-Menten equation (derivation, significance and transformation). Two substrate kinetics. Modifying factors of enzyme kinetics, enzyme inhibition and types of inhibitors.
Enzyme Engineering
Immobilization of Enzymes

M. Sc. BIOTECHNOLOGY
Semester I
Paper – II (Code: 1T2)
Molecular Biology

UNIT I:
DNA Replication: Prokaryotic and Eukaryotic DNA replication, mechanisms of DNA replication, fidelity of replication, enzymes and accessory proteins involved in DNA replication.
Gene mutations: Types of mutations. Suppression. Ames' test.
DNA Repair: Direct repair, Ada protein, NER, BER, MMR, SOS repair, Transcription-repair coupling, repair of double-strand breaks.

UNIT II:
Prokaryotic Transcription: RNA Polymerase holoenzyme and apoenzyme, different sigma factors, details of initiation, elongation, termination.
Eukaryotic Transcription: Three types of RNA polymerases. Promoter of RNA polymerase II. Enhancers. General and inducible transcription factors.
Modifications of RNA: 5' cap formation, polyadenylation, splicing of nuclear pre-mRNA, mRNA stability.

UNIT III

Genetic code: characteristics, deciphering the code.
Protein biosynthesis: Prokaryotic and eukaryotic translation, the translational machinery, mechanism of initiation, elongation and termination.

UNIT IV
Regulation of expression in prokaryotes: lac operon, ara operon, trp operon, negative autogenous control.
Regulation of expression in eukaryotes: Britten-Davidson model. DNA binding and activation domains of transcription factors. Packaging of chromosomes and its relation to transcription regulation. Regulation of translation by 3' and 5' UTR motifs.

M. Sc. BIOTECHNOLOGY
Semester I
Paper – III (Code: 1T3)
Biomolecules

UNIT I:
Chemistry of Carbohydrates: Energy storage molecules – starch, glycogen. Building blocks – cellulose, hemicellulose, and chitin. Cell surface molecules – glycolipids, proteoglycans.

UNIT II:
Chemistry of Lipids: Triglycerides, phospholipids, glycolipids, sphingolipids, sterols, terpenes, lipoproteins (LDL, VLDL, HDL, IDL). Lipid micelles, Liposomes.

UNIT III:
Proteins: Amino acids and peptides. Primary, secondary, and tertiary structures. Protein sequencing, protease mapping. Ramachandran plot. Collagen structure. Domain structure, models of protein folding, methods of study of protein folding, roles of chaperones and chaperonins.

UNIT IV:
Nucleic acids: Structure of DNA and RNA: A, B, and Z forms of DNA. Novel structures. DNA bending and bendability. Denaturation and renaturation studies and their applications, nucleic acid hybridization. Topological structure of DNA.

M. Sc. BIOTECHNOLOGY
Semester I
Paper – IV (Code: 1T4)
Biophysical Techniques

UNIT I:
Spectrophotometry: UV-Visible spectrophotometry, fluorescence spectrophotometry, absorption and emission spectrophotometry, IR, NMR, Lumionometry.
Basic introduction to Raman and Mass spectrophotometry.

UNIT II:
Chromatography: Basic principles and techniques of partition, adsorption, gel filtration, affinity, and ion exchange chromatography. Concept of GLC and HPLC.

UNIT III:
Electrophoresis: Gel electrophoresis (Agarose, PAGE, SDS PAGE), Disc gel electrophoresis, Gradient electrophoresis, Pulsed field gel electrophoresis, capillary electrophoresis.
Viscosity: Determination of conformational changes through viscosity.

UNIT IV:
Centrifugation
Basic principles, Mathematics & theory (RCF, Sedimentation coefficient etc)
Types of centrifuge: microcentrifuge, high speed & ultracentrifuges.

Differential & density gradient centrifugation, Isolation of cell components using centrifugation technique.
Radioactivity
Radioactive & stable isotopes, Pattern and rate of radioactive decay, Units of radioactivity.
Measurement of radioactivity: Geiger-Muller counter, Solid & Liquid scintillation counters (Basic principle, instrumentation & technique),
Applications of isotopes in Biotechnology: Principles of tracer techniques, Its advantages and limitations, Distribution studies, Isotope dilution technique, Metabolic studies, Clinical application. Radioimmunoassay.

M. Sc. BIOTECHNOLOGY
Semester I
LAB I (Code: 1P1)
Cell Biology and Enzymology

1. Determination of activity of calcium ATPase of plasma membrane.
2. Subcellular fractionation and assay of marker enzymes.
3. Assay of activity of LDH.
4. Cell motility and flagellar staining.
5. Cell types of plants- maceration of various tissue explant and identification of xylem, trachied, stomata, root hair, etc.
6. Determination of activity of sodium/potassium ATPase of plasma membrane.
7. Isolation of neutrophils and demonstration of phagocytosis.
8. Determination of osmotic fragility of RBC membrane.
9. Assay of activity of beta-galactosidase
10. Assay of activity of acid phosphatase,
11. Enzyme purification by crystallization - urease.
12. Immobilization of enzymes (Invertase/ Protease/ Amylase.) by Na alginate method.
13. Whole cell immobilization (Yeast) by Na Alginate and the estimation of alcohol produced.
14. Effect of NaCl on amylase activity
15. Inhibition of alkaline phosphatase activity by EDTA
16. Estimation of lipase activity by titrimetric method
17. Effect of Temperature on activity of Amylase / Alkaline phosphatase and determination of optimum temperature.
18. Effect of Substrate concentration on activity of Amylase / Alkaline phosphatase and determination of optimum substrate concentration.
19. Effect of pH on activity of Amylase / Alkaline phosphatase and determination of optimum pH
20. Isolation of chlorophyll and xanthophyll from spinach leaves.
21. Effect of inhibitors on respiratory chain.
22. Study of Mitosis and Meiosis
23. Study of mutations by Ames Test.
24. Assay of Activity of SGOT & SGPT.
25. Isolation, Purity determination and quantitation of DNA by UV method.

Note: Candidates must perform at least 6 practicals in the semester.

M. Sc. BIOTECHNOLOGY
Semester I
LAB II (Code: 1P2)
Macromolecules & Analytical Techniques

1. Separation of proteins / lipids by ion exchange chromatography
2. Separation of lipids / amino acids by thin layer chromatography
3. Polyacrylamide gel electrophoresis: a) native enzyme preparation, b) SDS-PAGE of proteins.
4. Introduction to measurements: balance and pipetting, preparation of solutions of given molarity and normality.
5. Measurement of pH: buffering capacity, to determine pKa value and hence the dissociation constant of a given acid using pH meter.

6. Colorimetry: To determine the dissociation constant of a given indicator colorimetrically and to prepare buffer solutions in the pH range 2.2 to 8.0
7. Colorimetry: Assay of DNA by diphenylamine method.
8. Colorimetry: Assay of RNA by orcinol method.
9. Potentiometry: To determine redox potential of Fe++ and Fe+++.
10. Conductometry: to determine cell constant of 0.1 M KCl.
11. Conductometry: Titration of strong acid vs strong base, to find out equivalent conductance of salt formed.
12. Viscometry: Effect of temperature on the viscosity of DNA using Ostwald's viscometer.
13. Viscometry: To determine molecular weight of protein and DNA.
14. Viscometry: To determine changes in the conformation of bovine serum albumin by viscosity measurements, effect of pH on conformation of BSA.
15. Spectrophotometry: To study the absorption spectrum of hemoglobin and NADH
16. Determination of Tm of nucleic acid
17. The validity of beers law for colorimetric estimation of creatinine.
18. The ultraviolet absorption of proteins and amino acids.
19. Estimation of proteins by Lowry"s and Bradford method.
20. Estimation of protein by E280/E260 method.
21. Fractionation of proteins: Salt precipitation, solvent precipitation, isoelectric precipitation, dialysis, centrifugation.

Note: Candidates must perform at least 6 practicals in the semester.

M. Sc. Sem I
Seminar (Code: 1S1)

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M. Sc. BIOTECHNOLOGY
Semester II
Paper – I (Code: 2T1)
Microbiology

UNIT I:
Eukaryae and Viruses

- Algae: General characteristics, Applications in biotechnology.
- Fungi and slime moulds: General characteristics, applications in biotechnology.
- Viruses: Nature, symmetry, capsid structure, nucleic acid.
- Quantification of viruses
- Life cycles: T4 and lambda.
- Viroids and prions.

UNIT II:
General Microbiology and Taxonomy

- Prokaryotes: bacterial structure and morphology, endospore forming bacteria, pseudomonas, mycobacteria, archaebacteria.
- Microbial classification: 16s rRNA sequence and bacterial phylogeny.
- Bacterial genetic system: recombination (transformation, conjugation, transduction and transposition) Plasmids, salient features of the E. coli genetic map.

UNIT III:
Microbial Physiology

- Nutrition: nutritional classification, behavior, cultivation, isolation, media and their types, maintenance of culture.
- Growth: Measurement of growth, growth curve, continuous and synchronous culture, factors affecting microbial growth.

UNIT IV:
Microbial Control

- Microbial control: methods and dynamics of sterilization, mechanisms of control, biocontrol and preservation.
- Concept of chemotherapy, chemotherapeutic agents, mechanisms of action.
- Drug resistance, MDR, assessment and management of drug resistance.

M. Sc. BIOTECHNOLOGY
Semester II
Paper – II (Code: 2T2)
Immunology

UNIT I:
Immunology- fundamental concepts and anatomy of the immune system
Components of innate and acquired immunity; Organs and cells of the immune system- primary and secondary lymphoid organs; Lymphatic system;; Mucosal and Cutaneous associated Lymphoid tissue.(MALT&CALT); Mucosal Immunity; Antigens - immunogens, haptens; Major Histocompatibility Complex - MHC genes, HLA typing, flow cytometry, Microarrays.

UNIT II:
Immune responses generated by B and T lymphocytes
Immunoglobulins-basic structure, classes & subclasses of immunoglobulins, antigenic determinants;Basis of self —non-self discrimination; B cell maturation, activation and differentiation; Generation of antibody diversity; T-cell maturation, activation and differentiation and T-cell receptors; Cell-mediated immune responses, ADCC; Cytokines-properties, receptors and therapeutic uses, Hapten-carrier system

UNIT III:
Vaccinology

Active and passive immunization; Live, killed, attenuated, sub unit vaccines; Vaccine technology- Role and properties of adjuvants, recombinant DNA and protein based vaccines, plant-based vaccines, reverse vaccinology; Peptide vaccines, conjugate vaccines; Antibody genes and antibody engineering- chimeric and hybrid monoclonal antibodies; Catalytic antibodies and generation of immunoglobulin gene libraries.

UNIT IV:

Clinical Immunology

Hypersensitivity — Type I-IV; Autoimmunity; Types of autoimmune diseases; Mechanism and role of CD4+ T cells; MHC and TCR in autoimmunity; Treatment of autoimmune diseases; immunosuppressive therapy; Cancer immunotherapy. Apoptosis, transgenic mice, Gene knock outs.

M. Sc. BIOTECHNOLOGY
Semester II
Paper – III (Code: 2T3)
Fundamentals of Genetic Engineering

UNIT I:

- Restriction endonucleases and modification methylases
- Other enzymes needed in genetic engineering: exonucleases and endonucleases, ligases, polymerases, DNA modification enzymes and topoisomerases.
- Gene isolation and purification: general methods (shotgun method for producing gene library, cloning specific genes by hybridization and reverse transcriptase methods, direct selection of a gene)

UNIT II:

- Insertion of DNA and ligation: Berg's terminal transferase method (dA:dT joints); Boyer-Cohen-Chang experiment (cohesive ends), Butt joints (T4 DNA ligase); current ligation techniques (blunt-end ligation, complementary end ligation, linkers, adaptors, homopolymer tailing.

UNIT III:

Construction of Genomic DNA library and its applications

- Construction of cDNA Library: Method, problems to be addressed, advantages and disadvantages compared to the genomic DNA library, uses
- Screening of recombinants: Screening by complementation, southern hybridization, northern hybridization, colony lift, western blotting, immunoprecipitation, south-western screening. Synthesis and labeling of probes.
- DNA sequencing: Sanger-Coulson dideoxynucleotide method, Maxam-Gilbert chemical cleavage method, multiplex DNA sequencing, automated DNA sequencing. Basic idea of oligonucleotide synthesis.

UNIT IV:

Cloning vectors

- Plasmids as vectors, general characteristics of plasmids, bacterial vector plasmids, yeast vector plasmids,
- yeast artificial chromosomes
- Phage Vectors (lambda, M13).
- Cosmid vectors.
- Animal virus derived vectors – SV 40 and retroviral vectors

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M. Sc. BIOTECHNOLOGY
Semester II
Paper – IV (Code: 2T4)
Applied Molecular Biology

UNIT I:

Recombination and Genome Mapping,

- Homologous recombination: Holiday junction, gene targeting, gene disruption, FLP/FRT and Cre/Lox recombination, RecA and other recombinases.
- Molecular mapping of genome: Genetic and physical maps, choice of mapping population, southern and fluorescence in situ hybridization for genome analysis, RFLP, RAPD, and AFLP analysis, molecular

markers linked to disease resistance genes, application of molecular markers in forensic, disease prognosis, genetic counseling, pedigree etc.

UNIT II:

Antisense, Ribozymes and Epigenetics

- Antisense and ribozyme technology: Molecular mechanism of antisense molecule, biochemistry of ribozyme, hammerhead ribozymes, applications of antisense and ribozyme technologies.
- Epigenetics: chromatin marking systems, Direct chemical modification of DNA, Basic concepts of RNAi.

UNIT III:

Cancer Biology

- Methods to study cancer: Animal models. Role of tissue culture in study of cancer. Combination of tissue culture and animal models.
- DNA Viruses and cancer: Polyoma virus, SV40, adenovirus
- Genetics of Cancer: Oncogenes (ras, myc), suppressor genes (p53, Rb).

UNIT IV:

- Angiogenesis: Brief idea of healthy vasculature, definition of angiogenesis, basic process of tumor induced angiogenesis, Hypoxia induced factor (HIF), basics of pro- and anti- angiogenic factors, positive and negative factors affecting angiogenesis.
- Metastatsis: Stages of metastatic progression, prerequisites for metastasis (properties a cell must acquire for metastasis), epithelial-mesenchymal transition, biochemical parameters acquired by metastatic cells.
- Basic idea of Cancer stem cells.

M. Sc. BIOTECHNOLOGY
Semester II
LAB I (Code: 2P1)
Microbiology & Immunology

1. Production of microbial products in bioreactors/fermentors.
2. Immobilization of cells/enzymes.
3. Cleanliness, media preparation, sterilization, culturing methods, dilution techniques.
4. Staining techniques in microbiology; simple staining, gram staining, spore staining capsule staining, flagella staining.
5. Isolation of pure culture by different techniques.
6. Replica plating technique.
7. Propagation of viruses.
8. Assay of viruses.
9. Purification of immunoglobulins, qualitative assessment.
10. Demonstration of immunochemical reactions (blood group, Widal, VDRL, pregnancy, ELISA)
11. Blood film preparation and identification of cells.
12. Ouchterlony immunodiffusion,
13. Determination of albumin by radial immunodiffusion.
14. Biochemical tests for identification of Bacteria – Oxidase, catalase, IMViC test, etc.
15. Isolation of antibiotic resistant bacteria from waste / sewage water.
16. Motility of bacteria by hanging drop method.
17. Assay of antibiotics by disc diffusion method.

Note: Candidates must perform at least 6 practicals in the semester.

M. Sc. BIOTECHNOLOGY
Semester II
LAB II (Code: 2P2)
Genetic Engineering & Applied Molecular Biology

1. Induction of β-galactosidase in strains of E. coli (I+ and I-).
2. Southern blotting.
3. Isolation of genomic DNA.
4. Western blotting.
5. Endonuclease digestion of DNA and analysis of DNA fragments by agarose electrophoresis.
6. Isolation of RNA.
7. Restriction fragment length polymorphism.
8. Ames test.
9. Isolation of plasmid DNA (miniprep and alkaline bulk method)
10. Isolation of RNA
11. Isolation of polyA RNA using oligodT columns
12. Estimation of RNA by Orcinol method
13. Estimation of DNA by diphenylamine method
14. Estimation of DNA by E260 method
15. Isolation of Lambda phage DNA.

Note: Candidates must perform at least 6 practicals in the semester.

M. Sc. Sem II
Seminar (Code: 2S1)

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M. Sc. BIOTECHNOLOGY
Semester III
Paper – I (Code: 3T1)
Genetic Engineering & its Applications

UNIT I:

- Transformation: DNA uptake by bacterial cells.
- Transfection: Chemical and physical methods, Viral vectors. Polyethylene glycol, DEAE-dextran, calcium phosphate coprecipitation, dimethyl sulfoxide, liposomes, microinjection, macroinjection, electroporation, biolistics, somatic cell fusion, gene transfer by pronuclear microinjection
- Amplification of DNA: Polymerase chain reaction.

UNIT II:

Plant transformation technology: Basis of tumor formation, hairy root, features of Ti and Ri plasmids, mechanism of DNA transfer, role of virulence genes, use of Ti and Ri as vectors, binary vectors, use of 35S and other promoters, genetic markers, use of reporter genes, use of scaffold attachment regions, methods of nuclear transformation, viral vectors and their application, Biological and physical transformation methods. Chloroplast transformation.

UNIT III:

- Expression of heterologous genes: expression of eukaryotic genes in bacteria, expression of heterologous genes in yeast, insect and mammalian cells.
- Salient features of expression vectors.
- Processing of recombinant proteins: Refolding and stabilization.
- Industrial Products of Protein engineering

UNIT IV:

- Phage Display: Production of monoclonal bodies by phage display technique using filamentous phage vectors.
- Gene Therapy: somatic and germline, gene replacement, in vivo and ex vivo gene delivery, retrovirus gene transfer system, advantages and disadvantages of adenovirus, adeno-associated virus, herpes virus vectors, gene correction, replacement/augmentation, editing, regulation and silencing. Gene therapy of human diseases

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M. Sc. BIOTECHNOLOGY
Semester III
Paper – II (Code: 3T2)
Plant Biotechnology

UNIT I:

- Conventional plant breeding (introductory).
- Introduction to cell and Tissue culture. Tissue culture as a technique to produce novel plants and hybrids.
- Tissue culture media (composition and preparation)
- Callus and suspension cultures: initiation and maintenance of callus and suspension cultures; single cell clones.
- Organogenesis. Embryogenesis; transfer and establishment of whole plants in soil.

UNIT II:

- Shoot tip culture: rapid clonal propagation and production of virus free plants.
- Embryo culture and embryo rescue.
- Hybrid plants: protoplast isolation, culture and fusion, selection of hybrid cells and regeneration of hybrid plants, symmetric and asymmetric hybrid, cybrid.
- Production of haploid plants: anther, pollen and ovary cultures for production of haploid plants and homozygous lines.

- Germplasm conservation: cryopreservation, slow growth cultures and DNA banking for germplasm conservation.

UNIT III:

- Applications of plant transformation for productivity and performance
- Herbicide resistance, phosphoinothricine glyphosate, sulfonyl urea, atrazin, insect resistance, Bt genes, non-Bt-like protease inhibitor, virus resistance, coat protein mediated nucleocapsid gene, disease resistance, chitinase, 1-3 beta glucanase, RIP,
- antifungal proteins, thionins, PR proteins, nematode resistance, abiotic stress, post harvest losses, long shelf life of fruits and flowers, use of ACC synthase, polygalacturanase, ACC oxidase, male sterile lines, bar and barnase systems, carbohydrate composition and storage, ADP glucose pyrophosphatase.

UNIT IV:

- Plant metabolic engineering and industrial products: plant secondary metabolites, control mechanisms and manipulation of phenylpropanoid pathway, shikimate pathway, alkaloids, industrial enzymes, biodegradable plastics, polyhydroxybutyrate, therapeutic proteins, lysosomal enzymes, antibodies, edible vaccines, purification strategies, oleosin partitioning technology.
- Molecular marker aided breeding: RFLP maps, linkage analysis, RAPD markers, STS, microsatellite, SCAR (sequence characterized amplified regions), SSCP (single strand conformational polymorphism), QTL, map based cloning, molecular marker assisted selection.
- Green House Technology

M. Sc. BIOTECHNOLOGY
Semester III
(NOTE: Candidates can choose any one elective paper from Core elective A or B)

Paper – III (Core Elective A) (Code: 3T3A)
Industrial Biotechnology I

UNIT I:
Bioreactors:

- Bioreactor function, utility, types of bioreactor. Modes of bioreactor operations. Main components of the bioreactor and their functions.
- Bioreactors
  a) Design/configuration of a basic fermentor; individual parts and probes for on-line monitoring of process.
  b) Concept of Batch and Continuous process, fed-batch semi-continuous systems; aerobic and anaerobic fermentors
  c) Submerged/liquid state and solid state fermentations

UNIT II
Types of Bioreactors:

- Continuous stirred tank and plug flow reactors
- Packed bed and fluidized bed reactors
- Trickle bed, immobilized bed, air lift, rotary disc reactors. Reactors with cell recycle.

UNIT III:
Immobilized reactor systems:

- Immobilization techniques for cells (physical adsorption, ionic binding, covalent binding, lattice entrapment, membrane entrapment, micro encapsulation) and enzymes (covalent binding, entrapment, micro encapsulation, cross-linking, adsorption, ionic binding, affinity binding, chelation, disulfide bonds)
- Immobilized enzyme kinetics
- Types of immobilized reactors

UNIT IV:
Scope of Downstream Processing:

- Importance of Down Stream Processing (DSP) in biotechnology, characteristics of products, criteria for selection of bio-separation techniques. Role of DSP methods in bioprocess economics. Cell Disruption

Methods: Various cell disruption methods, need for cell disruption for (Homogenizer, French press & Dynomill) intracellular products, cell disruption equipment. Applications in bio-processing. Flocculation: Principles of flocculation various flocculating agents, applications in bio-processing. Coagulation: Principles of coagulations and its applications in bio-processing

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M. Sc. BIOTECHNOLOGY
Semester III
(NOTE: Candidates can choose any one elective paper from Core elective A or B)

Paper – III (Core Elective B) (Code: 3T3B)
Environmental Biotechnology I
Environmental Science & Bioresources

UNIT I:
Introduction to environmental Science: Environmental ethics: Environmentalism, Environment & Religion, Environmental education, Need for environmental education. Environmental Pollution: Classification of pollutants, Air pollution and their properties, Gaseous pollutants, water pollutants and their properties. Noise pollution, Soil pollution, thermal pollution, marine pollution, solid water pollution.

UNIT II:
Ecosystem structure and functions, abiotic and biotic component, Energy flow, food chain, food web, Ecological Pyramids-types, biogeochemical cycles, ecological succession, Ecads and ecotypes. Biotechnological processes: Bioconversion, Bioaccumulation, Bioconcentration, Biomagnification, Biodegradation.

UNIT III:
Energy & Biofuels: Non conventional or renewable sources of energy, Energy from Biomass, Biofertilizers, Biosensors and biochips, Biofilters, Biofuel cells,

UNIT IV:
Biofertilizers, Biopestisides and Integrated pest management: Bacterial biofertilizers, algal biofertilizers, Aquatic ferns as biofertilizers, Fungi as biofertilizers, earthworm as biofertilizers, biopestisides, Integrated pest management.

M. Sc. BIOTECHNOLOGY
Semester III
(NOTE: Candidates of other M. Sc. Subjects can choose this paper from Biotechnology subject)
Paper – IV (Foundation Paper I) (Code: 3T4A)
Introductory Biotechnology

UNIT I:
Basics of Proteins

- Amino acids: Structures of amino acids found in proteins, classification, peptide bond structure; Protein Structure:
- Primary (basic idea of sequencing and amino acid composition), secondary (alpha and beta structures), tertiary and quaternary structures

UNIT II:
Nucleic acids

- Nucleoside, Nucleotides, Bases; Basic Structure of DNA (Watson Crick structure) and RNA.

UNIT III:
Genes and chromosomes

- Gene definition, prokaryotic and eukaryotic gene structure; Structure of chromatin (nucleosome, 30 nm fiber, solenoid structure); basic understanding of chromosome structure; centromeres, telomeres, Unique genes and gene families

UNIT IV:

Enzymes

- Overview, Enzyme classification with specific examples. Characteristics of enzymes, Concept of active centre, binding sites, stereospecificity and ES complex formation. Effect of temperature, pH and substrate concentration on reaction rate. Enzyme activity, international units, specific activity
- Introduction to Enzymes used in biotechnology: Restriction enzymes, exonucleases and endonucleases, ligases, polymerases, DNA modification enzymes and topoisomerases

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M.Sc. Biotechnology (CBCS)
Semester-III
(Candidate can opt for this paper in their main subject of postgraduation ONLY).
Paper-IV: (Core Subject Centric I) (Code: 3T4B)
Diagnostic Medical Biotechnology

Molecular and Nanomolecular Diagnostics

Unit I

Host pathogen interactions in disease process (Bacterial: Tuberculosis and Staphylococcal Diseases & Viral: Influenza and HIV/AIDS); Disease pathology and clinical spectrum; Clinical diagnosis of diseases; Molecular Genetics of the host and the pathogen. Molecular techniques for analysis of these disorders; Assays for the Diagnosis of inherited diseases; Bioinformatic tools for molecular diagnosis.

Unit II

Concept of Genomics, Human disease genes; DNA polymorphism including those involved in disease (Ex: Hemoglobin and the anemias); Phenylketonuria (monogenic) and diabetes (multigenic) genetic disorders; 'disease' gene vs. 'susceptibility' gene; SNP detection: hybridization based assays (allele specific probes); Polymerization based assays (allele specific nucleotide incorporation, allele-specific PCR); Ligation based assays (allele specific oligonucleotide ligation); Polymorphism detection without sequence information: SSCP. Single nucleotide polymorphism and disease association; High throughput DNA sequencing and diagnosis; and Array based techniques in diagnosis.

Unit III

Outline of a typical proteomics experiment, clinical proteomics and disease biomarkers. Isolation of proteins and other molecules associated with disease; 2D analysis of such proteins by sequencing individual spots by Mass Spectrometry; Protein Microarray; Present methods for diagnosis of Specific diseases like Tuberculosis and AIDS; Ethics in Molecular Diagnosis

Unit IV

Nanomolecular diagnostics and Biosensor: Introduction to Nanodiagnostics, Nanoarrays for diagnostics, detection of single DNA, self-assembled protein nanoarrays, protein nanobiochip nanoparticles for molecular diagnostics, DNA nanomachines, Nanobiosensor, CNT biosensor, DNA nanosensor, Nanowire biosensor, application of nanodiagnostics.

Texts/References

1. George Patrinos and Wilhelm Ansorage, Molecular Diagnostics, 1st Edition, Academic Press, 2005.
2. Willey J. Prescott, Harley, and Klein's Microbiology-7th international ed./Joanne M. Willey, Linda M. Sherwood, Christopher J. Woolverton. New York: McGraw-Hill Higher Education; 2008.
3. Lela Buchingham and Maribeth L Flawsm, Molecular Diagnostics: Fundamentals, Methods and Clinical Applications, 1st Edition, F A Davis Company, Philadelphia, USA, 2007.
4. Campbell, M.A and Heyer L.J., Discovering Genomics, Proteomics and Bioinformatics, 2nd Edition, CSHL Press, Pearson/Benzamin Cummings San Francisco, USA, 2007.
5. Andrew Read and Dian Donnai, New Clinical Genetics, Scion Publishing Ltd, Oxfordshire, UK, 2007.
6. Challa S.S.R. Kumar, Nanomaterials for medical diagnosis and therapy, Viley-VCH, 2007.
7. Dr.Parag Diwan and Ashish Bharadwaj (Eds), Nano Medicines, Pentagon Press, 2006.

M. Sc. BIOTECHNOLOGY
Semester III
LAB I (Code: 3P1)
Genetic Engineering & Plant Biotechnology

1. Recombinant DNA technology: in vitro DNA ligation and transformation of E. coli.
2. Recombinant DNA technology: characterization of transformants.
3. Northern blotting
4. Agarose gel electrophoresis and restriction mapping of DNA.
5. Construction of restriction map of plasmid DNA
6. Cloning in plasmid/phagemid vectors.
7. DNA sequencing.
8. Gene expression in E coli and analysis of gene product
9. Demonstration of technique of PCR
10. Demonstration of technique of RT-PCR
11. Replica plating technique.
12. Propagation of viruses.
13. Endonuclease digestion of DNA and analysis of DNA fragments by agarose electrophoresis.
14. Restriction fragment length polymorphism.
15. Ames test.
16. Quantitation of DNA by various methods.
17. Preparation of plant tissue culture media.
18. Surface sterilization.
19. Organ culture.
20. Callus propagation, organogenesis, transfer of plants to soil.
21. Protoplast isolation and culture.
22. Anther culture: production of haploids.
23. Cytological examination of regenerated plants.
24. Micropropagation of banana, citrus Papaya, Sugarcane etc.
25. Effect of various growth hormones on cell divisions and cell proliferation
26. Isolation, purification and culture of protoplast
27. Artificial seed preparation
28. Cytological examination of regenerated plants
29. Agrobacterium culture and selection of transformants.
30. Hardening of tissue culture raised plants.
31. Transfer of plants to soil.

Note: Candidates must perform at least 6 practicals in the semester.

M. Sc. BIOTECHNOLOGY
Semester III
LAB II (Core Elective A) (Code: 3P2)
Industrial Biotechnology

1. Immobilization of cells/enzymes
2. Determination of rheological constant.
3. Determination of oxygen transfer rate, volumetric transfer coefficient.
4. Microbial production of Alcohol
5. Microbial production of antibiotics
6. Production of microbial products in fermentors / bioreactors
7. Preparation and formulation of microbial biopestisides / biofertilizers.
8. Study of patenting procedure
9. Preparation of proposal for patenting.

Note: Candidates must perform at least 6 practicals in the semester.

M. Sc. BIOTECHNOLOGY
Semester III
LAB II (Core Elective B) (Code: 3P2)
Environmental Biotechnology

1. Detection of coliforms for determination of the purity of potable water.
2. Determination of total dissolved solids of water
3. Determination of Hardness and alkalinity of water sample.
4. Determination of dissolved oxygen concentration of water sample
5. Determination of biological oxygen demand of sewage sample
6. Determination of chemical oxygen demand (COD) of sewage sample.
7. Analysis of oligodynamic action.
8. Determine the efficiency of removal of air pollutant using fibrous air filter.
9. Preparation and formulation of microbial biopesticide (bacteria, fungi and viruses
10. Production of microbial fertilizers (Rhizobium, Azotobacter and AMF).

Note: Candidates must perform at least 6 practicals in the semester.

M. Sc. Sem III
Seminar (Code: 3S1)

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M. Sc. BIOTECHNOLOGY
Semester IV
Paper – I (Code: 4T1)
Animal Biotechnology

UNIT I:

- Animal Cell Culture: Equipments and materials for animal cell culture technology. Various systems of tissue culture, their distinguishing features, advantages and limitations.
- Culture medium: natural media, synthetic media, sera. Introduction to balanced salt solutions and simple growth medium. Brief discussion on the chemical, physical and metabolic functions of different constituents of culture medium, role of carbon di oxide, serum and supplements.
- Characteristics of cells in culture: Contact inhibition, anchorage dependence, cell-cell communication etc.; Cell senescence; cell and tissue response to trophic factors.

UNIT II:

- Primary Culture: Behavior of cells, properties, utility. Explant culture; suspension culture.
- Established cell line cultures: Definition of cell lines, maintenance and management; cell adaptation.
- Measurement of viability and cytotoxicity. Cell cloning, cell synchronization and cell manipulation. Various methods of separation of cell types, advantages and limitations; flow cytometry.

UNIT III:

- Scaling up of animal cell culture. Cell transformation.
- Stem cell cultures, embryonic stem cells and their applications. Somatic cell genetics.
- Apoptosis: Measurement of cell death. Apoptosis (death domain, role of cytochrome C)

UNIT IV:

- Commercial applications of cell culture: Tissue culture as a screening system; cytotoxicity and diagnostic tests. Mass production of biologically important compounds (e.g. Vaccines). Harvesting of products, purification, and assays.
- Three dimensional cultures and tissue engineering.

M. Sc. BIOTECHNOLOGY
Semester IV
Paper – II (Code: 4T2)
Biostatistics, Bioinformatics, Ethics & Patenting

UNIT I:

Biostatistics

- Measures of central tendency: mean, mode, and median.
- Measures of dispersion: range, mean deviation, standard deviation.
- Methods of sampling, sampling error, non-sampling errors, standard error.
- Chi-square test, meaning of correlation and regression.
- Cluster analysis: phylogenetic clustering by simple matching coefficients.
- Presentation of statistical data: tabulation (simple tables, frequency distribution table); charts and diagrams (bar charts, histograms, pie charts, dendrogram).
- Research designs with basic principles and field layout.

UNIT II:

Bioinformatics

- Computer concept: computer organization, hardware, software, operating system (windows, unix, brief list of computer languages).
- Concept of networking: internet, internet concepts, web browsing, public domain resources in biology.
- Concept of database management: brief idea of data types, data structures, searching, sorting, designing a database, genomic, proteomic, and metabolic pathways databases.

- Computer analysis of genetic sequences: general concepts of sequence analysis, identification of functional sequences, homology, brief idea of BLAST, ENTREZ, and PuBMed.
- Proteomics: basic issues and concepts, protein sequences and alignment, protein structure prediction.
- Bioinformatics tools in drug design.

UNIT III:

Ethics:

- Benefits of biotechnology, ELSI of biotechnology, recombinant therapeutic products for human health care, genetic modifications and food consumption, release of genetically engineered organisms, applications of human genetic rDNA research, human embryonic stem cell research.

UNIT IV:

Patenting

- Patent and Trademark, Biotechnology products and processes, Intellectual property rights, Plant breeders rights, biotechnology in developing countries. Biosafty and its implementation, Quality control in Biotechnology.

M. Sc. BIOTECHNOLOGY

Semester IV

(NOTE: Depending on the Core elective subject chosen in Semester III, Candidates shall pursue the same core elective subject in semester IV)

Paper – III (Core Elective A) (Code: 4T3A)

Industrial Biotechnology II

UNIT I:

Bioprocess Engineering Concepts:

- Mass transfer, heat transfer, mixing, rheology of fermentation fluids, residence time distribution, substrate utilization and yield-coefficients, oxygen transfer and oxygen sag.

UNIT II:

Process Optimization and Control:

- Optimization parameters, medium formulation, process optimization techniques:classical, Plackett-Burman design, ANOVA, central; composite design, response surface methodology with example.; medium formulation: classical, experimental design technique, fractional factorial design with egs.
- Concept of control: turbidostatic and chemostatic control, open loop and feedback control
- Advanced control policies: model predictive control, cascade control, PID control, programmed control

UNIT III:

Scale up & Biosensor Technology:

- basic principles of scale-up
- bases of scale up, scale down
- Biosensors

UNIT VI:

Production of Primary & Secondary Metabolite:

1. Primary Metabolites:

- A brief outline of processes for the production of some commercially important organic acids (e.g. citric acid, lactic acid, acetic acid etc); amino acids (glutamic acid, phenyalanine, aspartic acid etc.) and alcohols (ethanol, butanol etc.)

2. Secondary Metabolites:

- Brief Study of production processes for various classes of secondary metabolites: antibiotics: beta-lactams (penicillin), aminoglycosides (streptomycin) macrolides (erythromycin), vitamins and steroids.

M. Sc. BIOTECHNOLOGY

Semester IV

(NOTE: Depending on the Core elective subject chosen in Semester III, Candidates shall pursue the same core elective subject in semester IV)

Paper – III (Core Elective B) (Code: 4T3B)

Environmental Biotechnology II
Applied Environmental Biotechnology

UNIT I:
Bioremediation & Phytoremediation: Biofeasibility, applications of bioremediation, Bioreduction, Phytoremediation.
Solid waste pollution and its management: Current practice of solid waste management, composting systems, vermicomposting, sewage treatment.

UNIT II:
Bioabsorption and Bioleaching of heavy metals: Cadmium, Lead, Mercury, Metal binding targets and organisms, Bioabsorption, Metal microbial interaction, Biomethylation of elements (Methylation of mercury and arsenic), Commercial biosorbants, bioleaching, metal precipitation, advantages and disadvantages of bioleaching.

UNIT III:
Waste water Treatment: Biological treatment system (Oxidative ponds, aerobic and anaerobic ponds, facultative ponds, aerated ponds), Biological waste treatment, activated sludge treatment, microbial pollution in activated sludge, percolating filters, waste water treatment by biofilms. Treatment scheme of Dairy, Distillery, Tannery, Sugar, Fertilizers, Refinery, Chemical and Antibiotic waste.

UNIT IV:
Xenobitics in environment: Biodegradation of Hydrocarbons, Substituted hydrocarbons, Surfactant, Pesticides, Lignin, Tannin, Synthetic dyes, Biotransformation: Oxidation reactions: Cytochrome P450 monooxygenase system, Alcohol and aldehyde dehydrogenases, Peroxidases. Reduction reactions: Cytochrome P450 and flavin dependent reactions. Hydrolysis reactions: Carboxyl esterases. Conjugation reactions: Gluthione S transferases. Regulation of biotransformation.

M. Sc. BIOTECHNOLOGY
Semester IV
(NOTE: Candidates of other M. Sc. Subjects can choose this paper from Biotechnology subject)
Paper – IV (Foundation Paper II) (Code: 4T4A)
Basic rDNA Technology

UNIT I:
History of Gene cloning

- Boyer-Cohen-Chang experiment. Patenting of the recombinant DNA technique; Berg's role in gene cloning history, Change in medicinal science after discovery of recombinant DNA technology (brief mention of how we produce human insulin today, somatostatin and other therapeutic products, very brief overview of how we may treat diseases through gene therapy)
- Why do we clone genes? (amplification and/or heterologous gene expression). Basic steps of gene cloning:
- Agarose gel electrophoresis; 2D Electrophoresis; Pulsed field gel electrophoresis; SDS PAGE; 16S rDNA sequencing for bacterial identification; ITS region sequencing for fungal identification; RFLP; RAPD

Unit II:
Basic process of recombinant DNA technology

- Cutting and joining of DNA. Vectors: concept, types of vectors (plasmids, phage, virus), Essential qualities that a vector must possess
- Types of vectors: pBR322, cosmids, lambda phage

Unit III:
Basic process of recombinant DNA technology

- Transformation and Transfection – basic techniques. Selectable markers (antibiotic resistance, lacZ), Selection process, Screening.

Unit IV:

Applications of gene cloning

- Insulin, Somatostatin, BT Cotton, production of human proteins and drugs, recombinant vaccines, agricultural applications, production of transgenic animals, human gene therapy

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M.Sc. Biotechnology (CBCS)
Semester-IV
(Candidate can opt for this paper in their main subject of postgraduation ONLY).
Paper-IV: (Core Subject Centric II) (Code: 4T4B)
Therapeutic Medical Biotechnology

Molecular Therapeutics and Drug Discovery

Unit I

Gene therapy; Intracellular barriers to gene delivery; Overview of inherited and acquired diseases for gene therapy; Retro and adeno virus mediated gene transfer; Liposome and nanoparticles mediated gene delivery. Gene silencing technology; siRNA- Concept, delivery and therapeutic applications in treatment of influenza and HIV/AIDS; Tissue and organ transplantation; Transgenics and their uses; Cloning; Ethical issues

Unit II

Proteomics and drug discovery: High throughput screening for drug discovery; Identification of drug targets; Pharmacogenomics and pharamacogenetics and drug development; Toxicogenomics; Metagenomics.

Unit III

Nanobiotechnology for drug discovery, protein and peptide based compounds for cancer and diabetes, drug delivery - nanoparticle based drug delivery, lipid nanoparticles, vaccination, cell therapy, Gene therapy. Ethical, safety and regulatory issues of nanomedicine. Physicochemical characteristics of nanomaterials, Nanoparticle interaction with biological membrane, Neurotoxicology.

Unit IV

Drug Discovery & Clinical research

Introduction and importance of clinical research, Drug Development and phases of Clinical trials, Designing clinical Trials, Protocol designing, Ethical issues in clinical research, ICH-GCP Guidelines, Informed consent process, Role of CRC and CRA in clinical trials, Pharmacovigilance, Standard operating procedures, Guidelines to undertake clinical trials in India schedule Y.

Texts/References:

1. Bernhard Palsson and Sangeeta N Bhatia, Tissue Engineering, 2nd Edition, Prentice Hall, 2004.
2. Pamela Greenwell, Michelle McCulley, Molecular Therapeutics: 21st century medicine, 1st Edition, Sringer, 2008.
3. Primrose S & Twyman R, Principles of Gene Manipulation and Genomics, 7th Edition, Blackwell, 2006.
4. H. Rehm, Protein Biochemistry and Proteomics, 4th Edition, Academic Press, 2006.
5. Robert A. Freitas Jr., Nanomedicine, Volume I: Basic Capabilities, Landes Bioscience, Georgetown, TX, 1999.
6. Robert A. Freitas Jr., Nanomedicine, Volume IIA: Biocompatibility, Landes Bioscience, Georgetown, TX, 2003.
7. Kewal K. Jain, The Hand book of Nanomedicine, Humana Press, Springer 2008.
8. Nancy A. Monteiro – Riviere and C. Lang Tran, Nanotoxicology: Characterization, Dosing and Health Effects, Informa Healthcare. 2007.
9. Kumar, Challa S. S. R. (ed.) Nanomaterials - Toxicity, Health and Environmental Issues, Wiley-VCH, Weinheim, 2006.
10. Norris, Deborrah. Clinical Research Coordinator Handbook. Plexus Pub, 2009.
11. Portney, Leslie Gross, and Mary P. Watkins. Foundations of clinical research: applications to practice. Vol. 2. Upper Saddle River, NJ: Prentice Hall, 2000.
12. Stone, Judy. Conducting clinical research: A practical guide for physicians, nurses, study coordinators, and investigators. Mountainside MD Press, 2006.
13. Glasser, Stephen P., and P. Glasser. Essentials of clinical research. Springer, 2008.

Semester IV
LAB I (Code: 4P1)
Animal Biotechnology, Biostastics, Bioinformatics, Ethics & Patenting
And Industrial Biotechnology II or Environmental Biotechnology

Section I: Animal Biotechnology, Biostastics, Bioinformatics, Ethics & Patenting

1. Development of primary cell lines/maintenance of established cell lines
2. Preparation of animal cell culture media.
3. Filter sterilization and sterility test.
4. Media storage, serum inactivation.
5. Cell fusion.
6. Cell transformation by viruses.
7. Lyophilization of local germplasma.
8. Calculation of mean, mode, and median
9. Calculation of standard deviation and standard error
10. Using computer in single user and multiple user environment
11. Designing and management of databases
12. Computer aided statistical analysis
13. Computer presentation of statistical data, charts and diagrams
14. Computer aided visualization of amino acid sequence of protein and its 3D structure.
15. Retrieving metabolic pathway using internet
16. Homology searching using BLAST
17. Base sequence analysis of gene / protein sequence
18. Computer aided survey of scientific literature
19. Field layout based on statistical research designs
20. Determination of rheological constant

Section II: Section A) Industrial Biotechnology OR Section B) Environmental Biotechnology
A) Industrial Biotechnology

1. Demonstration of various bioreactor configuration, parts and integrated process control system.
2. Demonstration of addition of inoculation and sampling in CSTR
3. Determination fo volumetric mass transfer coefficient (KLa) by dynamic method and sulphite oxidation method
4. Preparation of wine from grapes.
5. Preparation and characterization of immobilized cells system
6. To perform cell disruption by ultrasonication
7. To study the settling velocity of solid particles under batch sedimentation

OR

B) Environmental Biotechnology

1. Test for the degradation of a aromatic hydrocarbons by bacteria
2. Survey of degradative plasmids in microbes growing in polluted environment
3. Effect of Sulphur dioxide on crop plants
4. Estimation of heavy metals in water/soil by Atomic absorption spectrophotometry,
5. Estimation of nitrate in drinking water.
6. Role of microorganisms in elevation of heavy metal induced stress in plants.
7. Isolation of xenobiotic degrading bacteria by selective enrichment technique
8. In vitro evaluation of medicinal plants against pathogenic microbes.
9. Effect of mycorrhizal fungi on growth promotion of plants.
10. Study of patenting procedure
11. Preparation of proposal for patenting.
12. Study of RFLP, VNTRs, SNPs

Note: At least 6 practical must be conducted within the semester.

M. Sc. Part II, Sem IV
Project (Code: 4PROJ1)

M. Sc. Part II, Sem IV
Seminar (Code: 4S1)

SYLLABUS for M. Sc. Zoology
Choice Based Credit System (Semester Pattern)
Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur
With effect from 2018-19

Candidates opting for this course are advised to go through the direction relating to the course "DIRECTION RELATING TO THE EXAMINATION LEADING TO THE DEGREE OF MASTER OF SCIENCE, SEMESTER PATTERN (CHOICE BASED CREDIT SYSTEM) AND DEGREE OF MASTER OF SCIENCE AND TECHNOLOGY (APPLIED GEOLOGY). SEMESTER PATTERN, (CHOICE BASED CREDIT SYSTEM) (FACULTY OF SCIENCE & TECHNOLOGY)" which is available on R. T. M. Nagpur University website.
The direction will provide details on admission criteria, rules for ATKT, scheme of examination, absorption scheme for CBS students into CBCS pattern, elective papers, foundation course papers, subject centric papers, coding pattern, pattern of question papers, practicals, distribution of marks, seminars, project work, internal assessment, calculation of SGPA and CGPA, etc.

Syllabus for M. Sc. Zoology (Semester with credit based Pattern) w e f 2018-19 Academic session

Scheme of teaching and examination under semester pattern Choice Based Credit System (CBCS) for M.Sc. Program in Zoology

M. Sc. Zoology Semester I												
Code	Theory / Practical	Teaching scheme (Hours / Week)			Credits	Examination Scheme						
						Duration in hrs	Max. Marks		Total Marks	Minimum Passing Marks		
		Th	Pract	Total			External	Internal		Th	Pract	
Core 1	Paper **$1T_1$:** Structure and Function of Invertebrates	4	-	4	4	3	80	20	100	40		
Core 2	Paper **$1T_2$:** General Physiology	4	-	4	4	3	80	20	100	40		
Core 3	Paper **$1T_3$**: Cell Biology and Genetics	4	-	4	4	3	80	20	100	40		
Core 4	Paper **$1T_4$:** Advanced Reproductive Biology	4	-	4	4	3	80	20	100	40		
Pract. Core 1 & 2	Practical **$1P_1$:** Based on theory Paper **$1T_1$& $1T_2$**	-	8	8	4	3-8*	100**	-	100		40	
Pract. Core 3 &	Practical **$1P_2$:** Based on	-	8	8	4	3-8*	100**	-	100		40	

4	theory Paper **$1T_3$& $1T_4$**										
Seminar 1	**Seminar -$1S_1$**	2	-	2	1			25	25	10	
	TOTAL	**18**	**16**	**34**	**25**		**520**	**105**	**625**	**170**	**80**

M. Sc. Zoology Semester II											
Code	Theory / Practical	Teaching scheme (Hours / Week)			Credits	Examination Scheme					
						Duration in hrs	Max. Marks		Total Marks	Minimum Passing Marks	
		Th	Pract	Total			External	Internal		Th	Pract
Core 5	Paper **$2T_1$:** Structure and Function of Vertebrates	4	-	4	4	3	80	20	100	40	
Core 6	Paper **$2T_2$:** Comparative Endocrinology	4	-	4	4	3	80	20	100	40	
Core 7	Paper **$2T_3$:** Molecular Biology and Biotechnology	4	-	4	4	3	80	20	100	40	
Core 8	Paper **$2T_4$:** Advanced Developmental Biology	4	-	4	4	3	80	20	100	40	
Pract. Core 5 & 6	Practical **$2P_1$:** Based on theory Paper **$2T_1$& $2T_2$**	-	8	8	4	3-8*	100**	-	100		40
Pract. Core 7 & 8	Practical **$2P_2$:** Based on theory Paper **$2T_3$& $2T_4$**	-	8	8	4	3-8*	100**	-	100		40
Seminar 2	Seminar -**$2S_2$**	2	-	2	1			25	25	10	
	TOTAL	**18**	**16**	**34**	**25**		**520**	**105**	**625**	**170**	**80**

M. Sc. Zoology Semester III									
Code	Theory / Practical	Teaching scheme (Hours / Week)			Credits	Examination Scheme			
		Th	Pr	To		Du	Max. Marks	To	Minimum

										Passing Marks	
							External	Internal		Th	Pract
Core 9	Paper **$3T_1$:** Parasitology and Immunology	4	-	4	4	3	80	20	100	40	
Core 10	Paper **$3T_2$: Special Group- Paper I** • Entomology • Fish and Fisheries • Mammalian Reproductive Physiology (MRP) • Animal Physiology • Environmental Biology	4	-	4	4	3	80	20	100	40	
Core 11	**Special Group- Paper $3T_3$** • Entomology • Fish and Fisheries • Mammalian Reproductive Physiology (MRP) • Animal Physiology • Environmental Biology	4	-	4	4	3	80	20	100	40	
Foundation Course 1 **(NOTE: Only for students of other M. Sc. Subjects**	Paper **$3T_4$:** Foundation **- I** • Basic Entomology **/** • Core (Subject Centric)- I Wild Life and Avian	4	-	4	4	3	80	20	100	40	

)	Biology										
Pract. Core 9	Practical **$3P_1$:** Based on theory of **$3T_1$**	-	8	8	4	3-8*	100**	-	100		40
Pract. Core Elective 1 and 2	Practical **$3P_2$:** Based on theory of **$3T_2$** and **$3T_3$**	-	8	8	4	3-8*	100**	-	100		40
Seminar 3	Seminar -**$3S_3$**	2	-	2	1			25	25	10	
	TOTAL	**18**	**16**	**34**	**25**		**520**	**105**	**625**	**170**	**80**

M. Sc. Zoology Semester IV											
Code	Theory / Practical	Teaching scheme (Hours / Week)			Credits	Examination Scheme					
						Duration in hrs	Max. Marks		Total Marks	Minimum Passing Marks	
		Th	Pract	Total			Extern	Intern		Th	Pract
Core 11	**Paper $4T_1$**: Biotechnique, Biostatistics, Ethology, Toxicology and Bioinformatics	4	-	4	4	3	80	20	100	40	
Core 12	**Paper $4T_2$**: **Special Group- Paper $4T_2$** • Entomology • Fish and Fisheries • Mammalian Reproductive Physiology (MRP) • Animal Physiology • Environmental Biology	4	-	4	4	3	80	20	100	40	
Core	Paper **$4T_3$**:	4	-	4	4	3	80	20	100	40	

Elective 2	**Special Group- Paper $4T_3$** • Entomology • Fish and Fisheries • Mammalian Reproductive Physiology (MRP) • Animal Physiology • Environmental Biology										
Foundation Course 2 **(NOTE: Only for students of other M. Sc. Subjects)**	**Paper $4T_4$:** Foundation- **II** • Applied and Industrial Entomology / • Core (Subject Centric)-II Radiation and Chronobiology	4	-	4	4	3	80	20	100	40	
Pract. Core 11, 12 & Elective 2	**Practical $4P_1$: Based on theory of $4T_2$ and $4T_3$**	-	8	8	4	3-8*	100**	-	100		40
Project	Project -**Pro**	-	8	8	4	3-8*	100**	-	100		40
Seminar 4	Seminar- **$4S_4$**	2	-	2	1			25	25	10	
	TOTAL	**18**	**16**	**34**	**25**		**520**	**105**	**625**	**170**	**80**

Note: Th = Theory; Pr = Practical/lab, * = If required, for two days.
** = The Practical and Project shall be evaluated by both the External and Internal Examiner in the respective Department / Center / Affiliated College.

Changes in practical curriculum as per UGC Notification No. F.14-6/2014 (CPP-II) Dated 1st August 2014 (w.e.f. academic session 2015-16)

Important Instructions

I. Use of animals for dissection for practical purpose in the curriculum is banned by UGC vide its notification No. F.14-6/2014 (CPP-II) dated 1st August 2014. It is now essential to use necessary alternatives to stop dissection and promote and orient students towards the knowledge component rather than skill development using ICT and available resources without disturbing natural habitat. To understand anatomy of

any animal, virtual dissection of the animal should be conducted through various computer simulations. These digital learning devices and available resources are to be used to demonstrate the dissection of the animals and other laboratory exercises and to evaluate the students at the time of examination and to ensures compliance of the aforesaid notification.

II. Those institutions which are already having Zoology museum / Permanent Slides / Skeleton and Loose Bones of any animals should use them till they last. No new specimens/ slides or any other laboratory material procured from animal source shall be purchased for conducting practicals mentioned here- in above. If needed, they should purchase charts/ models/ photographs or digital sources as alternatives.

III. During regular practical and practical examination, for anatomical observations, demonstration and detailed explanation of the given system of Invertebrate/ Vertebrate animal, the student will expose/ explain the given system of the animal and draw, label and comment on it.

IV. During regular practical and practical examination, for mounting of given material and permanent stained preparation, the student is expected to describe the process and/or identify, draw, label and describe the given material.

Semester-I
Paper-IT1, Structure and function of Invertebrates

Unit-I

1.1 Classical and molecular taxonomic parameters, species concept, systematic gradation of animals, nomenclature, modern scheme of animal classification into sub-kingdom, division, section, phyla and minor phyla.

1.2 Ultrastructure of protozoan locomotory organs (pseudopodia-cytoplasmicorganells, flagella, cilia and pellicular myonemes) and mechanism of various modes of locomotion.

1.3 Dermal cells and skeletal organization in calcareous sponges, Hexactinilida andDemospongiae (Porifera).

1.4 Polymorphism and metagenesis in coelenterate. Types of polyps, medusa and metamorphosis.

Unit-II

2.1 Origin of metazoan-colonial, syncytial and molecular theories.

2.2 Reproductive system-structure and mechanism of reproduction in *Dugesia*, *Fasciola*, *Taenia* and *Ascaris*.

2.3 Formation, Evolution and significance of coelom, metamerism and symmetry in classification of animals, particularly coelomata.

2.4 Evolution of nephridia and mechanism of excretion (nitrogenous excretory products, transport of water and salts) in Polychaeta, Oligochaeta and Hirudinea of Annelida.

Unit-III

3.1 *Peripatus* (Onychophora) structure, affinities and taxonomic position.

3.2 Respiratory organs in Arthropoda. Mechanism of gaseous exchange in trachealrespiration in Insecta and gill respiration in Crustacea.

3.3 *Neopilina* (Monoplacophora): structure, affinities and taxonomic position.

3.4 Neuroanatomy in Gastropoda, Bivalvia and Cephalopoda.

Unit-IV

4.1 Water vascular system in Echinodermata: structure and functions.
4.2 Larval forms in Echinodermata: Metamorphosis and phylogenetic significance.
4.3 General account and affinities of Ctenophora and Rotifera.
4.4 General account and affinities of Entoprocta and Ectoprocta.

Semester-I
Paper-IT2, General Physiology

Unit-I

1.1 Enzyme: Classification, mechanism of enzyme action. Factors affecting enzyme action, regulation of enzyme activity, activators and inhibitors.
1.2 Respiratory pigments- types, distribution and properties, structure of haemoglobin and mechanism of O_2 transport.
1.3 Neurotransmitters: chemical nature, biosynthesis and mechanism of synaptic transmission.
1.4 Colour change mechanism: Chromatophores and melanophores- structure, physiology and significance.

Unit-II

2.1 Bioluminescence: light producing organs- distribution in invertebrates and vertebrates, physiology and significance.
2.2 Thermoregulation in poikilotherms and homeotherms, adaptations and regulatory mechanisms.
2.3 Osmoregulation in Pisces and Amphibia, mechanism of salt and water transport by gills and kidney.
2.4 Molecular mechanism of peptide and steroid hormonal action. Membrane receptors and signal transduction.

Unit-III

3.1 Myogenic and neurogenic heart, Cardiac cycle- Phases of cardiac cycle, ECG pace maker, and heart valves.
3.2 Digestion and absorption of carbohydrate, proteins and lipids in the gastrointestinal tract.
3.3 Carbohydrates- classification and metabolism- glycogenesis, glycogenolysis, glycolysis, TCA cycle, electron transport system and oxidative phosphorylation.
3.4 Lipids- classification and metabolism- oxidation of fatty acids, cholesterol metabolism. Proteins- classification and metabolism- oxidative deamination, decarboxylation and trans amination of amino acids, arginine-ornithin cycle.

Unit-IV

4.1 Hydromineral metabolism-water electrolyte balance, mineral metabolism in bone and egg shell formation.
4.2 Cerebrospinal fluid: Chemistry and functions.
4.3 Mechanism of reflex action.
4.4 Physiology of environmental stress and strain- tolerance, avoidance, resistance and physiological adaptations.

Semester-I
Paper-IT3, Cell Biology and Genetics

Unit-I

1.1 Membrane structure and function - structure of model membrane, lipid bilayer, membrane protein diffusion, osmosis, active transport, uniport, multiport, symport, antiport, membrane pumps, mechanism of sorting and regulation of intracellular transport, electrical properties of membranes.

1.2 Structural organization and functions of cell organelles- nucleus, mitochondria, endoplasmic reticulum, Golgi complex, lysosomes and peroxisomes.

1.3 Structure and Functions of microfilaments, microtubules and their role.

1.4 Cell division and cell cycle - phases of cell cycle, checkpoints of cell cycle, regulation of cell cycle, mitosis, meiosis.

Unit-II

2.1 Cell signaling - hormones and their receptors, cell surface receptor, signaling through G-protein coupled receptors, Receptor protein- tyrosin kinase and ion chanel receptors.

2.2 Signal transduction pathways, primary and secondary messenger systems, regulation of signaling pathways.

2.3 Cellular communication - general principles of cell communication, cell adhesion and roles of different adhesion molecules, gap junctions, extracellular matrix and integrins.

2.4 Cancer - genetic rearrangements in progenitor cells, oncogenes, tumor suppressor genes, cancer and the cell cycle, virus-induced cancer, metastasis.

Unit-III

3.1 Mendelian, non-Mendelian inheritance - mono / dihybrid inheritance, types ofdominance, multiple allelism, probability, exercises for solving genetics problems.

3.2 Extensions of Mendelian principles - codominance, incomplete dominance, geneinteractions, linkage and crossing over, sex linkage, sex limited and sex influenced characters.

3.3 Quantitative Genetics - polygenic traits and mode of inheritance, analysis ofvariation, genetic and environmental factors, heritability, inbreeding and consequences, co-efficient of inbreeding and consanguinity.

3.4 Mutation - types, causes and detection, mutant types- lethal, conditional,biochemical, loss of function, gain of function, germinal verses somatic mutants.

Unit-IV

4.1 Structural and numerical alterations of chromosomes - deletion, duplication, inversion, transversion, translocation, ploidy and their genetic implications.

4.2 Extra chromosomal inheritance - cytoplasmic inheritance, inheritance of mitochondrial genes, maternal inheritance.

4.3 Microbial genetics - recombination in bacteria and gene mapping, transformation, conjugation, transduction (generalized and specialized), fine structure mapping of genes.

4.4 Human genetics- pedigree analysis, lod score for linkage testing, karyotypes, genetic disorders.

Semester-I

Paper-IT4, Advanced Reproductive Biology

Unit-I

1.1 Various methods of asexual and sexual reproduction in Protozoa.

1.2 Regeneration in *Hydra, Digesia* and Annelid worms; Morphogenesis and hormonal control.
1.3 Metamorphosis in insects: Partial and complete metamorphosis, metamorphic forms-nymph, larvae and pupae.
1.4 Mechanism of vitellogenesis in insects.

Unit-II

2.1 Spermatogenesis: Process, hormonal control and ultra-structure of spermatozoa of man.
2.2 Mechanism of oogenesis: Process, biochemical events, hormonal regulation.
2.3 Cytological and molecular events of fertilization.
2.4 Types of cleavage, blastulation, gastrulation and embryonic induction.

Unit-III

3.1 Male accessory sex glands in mammals: structure, secretion and functions.
3.2 Semen- biochemical composition and sperm abnormality.
3.3 Sperm capacitation and decapacitation- molecular mechanism and significance.
3.4 Pheromones and sexual behavior in mammals.

Unit-IV

4.1 Neurohormonal control of fish reproduction and mechanism of vitellogenesis.
4.2 Molecular induction (Morphogenetic gradients) and organizer concept.
4.3 Cryopreservation of gametes, embryo and test-tube baby.
4.4 In vitro fertilization (IVF) and its significance.

Semester I, Practical-1P1, Structure and Function of Invertebrates and General Physiology
Section-A

1 Study of museum specimens using already available specimens in the museum/ charts/ models/ photographs/ digital alternatives etc.
Classification upto order and comments on the specimens representing all phyla.

2 Anatomical Observations
Anatomical observations, demonstration and detailed explanation of a) D**igestive system** of Earthworm, Leech, Cockroach, Silkworm and Honey bee b) N**ervous system** of Prawn, Cockroach, Silkworm and Honey bee and c) R**eproductive system** of Earthworm, Leech, Cockroach and Honey bee with the help of ICT tools/ Models/ Charts/ Photographs etc.

3 Mounting- Whole mount preparation of plankton and/or study of permanent preparation of the following with the help of already available permanent slides/ ICT tools/ charts/ photographs etc**.**

a. Earthworm – Nerve ring, ovary, spermatheca, nephridia.
b. Leech – jaws, ciliated organ.
c. Cockroach – Mouth parts, Salivary glands, trachea.
d. Prawn –Appendages, Statocyst.
e. Protozoans- rhizopods , flagellates , ciliates (fresh water forms).
f. Porifera – Spicules and gemmules of fresh water sponges.
g. Crustaceans and rotifers - Planktonic copepodes, cladoceran, ostracoderm and rotifers.
h. Larval forms of the free living invertebrates.
i. Larval forms of parasitic invertebrates.

4 Study of permanent Invertebrate slides

a. Porifera – T.S. and L.S. of *Sycon*, gemmules, spongian fibres, spiculesCo
b. elenterata – T.S. of *Hydra* , T.S. of Sea anaemon, Ephyra larva
c. Helminths – T.S. of *Planaria,* T.S. of *Taenia* , scolex W.M., Mature , gravid proglotids , T.S. of male and female *Ascaris*, W.M of *Ankylostoma* , *Enterbios, Dracunculus, Wuchereria*
d. Annelida -T.S. of *Nereis*, T.S. of Earthworm passing through various organs, T. S. of Leech.
e. Arthropod larvae – Nauplius, Zoea, Metazoea, Megalopa, Mysis.
f. Mollusca – T.S. of foot, Veliger and Glochidium larva.
g. Echinodermata- pedicellarae, T.S. of arm of star fish, Bipinnaria, Oricularia larva.
h. Hemichordata – T.S. through collar, proboscis, trunk and branchio-genital regions. Tornaria larva.

Section-B

Physiology experiments –

a. Total leucocyte count and differential leucocyte count.
b. Total R.B.C. count.
c. Demonstration of action of salivary amylase, trypsin, pepsin.
d. Demonstration of rate of O_2 consumption in aquatic animals, under various environmental stresses.
e. Demonstration of haemoglobin concentration in normal and pathological condition.
f. Estimation of sodium, potassium and chloride in blood and excretory organs by Colorimeter or flame photometer (Source of blood: Local recognized pathology laboratory).
g. Estimation of glucose in blood by spectrophotometer or Colorimeter (Source of blood: Local recognized pathology laboratory).
h. Estimation of total blood proteins by spectrophotometer or Colorimeter (Source of blood: Local recognized pathology laboratory).
i. Estimation of cholesterol in blood by spectrophotometer or Calorimeter (Source of blood: Local recognized pathology laboratory).

Distribution of Marks:		**Marks**
1.	Anatomical observations	10
2.	Stained permanent preparation:	10
3.	Identification and comment on the spots (1-10)	30
4.	Physiology experiment (Major)	15
5.	Physiology experiment (Minor)	10
6.	Submission of stained permanent slides	05
7.	Class Record	10
8.	Viva-voce	10

	Total marks	100

Semester-I, Practical- 1P2, Cell Biology, Genetics and Advanced Reproductive Biology

Section-A

1. Study of mitotic metaphasic chromosomes in plant material.

2. Preparation of human karyotypes by using photographs/pictures.
3. Demonstration of Barr body in human female leucocytes.
4. Demonstration of polytene chromosome in dipteran larvae with the help of already available permanent slides/ ICT tools/ models/ charts/ photographs etc.
5. Problems on genetics based on monohybrid/dihybrid ratios, sex linked inheritance and blood groups.
6. Study of various human genetic traits.

Section-B

1 Study of meiotic chromosomes and spermatogenesis in grasshopper with the help of already available permanent slides/ ICT tools/ models/ charts/ photographs etc.
2 Demonstration of oogenesis in earthworm/ fish/ rat ovary with the help of already available permanent slides/ ICT tools/ charts/ photographs etc.
3 Semen analysis: physical viscosity, pH, liquefaction time, agglutination test, motility and sperm count (Source of semen: Government artificial insemination centre).
4 Sperm vitality study using suitable stains (Source of semen: Government artificial insemination centre).
5 Hypo-osmotic swelling (HOS) for the assessment of normal semen.
6 Study of vaginal smear in rat by temporary mounting (methylene blue) or by permanent stained (Haematoxylin-eosin) with the help of already available permanent slides/ ICT tools/ charts/ photographs etc.
7 Histology of male and female reproductive organs and accessory reproductive glands with the help of already available permanent slides/ ICT tools/ charts/ photographs etc.

Distribution of Marks		**Marks**
1.	Cytological preparation	20
2.	Problems on genetics (any two)	20
3.	Spermatogenesis/oogenesis/spermvitality	15
4.	Sperm count/vaginal smear/hypo-osmotic test for fertility	10
5.	Identification and comment on spots (1-5)	15
6.	Class record	10
7.	Viva-voce	10

Total marks100

- **Suggested Readings**

Structure and function of Invertebrates

1. Hyman L.H. The Invertebrate Vol. I, Protozoa through Ctenophora. McGraw-Hill Co., New York.
2. Barrington E.J.W. Invertebrate structure and function. Thomas Nelson and sons Ltd., London.
3. Jagerstein G. Evolution of Metazoan life cycle . Academic press, New York and London.
4. Hyman L.H. The invertebrate vol. 2 McGraw-Hill Co., New York.
5. Hyman L.H. The invertebrate vol. 8 McGraw-Hill Co., New York.
6. Barnes R.D. Invertebrate Zoology W.B. Saunders and Co., Philadelphia
7. Russet HunterW.D.D. biology of higher invertebrate The Macmillan Co. Ltd., London.

8. Hyman L.H. The Invertebrates, smaller coelomate groups. Vol. 5 McGraw-Hill Co. New York.
9. Read C.P. Animal Parasitism. Prentice Hall. New-Jersey.
10. Kudo R.R. (1966) Protozoology, Charler, C. Thomas Springfield, Illinois.
11. Barradailes L.A. and potts F.A. Invertebrates (1961) The Eastham L.E. S. Saunders, Cambridge University Press, Cambridge.
12. Russel W.D. Hunter, Biology of lower invertebrates McMillan, New York.
13. Marshall A.J. and Williams W.D. (1972) J. B. Zoology of Invertebrates , ElBs and McMillan, London.
14. Gtryyrt V. and Graham A. A Functional anatomy of Invertebrates. Academic press, New York.
15. Backlemiccher W.N. Principles of comparative anatomy of Invertebrates Oliver and Boyed Edinberg.
16. Hadisi J. The Evolution of Metazoa. Pergamon Press, Oxford.
17. Dales R.P. Annelids, Hutchinson, London.
18. Green J. Biology of Crustacea, Wither by, London.
19. Morton J. E. Mollusca, Hutchinson, London.
20. Nichols D. Echinodermata, Hutchincon, London.

General Physiology

1. Text Book of Physiology & Biochemistry: Bell, G.E. & Davidson, J.N. & Emslie D. Smith, 1922.
2. Medical Physiology: A Wiley Medical Publication, John Wiley & Sons, New York.
3. Mineral Metabolism: Comar, C.L. & Felix Bronner (1961) Acad Press, New York & London.
4. A Text Book of General Physiology: Dayson (1964): Little Brown & Co. Boston.
5. Animal Physiology: R. Eckert & D. Randall (1983) 2nd Edn., W.H. Rexeman & Co.
6. Biochemistry & Physiology of the Cell: (2nd Edn.), M.A. Edwards & K.A. Hassall (1980) Mc. Graw Hill Co.
7. The Physiology of Cells: Cuthe F. (1968): The Macmillan Co.
8. Textbook of Medical Physiology: Guyton, A.G. (1968). 7th Edn.Saunders Pub.
9. Samson Wrights Applied Physiology: Oxford University Press.
10. Comparative Animal Physiology C.L. Prosser, W.B. Saunders & Company.
11. Animal Physiology: Mechanism & Application, R. Eckert, W.H. Freeman & Company.
12. General & Comparative Animal Physiology: W.S. Hoar.
13. Medical Physiology: W.F. Ganong (1981): 10th Edn. Lange Medical Publications.
14. Principles of Anatomy and Physiology: Tortora Grabowski, 9th Edn.John Willey &Sons.
15. Reproductive Physiology of Vertebrates: Van Tienhoven, A. (1983): 2nd Edn. Cornell Univ. Press, New York.

Cell Biology and Genetics

1. Cell and Molecular Biology by De Robertis- E. D. P., I. S. E. publication.
2. Molecular Biology by Turner P. C. and Mc Lennan , Viva Books Pvt. Ltd.
3. Advanced Molecular Biology by Twyman R. M., Viva Books Pvt. Ltd.
4. Molecular Biology by Freifelder D., narosa publication House.
5. Gene VI by Benjamin Lewis, Oxford press.
6. Gene VIII by Benjamin Lewis, Oxford press.

7. Molecular biology of Gene by Watson J. D. et. al., Benjamin publication.
8. Molecular cell Biology by Darnell J. Scientific American Books USA.
9. Molecular Biology of the Cell by Alberts B., Bray D. Lewis J., garland publishing Inc.
10. Genetics Vol. I and II by Pawar C. B., Himalaya publication.
12. Essentials of Molecular Biology by Freifelder D., narosa publication House.
13. Molecular Cell Biology by Laodish H., Berk A., Zipursky S. L., Matsudaira P., Baltimore D. and Darnell J., W. H. Freeman and Co.
14. The Cell: Molecular Approch by Cooper G. M.
15. Molecular Biology by Upadhay A and Upadhay K. Himalaya publication.

Advance reproductive Biology

1. Developmental Biology. 2nd Edition.Leon W. Browwer Saunders College publishing.
2. Current Topics in Developmental Biology eds. R. A. Pedersen and G. P. Schatten.
3. Principles of animal developmental biology: S. C. Goel, Himalaya Publishing House.
4. Developmental Biology, S.F. Gilbert. 4th Edn.Sinauer Associates Inc. Publishers.
5. An Introduction to Developmental Biology: D. A. Ede.
6. Principles of developmental: Paul Weiss edited by Hafner publishing company NewYork.
7. Cells into organs. 2nd Edition.The forces that shape the Embryo.John Philip Trinkaus ed. Tom Aloisi.
8. Principles of development: Lewis Wolpert et al. 1998. Oxford University Press.
9. Foundations of Embryology. B. M. Patten & B. M. Carlson. Tata McGraw Hill Publishing Company Ltd., New Delhi.
10. An Introduction to Embryology: Balinsky (1981) 5th Ed. (CBS College Publishing).
11. Embryonic and foetal development. Cambridge University Press by Austin and Short, 1982, 1994 2nd Ed.
12. Marshall's Physiology of Reproduction Longmont, Green and Co. London Vol. 1 & 2. Lamming 1984, 2000.

Semester-II

Paper-2T1, Structure and Function of Vertebrates

Unit-I

1.1 Origin and ancestry of Chordata.
1.2 General organization and affinities of Cephalochordata.
1.3 Structure, development and metamorphosis of Amoecoetus.
1.4 General characters and affinities of Dipnoi.

Unit-II

2.1 Organs and mechanism of respiration in Pisces and Amphibia.
2.2 Vertebrate integument and its derivatives.
2.3 Appendicular skeleton (Limbs and girdles) in Amphibia, Reptilia, Aves and Mammals.
2.4 General body organization and classification in Chelonia.

Unit-III

3.1 Evolution of urinogenital organs in vertebrates.
3.2 Origin of Birds.
3.3 Cetacia: general characters and adaptations.
3.4 Comparative anatomy of the brain in vertebrates (teleost, frog, lizard, fowl and rat).

Unit- IV

4.1 Autonomous nervous system in vertebrates: structure and functions.

4.2 Evolution of heart in vertebrates.
4.3 Sense organs in vertebrates.
4.4 Evolution of Man.

Semester-II
Paper-2T2, Comparative Endocrinology
Unit-I
1.1 Hormones and functions in Coelentereta and Helminths.
1.2 Neurosecretory system in Annelida: structure, hormones and functions.
1.3 Neuroendocrine system in Mollusca: structure, hormones and functions.
1.4 Hormones and functions in Echinodermata.

Unit-II
2.1 Neuroendocrine system in crustacean; structure and hormones.
2.2 Endocrine control of metamorphosis, reproduction and colour change mechanisms in crustacea.
2.3 Cephalic neuroendocrine system in insects: structure and hormones.
2.4 Endocrine control of metamorphosis and reproduction in insects.
Unit-III
3.1 Pineal organ: structure, hormones and functions.
3.2 Hypothalamo hypophysial system: structure, hypothalamic nuclei, hormones and function.
3.3 Pituitary: cell types, hormones and functions.
3.4 Thyroid: Structure, hormones and function.
Unit-IV
4.1 Parathyroid ultimobranchial glands: Structure, hormones and regulatory mechanisms.
4.2 Gastro-entero-pancreatic endocrine system: endocrine pancreas and gastro intestinal tract: endocrine cells, hormones and functions.
4.3 Adrenal gland: structure, hormones and functions in vertebrates.
4.4 Gonadal hormones in vertebrates and their hormonal actions, feedback mechanisms.

Semester-II
Paper-2T3, Molecular Biology and Biotechnology
Unit-I
1.1 Cot ½ and Rot ½ values, organelle genome, DNA structure, forms of DNA.
1.2 DNA replication – molecular mechanisms of prokaryotic and eukaryotic DNAreplication, regulation of replication.
1.3 DNA damage and repair – types of DNA damages, excision repair system.
1.4 Mismatch repair, recombination repair, double strand break repair, and transcription coupled repair.
Unit-II
2.1 Transcription- prokaryotic and eukaryotic transcription, RNA polymerases, transcriptional unit, initiation, elongation, termination, transcriptional factors.
2.2 Regulation of transcription – Operon, positive and negative control, attenuation phage strategies, anti-termination, response elements and inducible elements.
2.3 Translation - prokaryotic and eukaryotic translation, genetic code, altered code in elongation, termination factors, fidelity of translation, post translational modifications.

2.4 Mobile DNA elements – transposable elements, IS elements, P elements, retroviruses, retrotansposons.

Unit-III

3.1 Antisense and ribozyme technology – initiation of splicing, polyadenylation, molecular mechanisms of antisense molecules, miRNA, siRNA, gene silencing.

3.2 Isolation and sequencing of DNA, gene amplification, PCR, RAPD, RFLP, Maxam-Gilbert, Sanger's dideoxy methods.

3.3 Splicing and Cloning – Cloning vectors for recombinant DNA technology- plasmids, cosmids, phagemids, YACS, gene replacement, restriction enzymes.

3.4 Hybridization techniques – Southern- Northern hybridization, microarray.

Unit-IV

4.1 Medical biotechnology-Application of restriction fragment length polymorphism (RFLP) in forensic science, disease prognosis and genetic counseling.

4.2 Agricultural biotechnology- biofertilizers, bioinsecticides, biogas.

4.3 Immunobiotechnology-Hybridoma technology and monoclonal antibodies.

4.4 Industrial and Environmental biotechnology-microbial production of fermentation products, enzymes, antibiotics, single Cell proteins and biosensors.

Semester-II

Paper-2T4, Advanced Developmental Biology

Unit-I

1.1 Implantation in Mammals.

1.2 Foetal membranes- types structure and functions.

1.3 Placenta-types, structure, functions. Hormones of placenta and their functions.

1.4 Metamorphosis in Amphibia: morphogenetic and biochemical mechanism,hormonal control.

Unit-II

2.1 Regeneration in vertebrates: tail, limb, lens and retina.

2.2 Apoptosis- mechanism and significance.

2.3 Ageing- mechanism, concepts and models.

2.4 Polymorphism (caste differentiation) in insect (Termites, Honey bees and Ants).

Unit-III

3.1 Multiple ovulation and embryo transfer technology (MOET).

3.2 Application of embryonic stem cells, clinical and economic significance.

3.3 Embryonic sexing, cloning, screening for genetic disorder diagnosis (ICSI, GIFT etc.)

3.4 Cloning of animals by nuclear transfer.

Unit-IV

4.1 Immunocontraception- fertilization, inhibition and pregnancy termination.

4.2 Classical contraceptive techniques: Physical, chemical, surgical and IUCD devices.

4.3 Anti-androgen and anti-spermiogenic compounds (LDH-CY and SP-10)

4.4 Role of mutants and transgenics in human welfare.

Semester-II, Practical-2P1, Structure and Function of Vertebrates and Comparative Endocrinology

Section-A

1 **Study of museum specimens using already available specimens in the museum/ charts/ models/ photographs/ digital alternatives etc.**

Classification of vertebrates up to order and comments on the specimens representing all phyla.

2 **Anatomical Observations**

Anatomical observations, demonstration and detailed explanation of the following with the help of ICT tools/ models/ charts/ photographs etc.

a) Brain and cranial nerves- Fish/ Rat. b) Arterial and venous systems- Fish/Rat c) Urinogenital system- Fish/Rat. d) Reproductive systems- Fish/Rat. e) Internal ear in fish, Weberian ossicles in fish, accessory respiratory organs in fish.

3 **Mounting:** Study ofStainedPermanent preparation of scales, ampullae of Lorenzini, otolith, striated muscles and cartilage of fish using animal wastes from local recognized fish markets or with the help of already available permanent slides/ ICT tools/ charts/ photographs etc.

4 **Microtomy, Histology and Skeleton**

a. Fixation, embedding, sectioning and staining of the internal organs of vertebrates (Source of tissue: Animal wastes from local recognized slaughter houses/ poultry farms/ fish markets etc.)
b. Study of slides of internal organs of vertebrates with the help of already already available permanent slides/ ICT tools/ models/ charts/ photographs etc.
c. Axial and appendicular skeleton of fowl and rabbit using already available skeleton/ ICT tools/ models/ charts/ photographs etc.

Section-B

1 **Microtomy** - Fixation, embedding, sectioning and staining of the endocrine gland (Source of tissue: Animal wastes from local recognized slaughter houses/ poultry farms/ fish markets etc.)

2 **Histological study** – a) Histological slide of endocrine glands and gonadal endocrine components, EM structure of endocrine gland. b) Identification of pituitary cell type. c) Identification of α, β, γ, cells of Islets of Langerhans with the help of already available permanent slides/ ICT tools/ charts/ photographs etc.

3 **Anatomical Observations-** Anatomical observations, demonstration and detailed explanation of the endocrine glands in a) Cockroachandb)Endocrine glands- pituitary, thyroid parathyroid, adrenal in fish/rat with the help of ICT tools/ models/ charts/ photographs etc.

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Distribution of Marks		**Marks**
1.	Anatomical observations of fish/rat	15
2.	Stained permanent preparation:	10
3.	Identification and comment on the spots (1-10)	30
4.	Submission of stained permanent slides	05
5.	Anatomical observations of Endocrine glands	10
6.	Histological staining of endocrine gland	10
7.	Class Record	10
8.	Viva-voce	10

Total marks 100

Semester-II, Practical-2P2–, Molecular Biology, Biotechnology and Developmental Biology

Section-A

1. Demonstration of glycogen/ carbohydrate- PAS reaction (Source of tissue: Animal wastes from local recognized slaughter houses/ poultry forms/ fish markets etc.)
2. Demonstration of DNA: Feulgen's reaction (Source of tissue: Animal wastes from local recognized slaughter houses/ poultry forms/ fish markets etc.)
3. Demonstration of DNA: RNA: Methyl Green- Pyronin reaction (Source of tissue: Animal wastes from local recognized slaughter houses/ poultry forms/ fish markets etc.)
4. Demonstration of Lipid: Sudan Black B staining (Source of tissue: Animal wastes from local recognized slaughter houses/ poultry forms/ fish markets etc.)
5. Demonstration of Protein: HgBP staining (Source of tissue: Animal wastes from local recognized slaughter houses/ poultry forms/ fish markets etc.)
6. Histochemical analysis of alkaline phosphatase (Source of tissue: Animal wastes from local recognized slaughter houses/ poultry forms/ fish markets etc.)
7. Histochemical analysis of acid phosphatase (Source of tissue: Animal wastes from local recognized slaughter houses/ poultry forms/ fish markets etc.)
8. Biochemical estimation of sugar: O-toluidine method (Source of blood: Local recognized pathology laboratory)
9. Biochemical estimation of protein: Lowrey's method (Source of blood: Local recognized pathology laboratory)
10. Biochemical estimation of DNA: Diphenylamine method (Source of blood: Local recognized pathology laboratory)
11. Biochemical estimation of RNA: Orcinol method (Source of blood: Local recognized pathology laboratory)To perform tests for qualitative analysis of saliva
12. To perform tests for qualitative analysis of bile
13. Demonstration of separation of amino acids by paper chromatography and TLC

Section-B

1 Study of the reproductive system in mammals with the help of ICT tools/ models/ charts/ photographs etc.

2 Study of different types of eggs on the basis of their yolk content.

3 Study of developmental stages of live eggs of Lymnea or any gastropod with the help of already available permanent slides/ ICT tools/ models/ charts/ photographs etc.

4 Study of developmental stages of insects/ fishes with the help of already available permanent slides/ ICT tools/ models/ charts/ photographs etc.

5 Study of developmental stages of frog with the help of already available permanent slides/ ICT tools/ models/ charts/ photographs etc.

6 Chick embryo mounting by window method.

7 Study of developmental stages of chick through slides and whole mounts.

8 Morphological study of different types of placenta with the help of already available permanent slides/ ICT tools/ models/ charts/ photographs etc.

9 Histological study of placenta with the help of already available permanent slides/ ICT tools/ models/ charts/ photographs etc.

10 Sperm count from any domestic animal (Source of semen: Government artificial insemination centre).

Distribution of Marks		**Marks**
1.	Histochemical demonstration of DNA/RNA protein / carbohydrate/lipids/enzymes	20
2.	Estimation of sugar/protein/DNA/RNA/ qualitative analysis of saliva/bile	20
3.	Whole mount preparation of chick embryo/sperm count.	15
4.	Preparation of development stages of live eggs of Lymnea	10
5.	Identification and comment on spots (1-5)	15
6.	Class record	10
7.	Viva voce	10
	Total marks	100

- **Suggested Readings**

Structure and function of Vertebrates

1. Alexander R.N., The Chordata, Cambridge University Press London.
2. Barrington EJW, The Biology of Hemichordates and Protochordates, Oliver and Boid Edinberg.
3. Bourne G.H., The structure and function of nervous tissue Academic press New York.
4. Kingslay J.S, Outlines of Comparative anatomy of vertebrates, Central Book Depot, Allahabad.
5. Honyelli A.R. The Chordates Cambridge University Press, London
6. Smith H.S. Evolution of Chordate structure, Hold Rinehart and Wintoin Inc. New York
7. Walter H.A. and Sayles L.D. Biology of Vertebrates Macmillan and co. New York
8. Romer A.S. Vertebrate body W.P. Sanders co., Philadelphia.
9. Young J.Z. Life of Vertebrates Oxford University Press, London.
10. Young J.Z. Life of Mammals Oxford University Press, London.
11. Colbert E.H. Evolution of Vertebrates John Wiley and sons Inc. New York.
12. Kent C.J. Comparative anatomy of Vertebrates.
13. Waterman A.J. Chordate Structure and Functions Macmillan Co. New York.
14. Montagna W. Comparative anatomy clarenden press, Oxford
15. Weichert C.K. Preach W. Elements of Chordates anatomy McGraw-Hill book co., New York.
16. Lovetrup S. The phytogeny of Vertebrates John Wiley and sons Inc., London.
17. Joysey K.A. and Kemp T.S. Vertebrate Evolution Oliver and Boyd, Edinberg.
18. Romer A.S. Vertebrate Paleontology University of Chicago Press, Chicago.
19. Newman Phylum Chordata.
20. Goodrich E.S. Structure and development of vertebrates. Dover publications Inc., New York
21. Hard disty M.W. and Potter I.C. Biology of Lampreys Academic Press Newyork
22. T.B.of Zoology Parker and Haswell W.A. Mac millon co. Ltd. London
23. The Biology of Amphibia Noble G.K. Dover Publication Inc Newyork

Comparative Endocrinology

1. General & Comparative Endocrinology: E.J.W., Barrington, Oxford, Clarendon Press.
2. Text Book of Endocrinology: R.H. Williams, W.B. Saunders.
3. Endocrine Physiology: C.R. Martin, Oxford University Press.
4. Comparative Endocrinology: A Gorbman et al, John Wiley & Sons.

5. Medical Physiology: W.F. Ganong (1981): 10th Edn. Lange Medical Publications.
6. Principles of Anatomy and Physiology: Tortora Grabowski, 9th Edn., John Willey & Sons.
7. Reproductive Physiology of Vertebrates: Van Tienhoven, A. (1983): 2nd Edn. Cornell Univ. Press, New York.
8. The Pituitary Gland: Imura, H. (1994), 2nd Edn., Comprehensive Endocrinology Revised Series Raven, New York.
9. Comparative Vertebrate Endocrinology: Bentley, P.J. (1976) Cambridge University Press, Cambridge.
10. General & Comparative Endocrinology: E.J.W., Barrington, Oxford, Clarendon Press.
11. Text Book of Endocrinology: R.H. Williams, W.B. Saunders.
12. Comparative Vertebrate Endocrinomental: Bentely, P.J. (1976) Cambridge University Press, Cambridge.
13. Invertebrate endocrinology: D. B. Tembhare, Himalaya publishing House (2012)

Molecular Biology and Biotechnology

1. Harper's Review of Biochemistry, Prentice Hall.
2. Principles of Biochemistry by Lehninger and Nelson, CBS publications and Distributors.
3. The Biochemistry "Students companion" by Allen J. Scism, Prentice Hall.
4. Fundamentals of Biochemistry by Jain J. L., S. Chand Publication.
5. Principles of Biochemistry by Zubay J. L., WM. C. Brown Publishers.
6. Principles of Biochemistry by Horton, Prentice Hall.
7. Concept of Biochemistry by Boyer R., Coel publication co.
8. Harper's Biochemistry eds.Murray, R. K. P. and Granner, D. K. Prentice Hall.
9. Biochemistry by Mathews C. K. and Van Holde K. E., Benjamin C. publishing Co.
10. Biochemistry by Garrett R. H. and Grisham C. M., Saunders College publication.
11. Cell and Molecular Biology by De Robertis- E. D. P., I. S. E. publication.
12. Molecular Biology by Turner P. C. and Mc Lennan , Viva Books Pvt. Ltd.
13. Advanced Molecular Biology by Twyman R. M., Viva Books Pvt. Ltd.
14. Molecular Biology by Freifelder D., narosa publication House.
15. Gene VI by Benjamin Lewis, Oxford press.
16. Gene VIII by Benjamin Lewis, Oxford press.
17. Molecular biology of Gene by Watson J. D. et. al., Benjamin publication.
18. Molecular cell Biology by Darnell J. Scientific American Books USA.
19. Molecular Biology of the Cell by Alberts B., Bray D. Lewis J., garland publishing Inc.
20. Genetics Vol. I and II by Pawar C. B., Himalaya publication.
21 Essentials of Molecular Biology by Freifelder D., narosa publication House.
22. Molecular Cell Biology by Laodish H., Berk A., Zipursky S. L., Matsudaira P., Baltimore D. and Darnell J., W. H. Freeman and Co.
23. The Cell: Molecular Approch by Cooper G. M.
24. Molecular Biology by Upadhay A and Upadhay K. Himalaya publication.

Gamete and Developmental Biology

1. Developmental Biology. 2nd Edition.Leon W. Browwer Saunders College publishing.
2. Current Topics in Developmental Biology eds. R. A. Pedersen and G. P. Schatten.
3. Principles of animal developmental biology: S. C. Goel, Himalaya Publishing House.

4. Developmental Biology, S.F. Gilbert. 4th Edn.Sinauer Associates Inc. Publishers.
5. An Introduction to Developmental Biology: D. A. Ede.
6. Principles of developmental: Paul Weiss edited by Hafner publishing company New York.
7. Cells into organs. 2nd Edition.The forces that shape the Embryo. John Philip Trinkaus ed. Tom Aloisi.
8. Principles of development: Lewis Wolpert et al. 1998. Oxford University Press.
9. Foundations of Embryology. B. M. Patten & B. M. Carlson. Tata McGraw Hill Publishing Company Ltd., New Delhi.
10. An Introduction to Embryology: Balinsky (1981) 5th Ed. (CBS College Publishing).
11. Embryonic and foetal development. Cambridge University Press by Austin and Short, 1982, 1994 2nd Ed.
12. Marshall's Physiology of Reproduction Longmont, Green and Co. London Vol. 1 &2. Lamming 1984, 2000.

Semester- III

Paper- 3T1, Parasitology and Immunology

Unit I:

1.1 *Vibrio cholera andClostridium titani*- Life cycle, mode of transmission, infection and treatment

1.2 *Yersinia pestis*- Life cycle, mode of transmission, infection and treatment

1.3 Influenza and H1 N1 viruses- Life cycle, mode of transmission, infection and treatment.

1.4 Dengue and Hepatitis- Life cycle, mode of transmission, infection and treatment

Unit II:

2.1 *Trypanosoma and Entomoeba* - Life cycle, mode of transmission, infection and treatment

2.2 *Leishmania and* Malaria- Life cycle, mode of transmission, infection and treatment

2.3 *Wuchereria* and *Trichinella* - Life cycle, mode of transmission, infection and treatment

2.4 Toxins and antitoxins

Unit III:

3.1 Immune system- innate and adaptive immunity; Antigens and antibodies and its interaction

3.2 Cells and organs of immune system; T cells and B cells - maturation, activation and differentiation, T cell receptors

3.3 Major Histocompatibility Complex (MHC)- general organization and inheritance of the MHC, MHC molecules and genes

3.4 Complement system- classical, alternative and lectin pathways, regulation of complement system, biological consequences of complement activation

Unit IV:

4.1 Cytokine receptors- properties of cytokines, cytokine receptors, cytokine secretion by TH1 and TH2 subsets; Cell mediated cytotoxic responses- effector mechanisms, leukocyte activation and migration.

4.2 Hypersensitivity reactions- types, mechanisms of type I to IV hypersensitivity reactions; Autoimmunity- Organ specific autoimmune disease and treatment

4.3 Transplantation immunology- blood antigens, transplantation rejection, graft rejection, familial grafting, tissue typing, cross matching, immunosuppression.

4.4 Tumor immunology- Types and roles of tumor antigens, immune response to tumor; Imunotechniques- RIA and ELISA

Semester-III, Practical-3P1, Parasitology and Immunology

Section-A

1. Study of different types of parasitic protozoan's with the help of already available permanent slides/ ICT tools/ Models/ Charts/ Photographs etc.
2. Study of different types of parasitic helminthes with the help of already available specimens, permanent slides/ ICT tools/ models/ charts/ photographs etc.
3. Study of different types of insect vectors with the help of already available specimens, permanent slides/ ICT tools/ models/ charts/ photographs etc.
4. Identification and study of various ecto and endo parasites with the help of already available permanent slides/ ICT tools/ models/ charts/ photographs etc.
5. Study of different types of insect vectors and their mouth parts with the help of already available specimens, permanent slides/ ICT tools/ models/ charts/ photographs etc.
6. Study of life cycles of various parasites with the help of already available specimens, permanent slides/ ICT tools/ models/ charts/ photographs etc.
7. Demonstration of Gram positive and Gram negative bacteria.
8. Demonstration of immunoelectrophoresis.

Section-B

9. Immunological diagnosis of pregnancy.
10. Preparation of tissue sections of thymus, spleen, and lymph nodes. (Source of tissue: Animal wastes from local recognized slaughter houses/ poultry farms/ fish markets etc.)
11. Agar gel diffusion.
12. Identification and study of T and B cells with the help of already available permanent slides/ ICT tools/ models/ charts/ photographs etc.
13. Demonstration of Mast cells. (Source of tissue: Animal wastes from local recognized slaughter houses/ poultry farms/ fish markets etc.)
14. Demonstration of ouchterlony double diffusion (ODD).

Distribution of marks		**Marks**
1.	Identification and comments on spot (1 to 10)	20
2.	Demonstration of Gram +ve (Positive), Gram –ve (Negative) bacteria.	10
3.	Antigen-antibody reaction/Agar gel diffusion/diagnosis of pregnancy	10
4.	T and B cells identification/Mast cell demonstration	15
5.	Submission of photographs of vectors	10
6.	Practical record	10
7.	Viva-voce	05
	Total marks	100

- **Suggested Readings**

Parasitology

1. Brock Biology of Microorganisms (Ed. IX) M. T. Madigan J. M. Martinko and J. Parker.Prentice Hall International Publication.
2. The Nematode Parasite in Vertebrate, W. Youle and Maplestone.
3. General Parasitology, V. A. Dogiel.
4. Helminthology, E. C. Fausy.
5. Platyhelminthes and Parasitisium, D.R.Birt.
6. Animal Parasite- O.W. Aisen
7. Parasitic Protozoa, J.P. Kreier and J.R. Baker. Allen and Unwin Press.

8. Medical and Veterinary Protozoalogy M. G. Kathering , A. James paul and V. Zaman. Churchill Livingstone.

Immunology

1. Immunology – R. C. Kuby et al.
2. Immunology - Tizzard.
3. Immunology -. Roitt, Brostoff and D. Male.
4. Microbiology- M. T. Pelzer. Jr. E. C. S. Chan and N. R. Krieg. Tata McGraw -Hill
5. Immunology - Abbas

Semester-III
Paper-3T2, Special Group-Entomology-I
Insect Morphology and Physiology
Unit-I

1.1 Integument: molecular structure, moulting and sclerotization.
1.2 Morphology of head, thorax and abdomen.
1.3 Appendages: antennae, legs and genitalia.
1.4 Wing structure and mechanism of flight.

Unit-II

2.1 Mouth parts: type, morphology and feeding mechanism.
2.2 Structure of alimentary canal and salivary glands, mechanism of digestion.
2.3 Respiratory system: tracheal, aquatic and plastron respiratory mechanism.
2.4 Circulatory system: organs, mechanism of circulation, haemolymph- cellular and chemical composition. Functions of haemocytes.

Unit-III

3.1 Excretory system: organs and physiology of excretion.
3.2 Nervous system: structure and anatomy of brain and ventral nerve cord.
3.3 Neuroendocrine system: structure and function, role in metamorphosis and reproduction.
3.4 Exocrine glands: Pheromones and allomones-chemistry and functions.

Unit-IV

4.1 Reproduction: male and female reproductive system, structure of testis and ovary, mechanism of spermatogenesis and vitellogenesis.
4.2 Specialized reproductive mechanism: viviparity, polyembryony, paedogenesis and parthenogenesis.
4.3 Early embryonic development up to germ band formation.
4.4 Metamorphosis: types of larvae and pupae.

Semester-III, (M. Sc. Part-II)
Paper-3T3, Special Group-Entomology-II
Classification and Industrial Insects

Unit-I

1.1 Modern scheme of insect classification and general characters of various Orders.
1.2 General characters and classification of Thysanura and Collembola.
1.3 General characters and classification of Mallophaga and Siphunculata.
1.4 General characters and classification of Siphonaptera.

Unit-II

2.1 General characters and classification of Orthoptera.

2.2 General characters and classification of Hemiptera.
2.3 General characters and classification of Lepidoptera.
2.4 General characters and classification of Coleoptera.

Unit-III

3.1 Mulberry silkworm *Bombyx mori*, life cycle, silkgland and silk proteins.
3.2 Silkworm rearing, cocoon harvesting and seed production.
3.3 Bacterial and viral diseases in silkworm.
3.4 Lac insect-biology, lac cultivation and economic importance.

Unit-IV

4.1 Tasar sericulture- life cycle, host plant, rearing, cocoon formation and silk production.
4.2 Eri sericulture- life cycle, host plant rearing and silk production.
4.3 Honey bee- types, life cycle, colony formation and apiary products.
4.4 Bee keeping- movable frame hive, bee rearing management and diseases.

Semester-III, Practical-3P2, Special Group-Entomology

1 Anatomical observations, demonstration and detailed explanation of the various organs and systems in insects such as cockroach, grasshopper, cricket, molecricket, red cotton bug, honey bee, beetle, house fly, butterfly/ moth and caterpillars with the help of ICT tools/ models/ charts/ photographs etc.

2 Histological study of alimentary canal, salivary glands, gastric caecae, malpighian tubules, testis, ovary, sex accessory glands, exocrine glands, endocrine glands, brain and other ganglia with the help of already available permanent slides/ ICT tools/ models/ charts/ photographs etc.

3 Whole mount preparation of insect parts using insects from agricultural wastes or with the help of already available permanent slides/ ICT tools/ charts/ photographs/ models etc.

4 Insect study- Identification, classification and characters up to families belonging to orders- Odonata, Orthoptera, Dictyoptera, Hemiptera, Lepidoptera, Coleoptera, Hymenoptera, Diptera etc. with the help of already available museum specimens, permanent slides/ ICT tools/ charts/ photographs/ models etc.

5 **Physiological Experiments:**

a. Estimation of total proteins/carbohydrates/lipids
b. Chromatographic separation of free amino acids
c. Separation of proteins by electrophoresis
d. Estimation of Na^+ and K^+ by flame photometer.
e. Estimation of DNA and RNA.

6 Visits to agricultural fields, national parks and forests for observations of insect population dynamics, behavior and diversity.

Note: Student should submit insect photographs of 10 locally available species at the time of examination.

	Distribution of Marks	**Marks**
1.	Anatomical observations 15	
2.	Physiological Experiment	10
3.	Identification of histological slides and insects (1-15)	45
4.	Mounting	05
5.	Class records and submission of insect photographs	10

6.	Submission of histological slides	05
7.	Viva-voce	10

	Total marks	100

Semester –III
Paper-3T2, Special Group-Fish and Fisheries -I
General studies

Unit-I

1.1 Origin and Evolution of fishes: Fossil record, classification, cyclostoms, ostracoderms, placoderms, Sharklike fisher, Bony fishes
1.2 Development of jaws and limbs in fishes.
1.3 Classification and general characters of Placoderms: Acanthodii, Coccostei, Pterychthyes, Stegoselachii, Palaeospondyli.
1.4 Affinities of Placoderms and fossil record.

Unit-II

2.1 Classification and general characters of Elasmobranch/Chondrichthyes: Sharks and Rays, Holocephali
2.2 Affinities of Elasmobranchs, specialized characters of Elasmobranchs.
2.3 Classification and general characters of Actinopterygii/Ray finned fishes:Palaeonisciformes,Polypteriformes, Acipenseriformes, Amiiformes, Teleostea (Osteoglossomorpha, Elopomorpha, Clupeomorpha, Euteleostei)
2.4 Affinities of Actinopterygiians.

Unit-III

3.1 Dipnoi: General characters, classification, origin, fossil Dipnoians and distribution of Dipnoians.
3.2 Specialized characters of Dipnoi, Blood vascular system of Protopterus and affinities of Dipnoians.
3.3 Respiratory system: Structure of gills in fishes, gill histology
3.4 Blood supply and mode of respiration and gaseous exchange in teleosts.

Unit-IV

4.1 Accessary respiratory organs: Origin of air breathing organs; skin, buccopharynx opercular cavity, air bladder
4.2 Mechanism of air breathing, function of accessory respiratory organ.
4.3 Air bladder: Origin, Development, types of air bladder; physostomous, physoclists, structure of gas secreating complex
4.4 Blood supply to air bladder and functions of air bladder

Semester-III
Paper-3T3, Special Group-Fish and Fisheries -II
Applied fisheries

Unit-I

1.1 Fresh water fisheries of India, Riverine and Reservoir fisheries.
1.2 Estuarine and Marine fisheries of India.
1.3 Breeding of Indian Major carps: i Natural breeding, ii Induced breeding, iii Methods

of obtaining eggs, spawn, fry and fingerlings from natural resources.

1.4 Neuroendocrine control of carp reproduction.

Unit-II

2.1 Culture of exotic fishes – common carp, Composite culture.

2.2 Monoculture, Monosex culture.

2.3 Integrated Fish farming – Poultry, Duck, Fish rice culture.

2.4 Sewage fed fisheries

Unit-III

3.1 Catfish culture

3.2 Trout culture

3.3 Ornamental fish culture: i) Oviparous, ii) Live bearers.

3.4 Culture of sea weeds and Spirulina.

Unit-IV

4.1 Pearl culture

4.2 Oyster culture: i) Species- edible ii) Culture methods.

4.3 Prawn culture (Life cycle and breeding)

4.4 Frog culture

Semester-III, Practical-3P2, Special Group-Fish and Fisheries

1. Identification of local fishes upon species.
2. Anatomical observations, demonstration and detailed explanation of fish in general, reproduction and urino genital system, Endocrine glands with the help of ICT tools/ models/ charts/ photographs etc.
3. Study of cranial nerves in *Wallago* and *Labeo* with the help of already available permanent slides/ ICT tools/ models/ charts/ photographs etc.
4. Identification of various stages of fry and fingerlings of major carps with the help of already available preserved material, permanent slides/ charts/ models / photographs/ ICT tools etc.
5. Permanent preparation of various scales using wastes from recognized fish markets..
6. Estimation of dissolve oxygen in water sample.
7. Estimation of CO2 in water sample.
8. Estimation of chloride sample in water.
9. Estimation of protein in blood of fish (Source of fish blood: Local recognized fish markets).
10. Estimation of sodium in blood of fish (Source of fish blood: Local recognized fish markets).
11. Estimation of potassium in blood of fish (Source of fish blood: Local recognized fish markets).

Distribution of Marks:		**Marks**
1.	Anatomical observations (Major)	20
2.	Physiology Experiment	20
3.	Mounting of Scale	10
4.	Identification of fishes	30
5.	Practical Record	10
6.	Viva voce	10
	Total marks	100

Semester –III
Paper-3T2, Special Group-Mammalian Reproductive Physiology -I
Reproductive Process in Male

Unit-I
1.1 Development, descent and structure of the testis.
1.2 Spermatogenesis: Molecular changes, hormonal regulation, and spermiogenesis.
1.3 Sertoli cells: Structure , functions, blood testis barrier.
1.4 Leydig cells: Structure , functions and interaction with peritubular and Sertoli cells.

Unit-II
2.1 Epididymis: Structure and function.
2.2 Structure of spermatozoa and anomalies.
2.3 Sperm capacitation: molecular and biochemical changes, decapacitation.
2.4 Vas deferens: Structure and function.

Unit-III
3.1 Seminal Vesicle: Structure, function and regulation.
3.2 Prostate gland: Structure, function and prostatic cancer.
3.3 Cowpers gland: Structure, function and anomalies.
3.4 Penis: Structure and mechanism of erection.

Unit-IV
4.1 Male reproductive behaviour: Mating system, neural and hormonal control.
4.2 Pheromones:types, structure and function.
4.3 Infertility: causes and remedy.
4.4 Andrologically relevant diseases in advanced age.

Semester-III
Paper-3T3, Special Group-Mammalian Reproductive Physiology-II
Reproductive Process in Female

Unit- I
1.1 Differentiation of the ovary and female genital tract.
1.2 The process of folliculogenesis and its hormonal control.
1.3 Recruitment, selection, dominance of follicle and signaling for ovulation.
1.4 Follicle wall: Theca, differentiation, steroid hormone synthesis (2-gonadotropin,2- cell concept).

Unit-II
2.1 Estrous cycle in mammals.
2.2 Menstrual cycle and Menopause.
2.3 Mechanism and hormonal control of ovulation .
2.4 Corpus luteum: histogenesis, function, maintenance and luteolysis.

Unit-III
3.1 Oviduct: structure, regional differentiation and function.
3.2 Uterus: Types, abnormalities.

3.3 Cervix-structure, functions.
3.4 Vagina-structure, function, detection of various stages of oestrous cycle by vaginal cytology, vaginal plug.

Unit-IV

4.1 Onset of puberty and delayed puberty.
4.2 Prostaglandins and their role in reproduction .
4.3 Anatomy and growth of mammary glands.
4.4 Lactogenesis and galactopoiesis.

Semester-III, Practical-3P2, Special Group-Mammalian Reproductive Physiology (MRP)

1. Demonstration of surgical operation in rat/ mice Orchidectomy or Vasectomy or Epididymoctomy with the help of ICT tools
2. Anatomical observations, demonstration and detailed explanation of the male reproductive system of rat/ mice with the help of ICT tools/ models/ charts/ photographs etc.
3. Sperm count for the assessment of fertility (Source of semen: Government artificial insemination centre).
4. Study of spermatogenesis and identification of its various stages with the help of already available permanent slides/ ICT tools/ models/ charts/ photographs etc.
5. Estimation of fructose/ sialic acid in reproductive tissue using animal wastes from recognized slaughter houses/ poultry farms etc.
6. Experimental studies (histological slides for identification) of the following with the help of already available permanent slides/ ICT tools/ models/ charts/ photographs etc.
   a. Effects of castration and androgen replacement on sex accessory glands
   b. Effects of anti-androgen on testis and sex-accessory glands
   c. Effect of anti-cancer drugs on testis and sex-accessory glands, different duration and different regimen studies
   d. Effect of heavy metals on testis and sex accessory glands
7. Histology: Histological changes in male reproductive organs and sex accessories during active and inactive stage with the help of already available permanent slides/ ICT tools/ models/ charts/ photographs etc.
8. Study of following endocrine glands with the help of already available permanent slides/ ICT tools/ models/ charts/ photographs etc.
   a. Pituitary gland: anatomy, cell types and identification of cell types
   b. Thyroid gland: Histology of active and inactive glands, effects of antithyroid drugs
   c. Adrenal: Normal histology and effects of metapyrone and corticosteroids administration
9. Field Work: Visit to Artificial insemination centre.

Distribution of marks		**Marks**
1.	Surgical operation	20
2.	Anatomical observations	15
3.	Minor experimental analysis	10
4.	Biochemical estimation	20
5.	Identification and comments on spots (1-5)	15
6.	Practical record	10
7.	Viva-voce	10

Total marks 100

Semester –III
Paper-3T2, Special Group-Animal Physiology-I
Physiology of Digestion and Excretion

Unit-I

1.1 Histology of salivary glands, Mechanism of salivary secretion, composition and functions of saliva.
1.2 Histology of stomach, mechanism of secretion of gastric juice, composition and functions of gastric juice.
1.3 Histology of pancreas, mechanism of pancreatic secretion, composition and functions of pancreatic juice.
1.4 Histology of liver, bile secretion, its composition and functions.

Unit-II

2.1 Histology of small and large intestine, intestinal glands, its secretion and control, intestinal bacteria.
2.2 Neural and endocrine regulation of gastro intestinal movements and secretions.
2.3 Gastrointestinal hormones - Synthesis, chemical structure and functions**.**
2.4 Digestion and absorption of proteins, carbohydrates and fats in the gastrointestinal tract.

Unit-III

3.1 Functional anatomy of kidney.
3.2 Mechanism of formation of urine.
3.3 Normal and abnormal constituents of urine.
3.4 Mechanism of concentration and dilution of urine – The Counter current system.

Unit-IV

4.1.1 Regulation of urine and body fluid concentration and volume, hormonal mechanismof Antidiuratic hormone, Aldosterone and Renin – Angiotensin system in renal physiology.
4.2 Regulation of water, electrolytes and acid base, renal clearance.
4.3 Physiology of nitrogen excretion
4.4 Renal failure.

Semester –III
Paper-3T3, Special Group- Animal Physiology-II
Physiology of Circulation

Unit-I

1.1 Types of heart (Myogenic and Neurogenic).
1.2 Anatomy, histology and nerve innervation of the heart, heart valves.
1.3 Pace maker and specialized conducting fibers.
1.4 Blood pressure and factors affecting blood pressure.

Unit-II

2.1 Cardiac cycle, Electrocardiogram (ECG).
2.2 Cardiac output, heart sound.
2.3 Haemodynamics.
2.4 Cardiac Failure.

Unit-III

3.1 Cellular composition and functions of blood.
3.2 Blood groups and Blood transfusion.

3.3 Blood sugars – Causes and control of hypoglycemia and hyperglycemia
3.4 Blood lipids- Causes and control of hypolipidimia and hyperlipidimia

Unit-IV

4.1 Plasma proteins- Albumins, globulins.
4.2 Haemostasis, Cascade of biochemical reactions involved in coagulation of blood.
4.3 Transport of O_2& CO_2 by blood.
4.4 Lymph – composition, formation and functions.

Semester-III Practical-3P2, Special Group- Animal Physiology

I. Physiology Experiments

1 Effect of pH, temperature and incubation on human salivary amylase activity.
2 Determination of:-
a) Clotting time, bleeding time.
b) Erythrocyte sedimentation rate and c) Haemoglobin concentration.
3 Determination of protein, glucose in Urine.
4 Study of structure of RBCs in vertebrates with the help of already available permanent slides/ ICT tools/ models/ charts/ photographs etc.
5 Determination of protein, glucose in Urine from diabetic patient.
6 Total leukocyte count and differential leukocyte count.
7 Total erythrocyte count.

II. Quantitative Analysis

1 Estimation of blood Glucose (Source of blood: Local recognized pathology laboratory)
2 Estimation of blood proteins (Source of blood: Local recognized pathology laboratory)
3 Estimation of blood triglycerides (Source of blood: Local recognized pathology laboratory)
4 Estimation of blood cholesterol (Source of blood: Local recognized pathology laboratory)
5 Estimation of blood Sodium, potassium, Calcium (Source of blood: Local recognized pathology laboratory)
6 Estimation of blood alkaline & acid phosphates (Source of blood: Local recognized pathology laboratory).
7 Blood amino-acid separation by TLC / Paper chromatography (Source of blood: Local recognized pathology laboratory).

III. Qualitative Analysis

1 Normal & abnormal constituents of human urine.
2 Blood group detection by antisera.
3 Preparation and study of Urine crystals.
4 Estimation of serum urea (Source of blood: Local recognized pathology laboratory)
5 Preparation and study of haemin crystals.

IV. **Histological Study of** Stomach, Liver, Small intestine, Large intestine, Pancreas, Kidney, Thyroid, Pituitary, Blood smear, Heart, T.S. Vein, T.S. Arterywith the help of already available permanent slides/ ICT tools/ charts/ photographs etc.

Distribution of Marks: **Marks**

1.	Physiology Experiment	20
2.	Major quantitative analysis	20
3.	Minor quantitative analysis	10
4.	Qualitative analysis	15
5.	Identification and comment on spots(1-5)	15
6.	Practical Record	10
7.	Viva-voce	10

	Total marks	100

Semester –III

Paper-3 T_2, Special Group-Environmental Biology-I

Ecosystems and Communities

Unit-I

1.1 Ecosystem: Structure and functions of marine and freshwater ecosystems, grassland, desert and forest ecosystems, abiotic and biotic components of ecosystems.

1.2 Energy flow: Y shaped and universal model.

1.3 Food chain, food web, ecological pyramid-types and diversity.

1.4 Planktons: nature, distribution, seasonal succession, beneficial and harmful effects, qualitative and quantitative estimation

Unit-II

2.1 Nekton, Benthos: nature, distribution and analysis, Periphyton- definition, collection, preservation and importance.

2.2 Eutrophication: Definition, types, effects and control measures.

2.3 Biogeochemical Cycles in Nature- Gaseous Cycles: Water, Carbon and Oxygen cycle.

2.4 Sedimentary Cycles in nature- Nitrogen, sulphur and Phosphorus cycles.

Unit-III

3.1 Productivity: concept, Primary and secondary productivity, measurement of productivity by light and dark bottle method, factors affecting primary and secondary productivity.

3.2 Biotic community: definition, concept and characteristics of community, community structure, stratification and periodicity, ecotone and edge effect.

3.3 Ecological niche, ecotype, ecophene and ecological indicators.

3.4 Ecological succession: definition, types and process of ecological succession, significance.

Unit –IV

4.1 Biosphere: Major biomes of the world with emphasis on Indian biomes.

4.2 Biometeorology: scope and factors

4.3 Water and soil as essential factors for the meteorological studies.

4.4 Radiant energy, temperature and light.

Semester –III

Paper-3 T_3, Special Group- Environmental Biology-II

Adaptations, Population dynamics, and Animal Behaviour

Unit-I

1.1 Adaptations of animals with reference to physical conditions: temperature and light.

1.2 Chemical conditions: oxygen, carbon dioxide.

1.3 Physiological process: osmoregulation and thermoregulation.

1.4 Physiological process: Bioluminescence and Echolocation.

Unit-II

2.1 Influence of physical environment on organism: viscosity, surface tension, salinity, pressure, buoyancy and surface film animals.

2.2 Biological Rhythms: photoperiodism, biological clock, annual and lunar periodicity.

2.3 Mimicry and protective colouration: definition of mimicry, kinds of mimicry.

2.4 Batesion and mullerian mimicry and significance.

Unit-III

3.1 Population dynamics: population structure, pattern of population distribution, population growth and density relationship, population fluctuations and dispersal of population.

3.2 Dispersal: Barriers of dispersal, means of dispersal, migration.

3.3 Intersepecific relationship: mutualism, commensalism, parasitism, synergism, antagonism and competition.

3.4 Prey and Predator relationship

Unit-IV

4.1 Intraspecific relationship: aggregations and social organization.

4.2 Animal behavior: innate or inherent behavior, learned behavior, visin and behavior, sound and behavior.

4.3 Social behaviour: mating, family, and group behavior, advantages of social behavior

4.4 Genetic, hormonal and evolutionary aspects of behavior.

Semester –III, Practical-3P$_2$, Special Group-Environmental Biology

1 Sampling of water determination of pH, temperature and turbidity.

2 Plankton study and analysis of zooplankton.

3 Identification of crustaceans, insects, snails from fresh water/ lake/ pond with the help of already available specimens, permanent slides/ ICT tools/ charts/ models/ photographs etc.

4 Identification of common aquatic weeds, predatory fishes and harmful insects from the pond with the help of already available specimens, permanent slides/ ICT tools/ charts/ models / photographs etc.

5 Study of indication of pollution - estimation of BOD and COD.

6 Determination of primary productivity by light and dark bottle method.

7 Estimation of dissolved oxygen in water sample by wrinkler's method.

8 Estimation of carbon dioxide from given water sample.

9 Determination of relative humidity by hygrometer / psychrometer.

10 Determination of wind velocity by anemometer.

11 Physico-chemical analysis of water for determination of alkalinity, hardness, nitrites and phosphates.

12 Estimation of Sodium and potassium by flame photometry.

13 Identification of benthic and periphytonic organisms.

Distribution of Marks		**Marks**
1.	Major experiment	20
2.	Minor experiment	15
3.	Minor experiment	15
4.	Identification and comment on given spots (1-10)	30

5.	Class record	10
6.	Viva voce	10

	Total marks	100

Semester –III
Paper-3T$_4$, Foundation - I, Basic Entomology

UNIT- I
1.1 Introduction to Insects- Its systematic position; Classification From Anamalia to Insecta.
1.2 General anatomical description of Insect body: head, thorax and abdomen.
1.3 Insect eyes and antennae. Basic structure and function.
1.4 Insect metamorphosis- Complete and incomplete metamorphosis.

UNIT- II
2.1 Insect sound production
2.2 Insect light production
2.3 Reproduction behaviour of butterflies- Copulation and egg laying
2.4 Reproduction behaviour of dragonflies- Copulation and egg laying.

UNIT- III
3.1 Chemical communication in insects- Pheromones
3.2 Honey Bee Dance
3.3 Insect pollinators- Honey bee and butterflies
3.4 Predatory and edible insects.

UNIT- IV
4.1 Introduction of five species of Order- Lepidoptera (Butterflies) of central India.
4.2 Introduction of five species of Order- Odonata (Dragonflies) of central India.
4.3 Introduction of five species of Order- Coleoptera (Beetles) of central India.
4.4 Introduction of five species of Order- Hymenoptera (Bees, Wasps and Ants) of central India.

Semester -III
Core (Subject Centric)- I
Paper-3T$_4$ Wild Life and Avian Biology

Unit I- Wild life Ecology and Behaviour
1.1 Definition, importance of wildlife, Concept of conservation, Conservation movement in India
1.2 International conservation bodies; IUCN, UNDP, FAO, WWF, Red data book, rare and endangered animals of India.
1.3 Predatory-prey relationship, predator dynamics, optimal foraging theory: patch choice, diet choice, prey selectivity, anti-predator defenses.
1.4 Social organization in carnivores and primates.

Unit- II- Wild life Population and Pest Management
2.1 Population estimation of ungulates and carnivores: Faecal samples, Hair identification, Pug marks and census method.
2.2 Management and identification of animals by natural marking, collars, tags, branding, rings etc. Dynamic marking: beta light, radio- tracking, collars.

2.3 Basic Concept of forest soil dwelling arthropods, decomposer food web in forest soil, vertical distribution and aggregation of Collembola and mites.

2.4 Pests of Teak (Borers- *Alcterogystia cadambae*& Defoliators- *Hyblaea puera*) and Sal (Borers- *Hoplocerambyx spinicornis* and Defoliators- *Lymantria mathura*)

Unit- III- Avian Systematic

3.1 Morphology and morphometry of birds, methods of identification and bird diversity.

3.2 Bird study techniques: equipments, area of study, field data recording, bird photography.

3.3 Bird counting technique: sampling, bird singing techniques, use of hi-tech gadgets like GPS, CCTV, Camera and high vision equipments.

3.4 Estimation of breeding population, breeding ground mapping.

Unit- IV- Bird diversity and Breeding

4.1 Bird biodiversity hotspots in India, Bird sanctuaries in India.

4.2 Role of birds in ecosystem – pollination, seed dispersal, insect control, bird migratory routes.

4.3 Breeding biology, nesting territories, bird songs, courtship and mating.

4.4 Types of nest, nest building, nest defense and parental care.

Suggested reading

1. Ali, S. and Ripley, S. D. 1983. Handbook of the Birds of India and Pakistan Compact Edition. Oxford Univ. Press. New Delhi.
2. Anon. 1975. Forest Pest Control. National academy of Science. NAS, Washington, D. C.
3. Bailey J. A. 1984. Principles of Wildlife Management John Wiley and Son. N.Y.
4. Beeson, C. F. C. 1941. The ecology and control of forest insects of India and neighboring countries, Govt. of India Press.
5. Brockman, O.F. 1959. Recreational use of Wildlife. McGraw Hill Book Company.
6. Daniel, J. C. 1983. The Book of Indian Reptiles, Bombay Natural History Society, Bombay.
7. Davis & Johnson. 1987. Forest Management. McGraw Hill Book Company.
8. Eisenbeis, G & Wichard, W. 1991. Atlas on the Biology of Soil Arthropods, Springer – verlak, London.
9. Elseth,B.D. & Baumgartner, K.M. 2003. Population Biology,Van Nostrand Co., New York.
10. Findley, W. P. K. 1967. Timber pests and diseases: Pregman Press.
11. Graham, S.A. and Knight, F.B. 1965. Principles of Forest Entomology, McGraw Hill book Company.
12. Harris, W.V. 1964. Termites: Their recognition and control. Longmans, London.
13. Krebs, J. R. & Davies, N. B. (1989) An Introduction to Behavioral Ecology. Oxford: Blackwell Scientific Publications.
14. Knight, P. V., 1980. Principles of forest entomology, McGraw Hill Publication.
15. Lenderen D. 1991. Modelling in behavioral ecology. Chapman & Hall London U.K.
16. Rodgers N.A & Panwar H.S 2001. Planning of wild life / Protected area Network in India. The report of wild life Institute of India, Dehradun.
17. Snodgrass, R. E. 1995. Principles of Insect Morphology. USDA.1952. Insects: The Year Book of Agriculture.
18. Staddon, J.E.R. 1983. Foraging and Behavioral Ecology. Adaptive Behavior and Learning. Cambridge University Press.

19. Stephens, D.W., Brown, J.S. & Ydenberg, R.C., 2007. *Foraging: Behavior and Ecology*. Chicago: University of Chicago Press
20. Trippense, R.E. 1953. Wildlife Management, McGraw Hill Book Co.
21. Van Tyne, J. & Berger, A. J., 1976. Fundamental Ornithology, MacMillan Publishing Co. Inc. N. Y.
22. Wallace, G. J. & Mahan H. D., 1975. An Introduction to Ornithology. MacMillan Publishing Co. Inc. N. Y.
23. West, D.C., Shugart, H.H. & Botkin, D.F., 1981,Forest Succession: Concepts and Application, Springer-verlag, New York.
24. Witter, J A & Coulson, R N, 1984, Forest entomology: ecology and management, John Wiley and Sons, U.S.A

Semester-IV

Paper-4T$_1$, Biotechniques, Biostatistics, Ethology, Toxicology and Bioinformatics

Unit- I

1.1 Sterilization techniques, media for microbial culture, inoculation methods

1.2 Animal cell & tissue culture- primary culture, cell lines, cell quantification, growth kinetics of cells in culture, cryopreservation of cells

1.3 Basic principle of sedimentation and centrifugation; Radioactive isotopes.

1.4 Chromatographic separation- Thin layer and gas chromatography; Electrophoretic separation techniques

Unit- II

2.1 Central tendency and dispersion- mean, mode and median with examples; Dispersion and variance.

2.2 Probability and probability distribution -Basic theory and type of probability and probability distribution with example (binomial, poison and normal distribution).

2.3 Sampling – types, standard error (SE), standard deviation (SD), significance tests - t- test, z- test, Chi square test- assumption, importance and example

2.4 Neuronal control, genetic and environmental components in development of animal behavior; Animal ethics- Introduction, concept, organizations and their functions

Unit- III

3.1 Introduction and scope of toxicology

3.2 Environmental toxicology- Classification of environmental toxicants; Pesticides, Fertilizers, Heavy and trace metals, radioactive substances, food additives, automobile emission.

3.3 Translocation of toxicants- absorption, distribution, biotransformation and excretion of toxicants

3.4 Toxicity tests- Types (Acute and Chronic), calculation of LC50 and LD 50; Antidotal thereapy- Antidotes, type of antidotes and antidotal procedure.

Unit- IV

4.1 Introduction and scope of bioinformatics - history, scope of bioinformatics in research, business and employment opportunities; Bioinformatics in India.

4.2 Sequence alignment- Pair wise sequence alignment and multiple sequence alignment.

4.3 Biological databases– Basic local alignment search tool (BLAST), and FASTA, Variants of BLAST, PSI-BLAST.

4.4 Phylogenetic analysis- Tree style, tree building methods

- **Suggested Readings**

Tissue culture and Biotechniques

1. Animal cell culture – A practical approach, (III Edition) Ed. John R. W. Masters. IRLPress.
2. *In vtro*-cultivation of animal cell, biotechnology by open learning (BIOTOL), Butterworth Heinemann Ltd. Linaere house, Jordan Hill Oxford.
3. Introduction to instrumental analysis, Robert Broun, McGraw Hill International Edition.
4. A Biologist Guide to Principle and Techniques of Practical Biochemistry K. Wilson and K.H. Goulding ELBS Edition.
5. Molecular Cell Biology, J. Darnel, H. Lodish and D. Baltimore. W. H. Freeman and Company New York.
6. DNA Techniques by Alcamo.
7. Insect Cell Culturing Engineering, Ed. M. F. A. Goosen, A.J. Daugulis and P.Faulkner.
8. Biotechnlogy - B. D. Sings.
9. Biophysical Chemistry – Upadhyay, Upadhyay and Nath.

Toxicology

1. Animal Clinical Chemistry: A Primer for Toxicologists. G.O. Evans (Ed.) ISBN: 0748403515, Taylor & Francis, 1996.
2. Animal Models in Toxicology. S.C. Gad & C.P. Chengelis (Eds.), ISBN: 0824784561, Marcel Deker, 1992.
3. Annual Reviews of Pharmacology & Toxicology, ISBN: 0824304373, 1997
4. Basic Toxicology: Fundamentals, Target Organ & Risk Assessment. F.C. Lu, ISBN: 1560323809, Taylor & Francis, 1996.
5. Casarett & Doull's Toxicology: The Basic Science of Poisons. C.D. Klaassen (Ed), ISBN: 0071054766, McGraw-Hill, 1996.
6. Comprehensive Toxicology. I. Sipes, C.A. McQueen & A. Gandolfi (Eds.), ISBN: 0080423019, Elsevier Science, 1997.
7. General & Applied Toxicology. B. Ballantyne, T. Mars & P. Turner (Eds), Vol I & II, ISBN: 0333498011, Macmillon/Stockton Press, 1993.
8. Loomi's Essentials of Toxicology, T.A. Loomis & A.W. Hayes, ISBN: 0124556256, Academic Pess, 1996.
9. Encyclopaedia of Toxicology, Chemical and Concepts, P. Wexler, ISBN: 012227220-X, Academic Press, 1998.
10. Dictionary of Toxicology. E. Hogson, J.E. Chambers & R.B. Mailman, ISBN: 1561592161, Groves ic, 1997.

Biostatistics

1. Biostatistics-Arora and Malhan
2. Biostatistics- Jasraj and Gurudeep Raj
3. Biostatistics- P. Ramkrishan
4. Methods in Biostatistics-Mahajan

Bioinformatics

1. Mount W. 2004. Bioinformatics and sequence genome analysis 2nd Editon CBS Pub. New Delhi.

2. Bergman, N. H. Comparative Genomics. Humana Press Inc. Part of Springer Science+BusinessMedia, 2007.
3. Baxevanis, A. D. Ouellate, B. F. F. 2009. Bioinformatics: A Practical Guide to the analysis of genes and proteins. John-Wiley and Sons Publications, New York.
4. Campbell A. M. and Heyer, L. J. 2007. Discovering Genomics, Proteomics and Bioinformatics, 2nd Edition. Benjamin Cummings.
5. Des Higgins and Willie Taylor 2000. Bioinformatics: Sequence, structure and databanks. Oxford University Press.
6. Rashidi H. H. and Buehler 2002. Bioinformatics Basics: Applications in Biological Science and Medicine, CRC Press, London.
7. Gibas Cynthia and Jambeck P. 2001. Developing Bioinformatics Computer Skills: Shroff Publishersand Distributors Pvt. Ltd. (O'Reilly), Mumbai.

Semester-IV
Paper-4T_2, Special Group-Entomology-I
Sense organs, social life and Agriculture pests

Unit-I
1.1 Compound eyes- structure and functions.
1.2 Ocelli- structure and functions.
1.3 Sound producing organs: Structure and physiology.
1.4 Light producing organs: Structure and bioluminescent mechanism.

Unit-II
2.1 Mechanoreceptors: Senseroy hairs, campaniform sensilla and chordotonal organs.
2.2 Tympanal organs, Johanson's organ, Chemoreceptors- sensilla trichoidea, sensilla basiconica.
2.3 Pigments and mechanism of colour change, mimicry and camouflage.
2.4 Immunity in insect: Innate immunity and molecular mechanism.

Unit-III
3.1 Social life: Polymorphism, nest building and social behavior in Isoptera.
3.2 Social life: Polymorphism, nest building and social behavior in ants.
3.3 Parasitic Hymenoptera-types and significance.
3.4 Locust migration and swarming.

Unit-IV
4.1 Pest of major crops: Rice, Cotton and Sugarcane-classification, life history, damage and control.
4.2 Pest of fruits: Citrus and Mango-classification, life history, damage and control.
4.3 Pest of vegetables: Cabbage and Brinjal- classification, life history, damage and control.
4.4 Stored grain pests: classification, life history, damage and control measures.

Semester-IV
Paper-4T_3, Special Group-Entomology-II
Pest control measures and Insects vectors

Unit-I
1.1 Inorganic insecticides: Properties, mode of action and use.
1.2 Chlorinated Hydrocarbons: Properties, mode of action and use.
1.3 Organophosphates: Properties, mode of action and use.

1.4. Natural organic compound and pyrethroids: Properties, mode of action and use.

Unit-II

2.1 Biological control: Historical and theoretical basis of biological control.

2.2 Desirable attributes of natural enemies of pests.

2.3 Parasitoids used in biological control programmes: life cycle and biological relationship.

2.4 Predators used in biological control programmes: life cycle and biological relationship.

Unit-III

3.1 Insect pathogenic bacteria used in biological control programmes, biological relationship, mass production and examples.

3.2 Insect pathogenic viruses used in biological control programmes, biological relationship, mass production and examples

3.3 Use of radiation, chemosterilants, hormones and pheromones in pest control programmes.

3.4 Integrated pest managements: principles, modeling, application and examples.

Unit-IV

4.1 Pest of horse and cattle: Nature of damage, life cycle and control measures.

4.2 Mosquitoes causing disease in man: life cycle, mode of transmission of pathogen and control measures.

4.3 Flies causing disease in man: life cycle, mode of transmission of pathogen and control measures.

4.4 Lice and fleas causing disease in man: life cycle, mode of transmission of pathogen and control measures.

Semester-IV Practical-4 P_1, Special Group-Entomology

1 Anatomical observations, demonstration and detailed explanation of the silkgland in mulberry and non mulberry silkworms with the help of already available permanent slides/ ICT tools/ models/ charts/ photographs etc.

2 Anatomical observations, demonstration and detailed explanation of the male and female reproductive system in silk moths with the help of ICT tools/ models/ charts/ photographs etc.

3 Anatomical observations, demonstration and detailed explanation of the salivary, pharyngeal glands and sting apparatus in honey bees with the help of ICT tools/ models/ charts/ photographs etc.

4 Demonstration of disease causing pathogens in insects.

5 Histopathological Study of baculovirus and protozoan infected tissues with the help of already available permanent slides/ ICT tools/ models/ charts/ photographs etc.

6 Collection of insect photographs, identification and classification of harmful insects, parasitic hymenopteran and other beneficial insects.

7 Listing of insects of different orders of central India.

8 Study of various systems of insects and their functional significance with the help of ICT tools/ charts/ models/ photographs etc.

9 Preparation of photographic life history of economical important insects.

10 Preparation of insect biodiversity register of a specific area by photographic collection/ observation.

11 Visit to Apiculture, Sericulture, Lac culture centers and entomology research laboratory/center.

Distribution of Marks: **Marks**

1.	Anatomical observations	20	
2.	Identification, classification and economic importance of spots (1 to 10)		30
3.	Demonstration of microbial pathogen in insect		10
4.	Whole mount preparation		10
5.	Class record and submission of slides		10
6.	Submission of life history		10
7.	Viva-voce	10	
	Total marks		100

- **Project work** 100
  (80 marks project evaluation including viva + 20 marks Internal assessment)

- **Suggested Readings**

Entomology

1. Imms General text book of Entomology, Eds. O. W. Richards and R. G. Davis Chapman and Hall, London.
2. General and Applied Entomology, K.K. Nayar, T. N. Ananthkrishan and B.V. Davis Tata McGraw -Hill Co.Ltd. Bombay.
3. The Insect: Structure and function, R.F. Chapman, Cambridge University Press.
4. The Physiology of Insect , Ed. M.Rockstein ,Vol, 1-5, Academic Press, New York.
5. The Physiology of Insect Reproduction, F, Englemann, Pergamon Press, New York.
6. Comprehensive Insect Physiology , Biochemistry and Pharmocology , Eds. G.A. Kerkut and I. A. Gillberd, VOL. 1-13, Pergamon Press, New York.
7. Analytical Biochemistry of Insect, Ed. R. B. Turner, Elsevier, Amsterdam.
8. Insect Hormone, M. J. A. Novak. Chapman and Hall, London.
9. Modern Entomology(Second edition): D. B. Tembhare, Himalaya Publication House, Bombay.
10. Destruction and Useful Insect, Their Hanits and Control, C. L. Metcalf, W. P. Flint and R. I. Metcalf, Mc Grow I Ill Co. New York.
11. Integrated Pest Management, J.L. Apple and R. E. Smith, Plenum Publication Co., New Delhi.
12. An Introduction Of Biological Control RVD Boarscho, P. S. Y. Messenger and A. P. Gaiter, Plenum Publication Co.
13. Text Book of Entomology, K. P. Shivastava, Vol. 1 And 2 Kalyani Publication, Ludhiana.
14. Agriculture Entomology, H. S. Dennis, Timber Press Inc.
15. Entomology and Pest Management, Larry P. Pedigo, Prentice Hall.
16. Text Book of Agriculture Entomology, Alford V. David, Blackwell Science.
17. Biopesticides In Insect Pest Management, S. J. Ignacimulha and Alok Sen , Phoenix Publishing House Pvt, Ltd.
18. Biotechnology in Invertebrate Pathology and Cell culture (Maramorosch, K. ed.). Academic Press, New York.
19. PEBFANS (2003)" (Solomon Raju, A. J. ed.). Andhara University Press, Visakhapatnam.
20. Living Resources for the Millennium 2000 (S. J. William ed.), Students Offset Press, Chennai.

Semester –IV
Paper-4T_2, Special Group-Fish and Fisheries-I
General studies

Unit-I
1.1 Structure of alimentary canal in teleosts; feeding habits, histology of different parts
1.2 Modification of alimentary canal in relation to feeding habits, digestion and absorption of food.
1.3 Structure of kidney in teleosts: Head kidney and trunk kidney, histology, blood supply
1.4 Osmoregulation in Freshwater forms, Marine forms, Rays and Skates, Diadromous fishes.

Unit-II
2.1 Chaemoreceptors: Structure of olfactory system, morphology of peripheral olfactory organ, cellular composition of olfactory epithelium, olfactory bulb and central projections
2.2 Structure and functions of taste buds.
2.3 Migration in fishes: Types- Anadromous, Catadromous, Amphidromous, factors responsible for migration (Intrinsic and environmental), periodicity of migration.
2.4 Role of hormones in migration, Orientation and Navigation during migration.

Unit-III
3.1 Structure of male reproductive system
3.2 Mechanism of spermatogenesis and its hormonal control
3.3 Structure of female reproductive system
3.4 Oogenesis, egg development, hormonal control of oogenesis

Unit-IV
4.1 Structure, hormones and functions of pituitary gland in fishes
4.2 Structure, hormones and functions of other endocrine glands.
4.3 Stucture of Hypothalamo-hypophysial system in fishes.
4.4 Neurohormones and their functions.

Semester –IV
Paper-4T_3, Special Group-Fish and Fisheries -II
Fishery technology and Fish pathology

Unit-I
1.1 Pond management (sitting construction and problems)
1.2 Gear and crafts in inland water
1.3 Conservation of fish, Fish legislation and their importance.
1.4 Water pollution and inland fisheries

Unit-II
2.1 Plankton in relation to fish production,
2.2 Culture of phytoplankton and zooplankton (Daphnia, Artemia, Monia)
2.3 Manufacture and maintenance of Aquarium
2.4 Hybridization and transgenic fish

Unit-III
3.1 Fish marketing: Marketing practices, information, marketing channels and systems
3.2 Domestic and export marketing.
3.3 Sex control and sex reversal under condition and chromosome set manipulation in fish
3.4 Gamete preservation: cryopreservation and its application.

Unit-IV

4.1 Methods of curing and preservation of fish.
i. Refrigeration and freezing, ii. Drying, iii. Salting, iv. Smoking, v. Canning

4.2 Fish products and by-products: i. Fish body oil, ii. Fish liver oil, iii. Fish meal, iv. Isinglass, v. Fish protein concentrate, vi. Fish glue, vii. Fish manure

4.3 Fish pathology: i) Signs of sickness and effects on fish, ii) Pathological procedure for diagnosis of fish diseases

4.4 Fish diseases and its control: Biotic (fungal, bacterial and viral etc.) and Abiotic.
a) Viral diseases, b) Bacterial diseases, c) Fungal diseases, d) Protozoan diseases

Semester- IV, Practical-4P$_1$, Special Group-Fish and Fisheries

1 Elementary work on surgical ablation with reference to gonads with the help of ICT tools/ charts/ models / photographs etc.

2 Study of normal differential count in fish blood (Source of fish blood**:** Local recognized fish markets).

3 Effect of stress (cold) on differential count in fish blood (Source of fish blood**:** Local recognized fish markets).

4 Effect of stress (hot) on differential count in fish blood (Source of fish blood**:** Local recognized fish markets).

5 Estimation of protein in blood serum of fish (Source of fish blood**:** Local recognized fish markets).

6 Separation of proteins based on molecular weight by SDS-PAGE.

7 Study of permanent histological slides of various fish organs & endocrine glands with the help of already available permanent slides/ ICT tools/ charts/ models/ photographs etc.

8 Study of skeletal system of *Wallago* &*Labeo* with the help of already available skeleton/ ICT tools/ charts/ models / photographs etc.

9 Study of weberrian ossicles in *Heteropneustes fossilis, Clarias batrachus & Wallago* with the help of already available permanent slides/ ICT tools/ charts/ models/ photographs etc.

10 Study of accessory respiratory organs in some air breathing fishes with the help of already preserved material/ ICT tools/ charts/ models/ photographs etc.

11 Assessment of maturity of gonads using already available preserved specimens, permanent slides/ ICT tools/ charts/ models/ photographs etc.

Distribution of Marks:		**Marks**
1.	Surgical ablation of gonads	30
2.	Anatomical observations (Minor)	15
3.	Physiology Experiment	20
4.	Spotting	15
5.	Viva voce	10
6.	Practical Record	10

	Total marks	100

- **Project work** 100
(80 marks project evaluation including viva + 20 marks Internal assessment)

- **Suggested Readings:**

1. Fish Physiology Vol. 1 to 13: Hoar H.S. & Randall (Eds.) (1964-1994) Academic press London, New York.
2. The physiology of fishes Vol. 1&2: Brown M.E.(1957) Academic press, New York.
3. Natural history of fishes & systematic of fresh water fishes:P Datta Munshi, J.S. & Shrivastva, M.P.(1988): Narendra pub. House, Delhi.
4. Air breathing fishes of India- Their structure, function and life history: Dutta Munshi, J. S., Hunghes G.M. (1992) .Oxford and JBH publication Co. New Delhi.
5. The freshwater fishes of India, Pakistan, Bangladesh, Burma and Shri Lanka Handbook: Jayaram, K.C. (1981): Zoological Survey of India, Calcutta.
6. Fish migration: Jones, F.R. S. (1968), E.Arnold, London
7. Aquaculture, Bardach, Ryther and Mc Lamy
8. Marine fisheries: D. K. Dal, K. V. Rao
9. Ichthyology: Lagler, K. F., Bardach, J. and Miller, R.(1977) John Wileys and sons.
10. Fish Endocrinology: Matty, A. J. (1985), Chapman and Hall, London.
11. An aid to the identification of common commercial fishes of India and Pakistan: Mishra K. S. (1982).
12. Aquaculture: The farming and husbandry of freshwater and marine organism: Bardach, J.E. (1974). Narendra Publication House, New Delhi.
13. Handbook of breeding of Indian Major Carps by pituitary hormone injection: Chonder, S. L. (1970). Satish book enterprises, Agra.
14. Diseases of fish: Duijin, C:Van Inr. (1973), life books London.
15. Fish and fisheries of India: Jhingran , V. G. (1985). Hindustan Publication Company, New Delhi.
16. Prawns and prawn fisheries of India: Kurian, C.V. and Sebastian, V. O. (19876) . Hindustan Publication Company, New Delhi.
17. The Sea food Industry: Martin, R. E.(1990). Narendra Publication House, New Delhi.
18. Ecological effects of water, applied limnology and pollutant effect: Welch, E. B. (1992).
19. A compemendium of aquaculture technologies: Sinha, V.R. P.(1993). Oxford and JBH publication Co. New Delhi.

Semester-IV

Paper-4T_2, Special Group-Mammalian Reproductive Physiology-I

Reproductive Endocrinology

Unit-I

1.1 Hypothalamus – Anatomy, cytoarchitecture.
1.2 Releasing and release inhibiting hormones.
1.3 Neurotransmitters and neural signals.
1.4 Feedback regulatory mechanism

Unit-II

2.1 Adenohypophysis: Anatomy, cytology.
2.2 Neurohypophysis: Anatomy, cytology.
2.3 Gonadotrophic hormones: structure, mechanism of secretion and function.
2.4 Anatomy and hormones of pars intermedia.

Unit-III

3.1 Hypothalamo – hypophyseal testis axis
3.2 The Androgen: Biosynthesis, mode of action, transport and functions of testosterone.
3.3 Physiology of inhibin-biosynthesis, mode of action and functions.

3.4 Hypothalamo – hypophyseal thyroid-gonad axis.

Unit- IV

4.1 Hypothalamo – hypophyseal ovarian axis.
4.2 The oestrogen: Biosynthesis, mode of action, transport and functions.
4.3 The progesterone: Biosynthesis, mode of action, transport and function.
4.4 Hypothalamo- hypophyseal adrenal-gonad axis.

Semester-IV

Paper-4T_3, Special Group-Mammalian Reproductive Physiology-II
Reproductive Toxicology, Embryology and Fertility

Unit-I

1.1 Chemical toxicants and Testicular toxicity.
1.2 Environmental factors and reproductive health.
1.3 Induction of gonadal toxicity in females.
1.4 Interruption of pregnancy by pesticides.

Unit-II

2.1 Implantation of mammalian blastocyst.
2.2 Development of chorio–allantoic placenta.
2.3 Foetal membranes – Development, structure, function of chorion, amnion, allantois, yolk sac.
2.4 Onset and endocrine control of parturition.

Unit-III

3.1 Intrauterine and intra cervical devices (IUDS and IUCDS) medicated and non-medicated IUD's, Long acting steroidal contraceptives.
3.2 Surgical sterilization and medical termination of pregnancy (MTP).
3.3 Pregnancy vaccine (anti-HCG, Antizona vaccine, immunization with FSH).
3.4 Recent advances in female contraception (inhibin, prostagladin, hormone analogues, subdermal implants).

Unit- IV

4.1 Vasectomy and reversible vas occlusion.
4.2 LH-RH antagonist, estrogen antagonist, GnRH antagonist.
4.3 Anti-androgen and anti-spermiogenic compounds (LDH-Cy and Sp-10), Inhibin.
4.4 Antibodies for acrosomal enzymes and sperm surface proteins.

Semester-IV, Practical-4 P_1, Special Group-Mammalian Reproductive Physiology

1 Demonstration of surgical operation in rat/ mice Ovariectomy or Hysterectomy or Unilateral adrenalectomy with the help of ICT tools/ Charts/ Models / Photographs etc.
2 Anatomical observations, demonstration and detailed explanation of the female reproductive system of rat or mice with the help of ICT tools/ models/ charts/ photographs etc.
3 Vaginal smear: Vaginal cytology with relation to estrous cycle with the help of already available permanent slides/ ICT tools/ charts/ models/ photographs etc.
4 Pregnancy detection test.
5 Study of histochemical localization of proteins in rat/ mouse thyroid by Mercury-Bromophenol blue method with the help of already available permanent slides/ ICT tools/ charts/ models/ photographs etc.

6 Study of histochemical localization of lipids in rat / mouse ovary by Sudan Black–B method (Propylene glycol method) with the help of already available permanent slides/ ICT tools/ charts/ models/ photographs etc.

7 Experimental (histological slides for identification) study of the following with the help of already available permanent slides/ ICT tools/ charts/ models/ photographs etc.
a) Effects of ovarictomy and oestrogen replacement on pituitary, uterus and vagina.
b) Effects of some female antifertility drugs on ovary and adrenal gland

8 Histology: (Identification of slides) Histological changes in female reproductive organs during different phases of oestrous cycle in continuous and seasonal breeder with the help of already available permanent slides/ ICT tools/ charts/ models/ photographs etc.

9 Embryology: Study of various stages of development of mammalian egg, development of foetal membranes, different types of placenta, progestational changes in uterus with the help of already available permanent slides/ ICT tools/ charts/ models / photographs etc.

10 Field work: Visit to laboratory for embryo transfer and family planning clinics.

Distribution of marks	**Marks**
1. Surgical operation	20
2. Anatomical observations	20
3. Vaginal smear and oestrous cycle stages	10
4. Experimental analysis	15
5. Identification and comment on spots	15
6. Practical Record	10
7. Viva voce	10
Total marks	100

- **Project work** 100

(80 marks project evaluation including viva + 20 marks Internal assessment)

- **Suggested Readings**

1. A textbook of in vitro fertilization and assisted reproduction edited by P.R. Brinsden and P. A. Rainsbur Jaypee brothers 1992.
2. Advances in Reproductive Physiology, Vol. 1 to 6: Mclaren, (1968). Logos Press Ltd., London.
3. Advances in Reproductive Toxicology eds. S. C. Joshi and A. S. Ansari Pointer publishers.
4. Andrology. 2nd Edition Male Reproductive health and dysfunction (Eds. E. Nieschlag & H.M. Behre) 2000.
5. Biochemistry of Mammalian Reproduction: Zanveld, L.J.D. & R.T. Chatterton (1982). John Wiley & sons, New York.The Ovary.Vol. I, II & III: Zuckerman, S, (1962). Academic Press, London.
6. Biology of Gestation: Assalye, N.S. (1968). Academic Press, London.
7. Biology of ovarian follicles in mammals (1985). S. S. Guraya Springer-Verlag.
8. Comparative cellular and molecular biology of testis in vertebrates (Trends in endocrine, paracrine and autocrine regulation of structure of functions) (2001) S.S. Guraya, Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi, Calcutta.
9. Comparative Endocrinology and Reproduction. Eds. K.P. Joy, A. Krishna and C. Haldar, Narosa Publishing House (1998).

10. Contraceptive Technology Past, Present and Future: Das. R.P. (1989). N.I.H.F.W. New Delhi.
11. Control of ovulation: Crighton, D.B., Haynes, N.B. Foxcroft, G.R. & G.E. Lamming (1978). Butterworths, London.
12. Encylopedia of Reproduction Vol. I, II, III, IV eds. Ernst Knobil and J.D. Neill (1998).
13. Endocrinology and metabolism. 4th edition 2001. Philip Felig & Lowrence A. Frohmon McGraw Hill Inc. Medical Publishing Division.
14. Endocrinology. Vol. 1 to 3: L.J. Degroot et al. (1989). W.B. Saundors Co. Philadelphia.
15. General Endocrinolgoy: Turner, C.D. & J.T. Bagnara (1990) W.B. Saunders Co., & Toppan Co., Philadelphia, London & Tokyo.
16. Hormonal Control of Lactation: Cowie, A.T. Forryth, I.A. and I. Hart (1980). Springer-Verlag, Berlin & New York.
17. Mammalian Oviduct: Hafez, E.S., and R.J. Blandu. The University of Chicago Press, Chicago, London.
18. Marshall's Physiology of Reproduction. 4th Edition Vol. 3 Pregnancy and Lactation Part I, II, III edited by G.E. Lamming, Champan and Hall.
19. Ovarian Cycle of Mammals: Perry, J.S. Oliver and Boyd, Edinburgh.
20. Patterns of Reproduction: Asdell, S.A. (1964). Constable and Co. London.
21. Physiology of Lactation: Smith, Vearch, Constable & Co., London.
22. Postgraduate Reproductive endocrinology. 4th Edition. 1997. R. Rajan Jaypee brothers. Medical Publishers (P) Ltd.
23. Practice of fertility control, Choudhary S. K. Churchill and Livingstone.
24. Progress in Reproductive Biology, Vol. 4. The pineal and reproduction: Reiter, R.J. Series Ed. P.O. Hubinant, Karger, Basel. Paris, London (latest edition).
25. Reproduction in Mammals Series: 1 to 6: Austin, C.R. and R. V. Short (1984 & 1994),
Cambridge University Press, Cambridge.
26. Reproductive Endocrinology: Ref. No. 1, Vol. 3 Hormones in Reproduction.
27. Seasonal Patterns of Stress, immune function and disease R.J. Nelson, G.E. Demas, S.L. Klein, L.J. Kriegsfeld. 2002. Cambridge Univ. Press.
28. Shaw's textbook of Gynaecology eds. V. G. Padubidri and S. N. Daftary. 2000.
29. The Biology of Blastocyst: Blandau, R.J. (1971). The University of Chicago Press, Chicago & London.
30. The Prostaglandins Vol. I & II: Ramwell, P.W. (1974). Prenum Press, New York and London.
31. The Testis Vol. 1 to 4: Jhonson, A.D. and W. R., Gomes.
32. Vertebrate Foetal Membrances: Mossman, H.W. (1989). Rutgress Press Ltd.
33. WHO laboratory manual for the examination of human semen and sperm – cervical mucus interaction. 4th Edition Cambridge Univ. Press. 2000.

Semester –IV

Paper-4T_2, Special Group-Animal Physiology-I

Physiology of Brain, Nerve and Muscle

Unit-I

1.1 Morphological differentiation of mammalian brain
1.2 Brain stem
1.3 Cerebellum
1.4 Physiology of learning, memory and sleep

Unit-II

2.1 Types and functional properties of neurons
2.2 Ultrastructure of neuron
2.3 Ultrastructure of synapse and molecular mechanism of synaptic transmission
2.4 Bioelectrical properties of neurons- neuronal excitability, resting membrane potential- Nearnst equation, sodium and potassium pump, propagation of nerve impulses, generation of action potential.

Unit III

3.1 Biosynthesis, storage and release of neurotransmitters:Acetylcholine , GABA, Epinephrine, Nor-epinephrine , Serotonin.
3.2 Neuropeptides- oxitocin, vasopression, thyrotropin releasing hormone, cholecystokinin
3.3 Receptor physiology- Mechanoreception, photoreception, phonoreception, chemoreception
3.4 Disorders of nervous system: Alzheimer's disease, Parkinson's disease.

Unit-IV

4.1 Ultrastructure of skeletal muscle
4.2 Molecular mechanism of muscle contraction- muscle proteins, Calcium receptors, Calmodulin, Calcium pump, sliding filament theory, chemistry and role of ATP in muscle contraction.
4.3 Properties of muscle (twitch, tetanus, summation, tonus, all or none principle fatigue), muscular disorders.
4.4 Ultrastructure of Neuromuscular Junction.

Semester –IV

Paper-4T_3, Special Group-Animal Physiology-II

Physiology of Respiration and Reproduction

Unit I

1.1 Physiological anatomy of respiratory system.
1.2 Mechanism of respiration – Mechanism of breathing and the exchange of respiratory gases at pulmonary surface.
1.3 Transport of respiratory gases by blood.
1.4 Lung volumes and capacities, partial pressure of gases.

Unit II

2.1 Oxygen dissociation curve, Carbon -dioxide dissociation curve.
2.2 Carbonic anhydrate, chloride shift.
2.3 Neural and chemical regulation of respiration
2.4 Hypoxia, Cyanosis.

Unit III

3.1 Endocrine control of spermatogenesis and oogenesis
3.2 Leydig cells, sertoli cells and their hormones
3.3 Follicular cells and luteal cells and their hormones
3.4 Corpus luteum- formation, structure, hormones and functions

Unit IV

4.1 Placenta - structure, hormones and functions
4.2 Physiology of lactation
4.3 Role of hormones and pheromones in reproduction
4.4 Causes of infertility in male and female; Invitro fertilization (IVF) and Test Tube Baby

Semester-IV, Practical-4P$_1$, Special Group- Animal Physiology

I. Physiology Experiments

1. Study of Electrocardiograph (ECG) under different physiological conditions with the help of ICT tools/ charts/ models / photographs etc.
2. Body size and oxygen consumption in aquatic animals.
3. Effect of pH, temperature on oxygen and carbon dioxide concentration in pond water.
4. Biochemical estimation of tissue cholesterol (Source of tissue**:** Local recognized fish markets/ slaughter houses/ poultry farms etc.)
5. Measuring of heart beat under different physiological condition.
6. Study of nerve cells and neurosecretry cells of cockroach with the help of already available permanent slides/ ICT tools/ charts/ models/ photographs etc.
7. Estimation of SGOT/SGPT from blood sample (Source of blood**:** Local recognized pathology laboratory)

II. **Quantitative Analysis**

1. Muscle & Liver glycogen (Source of muscle/ liver: Local recognized fish markets/ slaughter houses/ poultry farms etc.)
2. Determination of fructose in seminal vesicle/ semen (Source of semen: Government artificial insemination centre)
3. Separation of protein by SDS-PAGE
4. Determination of semen constituents (Source of semen: Government artificial insemination centre)
5. Estimation of percentage quantity of lactose in milk in vertebrates.

III. Qualitative Analysis

1. Estimation of lactate dehydrogenase (Source of blood: Local recognized pathology laboratory).
2. Estimation of RNA and DNA (Source of blood: Local recognized pathology laboratory).
3. Histochemical localization of a dehydrogenase (Source of tissue: Local recognized fish markets/ slaughter houses/ poultry farms etc.)
4. Histochemical localization of Carbohydrate (Source of tissue: Local recognized fish markets/ slaughter houses/ poultry farms etc.)
5. Histochemical localization of Glycogen (Source of tissue: Local recognized fish markets/ slaughter houses/ poultry farms etc.)
6. Histochemical localization of lipid (Source of tissue: Local recognized fish markets/ slaughter houses/ poultry farms etc.)
7. Histochemical localization of protein (Source of tissue: Local recognized fish markets/ slaughter houses/ poultry farms etc.)

IV. Histological Study of Brain, Testis, Ovary, Thyroid, Adrenal, Corpus luteum in ovary, Leydig cells in testis, T. S. Muscle fiber, T. S. Spinal cord, Cerebellum & cerebrum, Nerve fiber, Lung with the help of already available permanent slides/ ICT tools/ charts/ photographs etc.

Distribution of Marks:		**Marks**
1.	Physiology Experiment	20
2.	Major quantitative analysis	20
3.	Minor quantitative analysis	10

4.	Qualitative analysis	15
5.	Identification and comment on spots(1-5)	15
6.	Practical Record	10
7.	Viva-voce	10
	Total marks	100

- **Project work** 100

(80 marks project evaluation including viva + 20 marks Internal assessment)

Semester –IV
Paper-4T_2, Special Group-Environmental Biology-I
Environmental Pollution and Aquaculture

Unit-I

1.1 Pollution Ecology: definition, sources of pollution, classification of pollutants, primary and secondary pollutants.
1.2 Air pollution: definition, sources, air pollutants and its effects on human health and atmosphere, control of air pollution.
1.3 Water Pollution: definition and sources, water pollutants and its effects, control of water pollution.
1.4 Noise pollution, sources, physiological and psychological effects of noise pollution, control measures of noise pollution.

Unit-II

2.1 Land pollution: definition, sources, effects and control of insecticide pollution.
2.2 Radioactive pollution: definition, sources, effects and control measures of radioactive pollution.
2.3 Biomedical waste: sources, effects and control measures
2.4 Hazardous waste: definition, sources, effects.

Unit-III

3.1 Biological and general effects of pollutants on organism.
3.2 Bioassay studies: definition, purpose, methodology, calculation of LC50 value, significance.
3.3 Bioaccumulation and biomagnifications.
3.4 Biotransformation of xenobiotics.

Unit-IV

4.1 Aquaculture: basic concept of fisheries, marine, inland and brackish water fisheries.
4.2 Indian major carps and their culture: fish, seed resources, transport.
4.3 Planning and management of freshwater fish farm.
4.4 Fishery economics and management: role of fishery co-operative societies, economics of fishery, aquaculture and rural development.

Semester –IV
Paper-4T_3, Special Group-Environmental Biology-II
Man and Environment

Unit-I

1.1 Natural resources: definition, concept , types of natural resources, use and abuse of natural resources.

1.2 Wild life: wild life in India, endangered species of mammals, birds, amphibian and reptiles,

1.3 Causes of wild life depletion, necessity of wild life conservation.

1.4 Modes of conservation, national parks and sanctuaries, strategies for biodiversity conservation, gene pool.

Unit-II

2.1 National resources: minerals, nutrient cycles, exploitation of nutrient resources.

2.2 Biomass, biogas and solar energy.

2.3 Conservation and sustainable development of natural resources, bacteria and biodegradation

2.4 Biodiversity- definition, types, hotspots of biodiversity.

Unit-III

3.1 Conservation of natural resources: potable water criteria, water supply, water borne diseases and control measures, bioremediation of ponds and lakes.

3.2 Process of soil formation, composition, soil profile, soil erosion, methods of conservation of soil.

3.3 Conservation of forest: needs, afforestation, deforestation, agroforestry, forest conservation through law.

3.4 Social forestry and environment.

Unit-IV

4.1 Environmental policy, social economic and legal aspects, social forestry, enforcement of anti pollution law.

4.2 Environmental education: environmental education programmes, environmental education in India

4.3 Formal environmental education, stages of environmental education, non formal environmental education.

4.4 Environmental Organizations and agencies.

Semester-IV, Practical-4P$_1$, Special Group-Environmental Biology

1 Bioassay test- toxicity evaluation of heavy metals/pesticides using snail/fish as test animals, determination of LC50 value by using provided data.

2 Determination of oxygen consumption in fish.

3 Estimation and proximate composition (Protein / glycogen) in fish (Source of fish blood/ tissue: Local recognized fish market).

4 Determination of NO2 and SO2 in ambient air.

5 Determination of suspended particulate matters in ambient air.

6 Determination of oil and grease by Soxhlet apparatus and separating funnel.

7 Identification of common commercial important inland / marine fishes, Crustaceans and mollusc.

8 Identification of maturity stages in fish using fishes available in the local fish markets or with the help of already available permanent slides ICT tools/ charts/ models/ photographs etc.

9 Determination of gonadosomatic index (GSI) by using provided data.

10 Study of fecundity of fish.

11 Physiochemical analysis of Soil, pH, moisture.

12 Field work and study tour:

a. Visit to National Institute / Centre of Aquaculture.
b. Visit to a fish farm
c. Visit to National park / sanctuary to observed wildlife and maintaining the field diary.

d. Study tour and visit to national Institute of Oceanography.

Distribution of Marks		**Marks**
1.	Major experiment	20
2.	Minor experiment	15
3.	Minor experiment	15
4.	Identification and comments on given spots (1-10)	30
5.	Class record	10
6.	Viva voce	10
	Total marks	100

- **Project work** 100
  (80 marks project evaluation including viva + 20 marks Internal assessment)

- **Suggested Readings**

1. The Science of Ecology: Brewer, A. (1998), Sanders Pub. New York.
2. The Science of Ecology: Ehrlich, P. R. & Roughsrden, J. (1987) McMillan Pub. Co. New York.
3. Population Biology: Emlein, J. M. (1984). McMillan Pub. London.
4. Current Ecology: Pattern & Progress: Killawa, J. & Anderson, G.J. (1986), Blackwell Science Publication, Oxford.
5. Basic Ecology: Odum, E. P. (1983), Sanders Pub. New York.
6. Systems of Ecology: Odum, H. T. (1983), John Wiley & Sons, New York.
7. Ecology with Special Reference to Animals and Man: Kendelgh, Prentice Hall Co.
8. National Resources & Conservation: Owen, O. S. (1985) McMillan Pub. New York.
9. Elements of Ecology: Smith, R. L. (1986), Harper & Row Pub. New York.
10. Environmental Physiology: Sonim, N. B. (1974), C. V. Mosby Pub. St. Louis, USA.
11. Environmental Physiology: Philips, J. G. (1975), Blackwell Science Publication, Oxford.
12. Ecology: Ricklefts, R. E. (1973), Thomas Nelson & Sons Ltd.
13. Threatened Animals of India: Tikader, B. K. ZSI Calcultta.
14. Ecology & Field Biology: Smith, R. L. Harper & Rw Pub. New York.
15. Wildlife in India: Sharin, V. B. (1985), Natraj Pub. Dehradun.
16. Fresh Water in India: Kulkarni, K. H. (1957), ICAR, New Delhi.
17. Marine Fishes: Bal, D. V. & Rao, K.V. (1989), Tata McGraw Hill, New York.
18. Textbook of Marine Ecology: Balkrishnan, N. A. & Thumpy, D. N. (1980), McMillan Co.
19. Marine Ecology & Fishes: Cushly, B. H. (1980), Cambridge University Press.
20. Treatise on Limnology: Hutchinson, G.E., (1967), John Willy Pub. New York.
21. Methods of Soil Analysis: De, S. K. (1962), Narayan Pub. House, Allahabad.
22. Fish & Fishes of India: Jhingran, V. G. (1985)
23. **Aquatic Pollution:** Edward A. (2000) Laws. 3rd edition**. John Wiley**and**Sons**, New York.
24. A Manual of Fresh Water Ecology: Santhanam, R., Velayntan, P. & Jagathesan, G. (1989), Daya Pub. House, Delhi.
25. Limnology: Welch, P. S. (1957), McGrall & Hill Co. New York.
26. **Air Pollution: Perkins, H.C.,** (1974) McGraw-Hill, New York.

Semester –IV
Paper-4T$_4$, Foundation -II
Applied and Industrial Entomology

Unit 1- Mulberry sericulture
1.1 Mulberry sericulture:- life history and rearing.
1.2 Silk gland of mulberry silkworm:- structure and silk synthesis.
1.3 Cocoon formation, cocoon harvesting and reeling.
1.4 Mulberry plantation and silkworm rearing house.

Unit 2- Tasar sericulture
2.1 Tasar silkworm biology and life cycle.
2.2 Mature tasar larvae, silk gland and silk proteins.
2.3 Hammock and cocoon formation, cocoon harvesting.
2.4 Natural host plants and predators of tasar silkworm.

Unit 3- Eri, lac culture and medical entomology
3.1 Eri silkworm biology and life cycle.
3.2 Lac insect- biology, lac cultivation and economic importance.
3.3 Forensic entomology- basic concepts and importance.
3.4 Insect causes diseases in man- (Malaria, Filarial, Kala- Azar).

Unit 4- Apiculture
4.1 Types of honey bees, *Apis dorsata*, *A. indica* and *A. melifera*.
4.2 Colony formation and Apiary products.
4.3 Beekeeping techniques: moveable frame hive and bee rearing management.
4.4 Economic importance of honey, wax and other apiary products

Suggested Readings for foundation -I and Foundation -II
Entomology

1. Imms General text book of Entomology, Eds. O. W. Richards and R. G. Davis Chapman and Hall, London.
2. General and Applied Entomology, K.K. Nayar, T. N. Ananthkrishan and B.V. Davis Tata McGraw -Hill Co.Ltd. Bombay.
3. The Insect: Structure and function, R.F. Chapman, Cambridge University Press.
4. The Physiology of Insect , Ed. M.Rockstein ,Vol, 1-5, Academic Press, New York.
5. The Physiology of Insect Reproduction, F, Englemann, Pergamon Press, New York.
6. Comprehensive Insect Physiology , Biochemistry and Pharmocology , Eds. G.A. Kerkut and I. A. Gillberd, VOL. 1-13, Pergamon Press, New York.
7. Analytical Biochemistry of Insect, Ed. R. B. Turner, Elsevier, Amsterdam.
8. Insect Hormone, M. J. A. Novak. Chapman and Hall, London.
9. Modern Entomology(Second edition): D. B. Tembhare, Himalaya Publication House, Bombay.
10. Destruction and Useful Insect, Their Hanits and Control, C. L. Metcalf, W. P. Flint and R. I. Metcalf, Mc Grow I Ill Co. New York.
11. Integrated Pest Management, J.L. Apple and R. E. Smith, Plenum Publication Co., New Delhi.
12. An Introduction Of Biological Control RVD Boarscho, P. S. Y. Messenger and A. P. Gaiter, Plenum Publication Co.

13. Text Book of Entomology, K. P. Shivastava, Vol. 1 And 2 Kalyani Publication, Ludhiana.
14. Agriculture Entomology, H. S. Dennis, Timber Press Inc.
15. Entomology and Pest Management, Larry P. Pedigo, Prentice Hall.
16. Text Book of Agriculture Entomology, Alford V. David, Blackwell Science.
17. Biopesticides In Insect Pest Management, S. J. Ignacimulha and Alok Sen , Phoenix Publishing House Pvt, Ltd.
18. Biotechnology in Invertebrate Pathology and Cell culture (Maramorosch, K. ed.). Academic Press, New York.
19. PEBFANS (2003)" (Solomon Raju, A. J. ed.). Andhara University Press, Visakhapatnam.
20. Living Resources for the Millennium 2000 (S. J. William ed.), Students Offset Press, Chennai.

Semester –IV

Core (Subject Centric)- II

Paper- $4T_4$ Radiation and Chronobiology

Unit- I: Radiation Biology

3.1. Definition, scope and significance of radiation biology.
3.2. General classification of radiation. Ionizing radiation, linear energy transfer, radiation dose and units.
3.3. Principles of radiation dosimetry, direct and indirect effects. Radiations lesions in DNA, radiobiological effect on cell.
3.4. Radiation sensitizers and protectors.

Unit II: Effect of Radiation on Human Health

4.1. Health consequences after total body irradiation from radiation accidents.
4.2. Long term radiation risks from low radiations doses.
4.3. Radiation induced cancer.
4.4. Radiation effects in the developing embryo and fetus, radiation induced heritable diseases.

Unit- III: Circadian cycle

1.1. Organization of circadian system in multicellular animals.
1.2. Concept of central and peripheral clock system.
1.3. Circadian pacemaker system in invertebrates with particular reference to *Drosophila.*
1.4. Circadian pacemaker system with particular reference to rodents.

Unit- IV: Biological clock

2.1. Centers of biological clock – Supra chiasmatic nuclei, pineal gland and optic lobes.
2.2. The relevance of biological clock for human welfare- clock function and dysfunction.
2.3. Depression and sleep disorders.
2.4. Chronopharmacology, chronomedicine, chronotherapy.

Suggested reading

1. Kumar, V. 2002. Biological Rhythms, Narosa Publishing House, Delhi/ Springer-Verlag, Germany
2. Dunlap, J. C., Loros, J. J. & DeCoursey, P. J. 2004. Chronobiology Biological Timekeeping, Sinauer Associates, Inc. Publishers, Sunderland, MA, USA
3. Fliedner, T. M., Friesecke, I. & Beyrer, K., 2001. Medical management of radiation accidents– manual on the acute radiation syndrome.British Institute of Radiology Supplement.

4. Kramer, K. & Merrow, G. 2013. Handbook of Experimental Pharmacology, Circadian Clocks, Springer, London.
5. Hall, E. J, Giaccia A. J. 2006. Radiobiology for the radiologist, Philadelphia, Pa: Lippincott Williams & Wilkins.
6. Saunders, D.S., Steel, C.G.H., Afopoulou X. & Lewis, R.D. 2002. Insect Clocks, Barens and Noble Inc., New York, USA.
7. International Commission on Radiological Protection, 2003: Biological effects after prenatal irradiation (embryo and foetus), ICRP publication.
8. INTERNATIONAL COMMISSION ON RADIOLOGICAL PROTECTION, 2006: Low dose extrapolation of radiation-related cancer risk, ICRP publication.
9.Foster, R. & Kreitzman, L. 2014. Rhythms of Life, The Biological Clocks that Control the Daily Lives of Every Living Thing by, Profile Books Ltd.

RASHTRASANT TUKADOJI MAHARAJ
NAGPUR UNIVERSITY NAGPUR

SEMESTER SYSTEM SYLLABUS

FOR

PSYCHOLOGY

B. A.
(Semester I, II, III, IV, V & VI)

WITH EFFECT FROM 2016-17

RASHTRASANTTUKADOJIMAHARAJ

NAGPUR UNIVERSITY NAGPUR

SEMESTER SYSTEM SYLLABUS FOR

B. A.

PSYCHOLOGY

Semester wise Distribution of Marks

Class	Marks for Theory Paper	Marks for Internal Assessment In Theory	Marks for Practical Marks	Marks for Internal Assessment In Practical	Total Mark
B.A. SEM I **Code:FP1T1**	40	10	40 CODE:1P1	10	100
B.A. SEM II **Code:SP2T1**	40	10	40 CODE:2P1	10	100
B.A. SEM III **Code:PP3T1**	40	10	40 CODE:3P1	10	100
B.A. SEM IV **Code:SMPT4T1**	40	10	40 CODE:4P1	10	100
B.A. SEM V **Code:OP5T1**	40	10	40 CODE:5P1	10	100
B.A. SEM VI **Code:COU&POS6T1**	40	10	40 CODE:6P1	10	100
TOTAL	240	60	240	60	600

Rules and Regulations

1. There will be four periods for theory and two periods for practical per week.
2. One batch of Practical will consist 16 students.
3. Minimum passing marks in each theory, practical and internal assessment will be 40%.(Combined passing))
4.. Student will not be allowed to appear in the practical examination without duly signed Practical record by teacher & Head of the Department.

CERTIFICATE

Department of Psychology

Name of College …….

This is to certify that this practical record is Original work done by Shri/ Kumari/ Smt.. …….....

Class…….. Semester…….. During the Academic year.....

He/ She has attended/ not attained the field work/ Study tour prescribed by the RTM Nagpur University Nagpur.

Signature of the teacher

1) ……

2) …… Head of Department

Question Paper Pattern

Examination UG level

PSYCHOLOGY

B.A. Semester- I, II, III, IV, V & VI

Time – Two Hours **Full Marks- 40**

Instructions- **1) All Questions are compulsory.**

2) All Questions carry equal marks.

Que.No.1. One Long answer questions with Internal Choice from any Unit of 08 Marks.

Que.No.2. One Long answer questions with Internal Choice from any Unit of 08 Marks.

Que.No.3. Two Short answer questions with Internal Choice from any Unit of 8 Marks (4 x 2).

Que.No.4. Two Short answers question with Internal Choice from any Unit of 8 Marks (4 x 2).

Que.No.5. Eight Very Short Answer Questions without internal choice from Unit 1 to Unit 4. Minimum one Question from each Unit and each question will carry 01 mark i.e. 1 x 8 = 08 Marks.

Note: 1) One question from each unit.

2) Question No.5 should be asked from all 4 units.

PATTERN OF EXAMINATION

Theory:

One theory paper of 40 marks and Examination duration will be two hours for all six semesters

Practicals:

1) One Practical examination of 50(External 40+ Internal 10) marks and Examination duration will be three hours for all six semesters

2) Practical examination in each semester will be conducted by Internal and External examiners appointed by the University.

Internal Assessment:

1) Head of the department will carry out internal assessment of the students on the basis of evaluation report from the concerned teacher/teachers, under the supervision of the principal of the college and will be done at the end of each semester.

2) Distribution of 10 marks of internal assessment is as under-

i) Class Attendance 03 marks

ii) Home Assignment 05 marks

iii) Group Discussion / Seminar 02 marks

Rashtrasant Tukdoji Maharaj Nagpur University

Syllabus for B. A. Semester- **I to VI (Psychology)**

To be implemented progressively from 2016-2017 onwards

Semester	Title of Paper
I	**FUNDAMENTALS OF PSYCHOLOGY**
II	**SOCIAL PSYCHOLOGY**
III	**PSYCHOPATHOLOGY**
IV	**STATISTICAL METHODS AND PSYCHOLOGICAL TESTING**
V	**ORGANAIZATIONAL PSYCHLOLGY**
VI	**COUNSELLING AND POSITIVE PSYCHOLOGY**

Rashtrasant Tukdoji Maharaj Nagpur University

Syllabus for B. A. **Semester - I** (Psychology)

FUNDAMENTALS OF PSYCHOLOGY

To be implemented progressively from 2016-2017 onwards

Objectives: To provide solid foundation to understand basic Psychological processes and their applications in everyday life.

(Marks: Theory: **40**, Internal Assessment: **10=50)**. (Marks: Practical: **40**, Internal Ass: **10=50**) Total marks= **100**

==========

CODE: **FP1T1**

Unit I - **Introduction**:

Definition and goals of psychology, Approaches to psychology. Fields of Psychology- Theoretical and Applied. Methods of Psychology- Introspection, Experimental and Observation. Application: Understanding behaviour through methods of psychology.

Unit II - **Cognitive Processes**

Perception: Definition, Gestalt principles: Figure and ground. Laws of perceptual organization.
Application: Laws of perceptual organization in daily life.
Learning: Definition, Types of learning, Methods of learning: Conditioning, Trial and Error, Insight learning. Thorndike's laws of learning.
Memory: Definition, Stages of memory- sensory memory, short term memory, long term memory. Techniques of Memory development.
Application: Memory Improvement.

Unit III – **Motivation and Emotion**

Motivation: Definition, Concept of homeostasis
Types of motives: Physiological, Psychological, Social
Maslow's theory of Hierarchy of Motives
Application: Enhancing self motivation.
Emotion: Definition and nature. Correlates: Internal and external Changes.
Application of emotion- Understanding Emotion.

Unit IV: **Intelligence and Personality**

Intelligence: definition, Concept of C. A., M. A., I. Q. Distribution of IQ in population. Measurement of Intelligence: Types of intelligence test.
Theories of Intelligence- Gardner's theory, Guilford's SOI model.
Application: Improving intelligence in childhood.

Personality: Nature, Definition
Theories of personality- Freud's Psychoanalytic theory,
Type theory and trait theory.
Application- Personality Enhancement.

Note:
1) 2 periods per week per batch of 16 students and 04 periods for theory per Week shall be allotted.
2) Student has to submit duly certified record book at the time of examination.
3) Every student has to submit one assignment and also participate in group discussion.
4) In Group Discussion, applications of Unit I, II, III & IV should be discussed.
5) Students will have to perform any **Four** of the following.

Practicum

CODE:1P1

1) Substitution learning
2) Knowledge of results
3) Judgment of emotion from Photographs
4) Achievement Motivation
5) Habit Interference
6) Personality Test
7) Alexander's Pass Along Test
8) Maze Learning

Distribution of Marks for practical:

Record Book	10
Conduct of Test.....	10
Viva Voice	10
Report of the Test.....	10
Internal Assessment.....	10
==========	
Total Marks	**50**

REFERENCES:

Baran, R. A. (1995): Psychology: The Essential Science, New Delhi, Allyn and Bacon.

Benjamin, L. T. (1997): History Of Psychology: Original Sources and Contemporary Research.New Delhi: McGraw-Hill Companies.

Chadha, N. K. Seth, S. (2014): The Psychological Realm: An introduction. Pinnacle learning, New Delhi.

Ciccarelli, S. & Meyer, G. E. (2008). Psychology. Pearson, New Delhi: Coon, D. & Mitterer, J. O. (2007): Introduction to Psychology*:* Gateways to Mind and Behaviour.Singapore, Thomson Wadsworth.

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Pandit, Kulkarni and Gore (1999). Samanya Manasashastra. Nagpur: Pimpalapure Pub.

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Rathus, S. A. (1986): Essentials of Psychology. CBS College Publishing, Holt, Rinehart and Winston, New York.

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Rashtrasant Tukdoji Maharaj Nagpur University

Syllabus for B. A. **Semester- II** (Psychology)

Social Psychology

To be implemented progressively from 2016-2017 onwards

Objectives: To understand the basics of Social Psychology and the individual in the social world.

(Marks: Theory: **40**, Internal Assessment: **10=50)**. (Marks: Practical: **40**, Internal Ass: **10=50**) Total marks= **100**

==========

Code:SP1T2

Unit 1: Introduction

Brief history of Social Psychology (special emphasis on Indian context), Scope of Social Psychology, Levels of social behaviour. Approaches towards understanding social behaviour.
Application: Behaviour in social situation.

Unit 2: Attitude and Prejudice

Attitude: Definition and formation of attitude. Theories: Balance theory, Cognitive dissonance theory. Prejudice: Nature and components of prejudice. Acquisition and reduction of prejudice.
Application: Attitude change.

Unit 3: Pro-social behaviour and Aggression

Pro-social behaviour: Nature, Determinants, Bystander Effect.
Aggression: Nature, types, determinants, prevention and control of aggression.
Application: Acquiring Pro-social behavior.

Unit 4: Communication

Communication: Definition, types, process, barriers and inter-personal communication.
Application: Effective communication.

Note:

1) 2 periods per week per batch of 16 students and 04 periods for theory per Week shall be allotted.
2) Student has to submit duly certified record book at the time of examination.
3) Every student has to submit one assignment and also participate in group discussion.
4) In Group Discussion, applications of Unit I, II, III & IV should be discussed.

5) Students will have to perform any **Four** of the following.

Practicum

CODE:1P2

1. Test of Attitude Measurement
2. Aggression Scale
3. Prejudice Scale
4. Immediate Memory span for digits
5. Social Maturity Scale
6. Bilateral Transfer of Training
7. Koh's Block Design Test
8. Concept Formation

Distribution of Marks for practical:

Record Book	10
Conduct of Test.....	10
Viva Voice	10
Report of the Test.....	10
Internal Assessment.....	10
==========	
**Total Marks..... **	**50**

References

Baron, R. A., Byrne, D. & Bhardwaj, G. (2010): *Social Psychology* (12th Ed).New Delhi, Pear Chadha, N.K. (2012): *Social Psychology*, McMillan, New Delhi

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Syllabus for B. A. **Semester- III** (Psychology)

PSYCHOPATHOLOGY

To be implemented progressively from 2016-2017 onwards

Objective: To develop an understanding of the various psychological disorders and treatment.

(Marks: Theory: **40**, Internal Assessment: **10=50)**. (Marks: Practical: **40**, Internal Ass: **10=50**) Total marks= **100**

==========

Code:PP1T3

Unit I: Introduction

Concept of Normality & Abnormality, Historical Background
Approaches to abnormality– Statistical, Evaluative, and Psychodynamic Orientation to Classificatory system (DSM-V, ICD-10).
Diathesis Stress Model.
Application: Maintaing Mental Health.

Unit II: Psychological Disorders

Anxiety disorders**:** Generalized, Hypochondriasis, Conversion Reaction, Phobias, Obsessive Compulsive Disorder. Childhood Disorders: ADHD (Attention Deficit Hyperactivity Disorder), Learning Disability: (Dyslexia, Dyscalculia, Dysgraphia), Slow learner
Application: Managing Anxiety.

Unit III: Psychological Disorders

Mood Disorders: Mania, Depression, Bipolar affective disorder.
Schizophrenia: Symptoms, types: Simple, Paranoid, Catatonic, Hebephrenic, Residual.
Application: Managing Moods.

Unit IV: Treatment of Disorders

Orientation to Biological treatment: Pharmacotherapy (Anti-anxiety, Antipsychotic, Anti depressants and mood stabilizers) and Electroconvulsive therapy
Psychological treatment: Psychoanalytic therapy, Behavior therapy and Cognitive- therapy, Indian perspective – Patanjali's Ashtang yoga.
Application: Relaxation techniques.

Note:

1) 2 periods per week per batch of 16 students and 04 periods for theory per Week shall be allotted.
2) Student has to submit duly certified record book at the time of examination.
3) Every student has to submit one assignment and also participate in group discussion.

4) In Group Discussion, applications of Unit I, II, III & IV should be discussed.
5) Students will have to perform any **Four** of the following.

Practicum
CODE:1P3

1) Positive Mental health
2) Depression scale
3) Muller Lyer Illusion
4) Anxiety test
5) Rational learning
6) Narcissism
7) Test of Locus of Control
8) Life Event Scale

Distribution of Marks for practical:

Record Book	10
Conduct of Test.....	10
Viva Voice	10
Report of the Test.....	10
Internal Assessment.....	10
==========	
Total Marks..... 50	

Reference

Anastasi, A. (1997): Psychological Testing, New York: Mac Millan Co.
Coleman, J. C. (1998): Abnormal Psychology and Modern Life, D.B.Taraporevala sons & Co. Pvt Ltd. Mumbai.

Barlow, D. H. and Durand V. M. (2005): Abnormal Psychology: An Integrated Approach (4th Ed.).Wadsworth: New York.

Carson, R. C., Butcher, J. N., Mineka, S. & Hooley, J. M. (2008): Abnormal Psychology. New Delhi: Pearson.

Frude, N. (1998): Understanding abnormal psychology. Oxford: Blackwell Publishers. DSM- V (2013): American Psychiatric Publishing, Washington, (5th Ed) DC London, England

Garret, H. E. (2006): Statistics in Psychology and Education, Surjeet Publications, Delhi.

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STATISTICAL METHODS AND PSYCHOLOGICAL TESTING

To be implemented progressively from 2016-2017 onwards
Objective: To introduce basic statistical methods, psychological testing and qualitative methods and their uses.

(Marks: Theory: **40**, Internal Assessment: **10=50)**. (Marks: Practical: **40**, Internal Ass: **10=50**) Total marks= **100**

==========

Code:SMPT1T4

Unit I: Introduction

Data: Ungrouped and grouped, frequency distribution. Graphical representation of data: Histogram and Frequency Polygon.
Application: Graphical representation.

Unit II: Data analysis

Measures of central tendency: Mean, Median, Mode
(Properties and Computation of grouped & ungrouped data**)**
Deviation: Standard Deviation, it's properties and computation
Correlation: Meaning & types: Spearman's Rank difference Correlation, Pearson's Product Moment method, Normal Probability Curve (NPC): Properties.
Application: computation of statistical problems.

Unit III: Test of Significance

Test of Significance: Chi Square (Equal probability), 't' test.

Unit IV: Psychological Testing

Psychological Testing: Introduction to psychological testing, characteristics Psychological test, Reliability, Validity, Norms and standardization. Types of tests. Qualitative methods: Interview, observation, case study.
Application: Use of psychological test in day to day life.

Note:
1) 2 periods per week per batch of 16 students and 04 periods for theory per week shall be allotted.
2) Student has to submit duly certified record book at the time of examination.

3) Every student has to submit one assignment and also participate in group discussion.
4) In Group Discussion, applications of Unit I, II, III & IV should be discussed.
5) Students will have to perform any **Four** of the following.

Practicum
CODE:1P4

1. Occupational Stress Index
2. Standard Progressive Matrices
3. Adjustment Inventory
4. Stress Scale
5. Goal Setting Behaviour
6. Reaction Time
7. DAT / DBDA
8. Multiple Choice

Distribution of Marks for practical:
Record Book …… 10
Conduct of Test…… 10
Viva Voice …… 10
Report of the Test…… 10
Internal Assessment…… 10
==========
Total Marks…… 50

Chadha, N. K. (1991): Statistics for Behavioral and Social Sciences. Reliance Pub. House: New Delhi.

Garrett, H. E. & Woodworth, R. S. (1987): Statistics in Psychology and Education. Mumbai, Vakils, Feffer & Simons Pvt. Ltd.

Gregory, R. J. (2006): Psychological Testing: History, Principles, and Applications (4th Ed.) New Delhi: Pearson Education.

King, B. M. & Minium, E. W, (2007): Statistical Reasoning in the behavioral Sciences USA: John Wiley & Sons.

Nimbalkar, K. P. (2016): Psychology Experiments and Tests (in Marathi), Psychoscan, Wardha

Organizational Psychology

To be implemented progressively from 2016-2017 onwards

Objective: To introduce the basic concepts of Industrial and Organizational psychology and to understand the application of psychology at the workplace.

(Marks: Theory: **40**, Internal Assessment: **10=50)**. (Marks: Practical: **40**, Internal Ass: **10=50**) Total marks= **100**

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Code:OP1T5

Unit I:

Understanding Organizational behaviour: Meaning, nature and goals of Organizational behaviour.
Application: Nature of organizational Behaviour

Unit II:

Work related Attitudes: Job satisfaction; factors affecting Job satisfaction. Enhancing Job satisfaction.
Application: Importance of Job Satisfaction in human life

Unit III:

Work Motivation: Theories – Maslow's Theory, Herzberg's Two factor theory, application; Indian Perspective.
Application: Role of Work Motivation in Organization

Unit IV:

Organizational Stress: Meaning and Causes, Consequences and managing stress.
Application: Effects of stress in work - life.

Note:

1) 2 periods per week per batch of 16 students and 04 periods for theory per Week shall be allotted.
2) Student has to submit duly certified record book at the time of examination.
3) Every student has to submit one assignment and also participate in group discussion.
4) In Group Discussion, applications of Unit I, II, III & IV should be discussed.

5) Students will have to perform any **Four** of the following. Visit to any organization is compulsory.

Practical:
CODE:1P5

1) Case Study
2) Mental Work and fatigue
3) Work Motivation Questionnaire
4) Organizational Climate Inventory
5) Job Satisfaction
6) Occupational Self Efficacy Scale
7) Depth Perception
8) Visit to any Organization

Distribution of Marks for practical:

Record Book	10
Conduct of Test.....	10
Viva Voice	10
Report of the Test.....	10
Internal Assessment.....	10
==========	
**Total Marks..... **	**50**

References

Aamodt, M.G. (2oo1): Industrial Organizational Psychology. India: Cengage Learning.

Chadha, N. K. (2007): Organizational Behavior. Galgotia; New Delhi.

Greenberg, J. and Baron R. A. (2007): Behavior in Organization. (9thEd), India; India; Dorling Kindersley.

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Muchinsky, P. (2006): Psychology applied to work: An introduction to industrial and organizational psychology, N C; Hyper graphic Press.

Pareek, U. (2010): Understanding organizational behaviour. Oxford University Press.

Counselling and Positive Psychology

To be implemented progressively from 2016-2017 onwardsObjective: To Develop and understanding of well-being.

(Marks: Theory: **40**, Internal Assessment: **10=50)**. (Marks: Practical: **40**, Internal Ass: **10=50**) Total marks= **100**

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Code:COU&POS1T6

Unit I: **Counselling**

Meaning and goals of counselling, counselling process and relationship. Counselling in Indian context
Application: Counselling an Art.

Unit II:

Techniques: Play, Art, Drama, Music, Dance, Yoga and Meditation.
Application: Role of Counselling techniques .

Unit III:

Applications of counselling: family, School, Career Premarital, Marriage.
Application: Challenges before Counsellor. Premarital counseling to students.

Unit: IV:

Well Being: Components of well–being; life satisfaction Life:
Enhancing Virtues: Wisdom and Knowledge, Courage, Humanity, Justice, Temperance, Transcendence.
Application: Understanding importance of Well-being.

Project : With a view to facilitate creativity, arouse curiosity and promote skills in planning and conducting psychological research, students are required to take up a mini project on an issue of interest, under the supervision of teacher.

Note:

1) 2 periods per week per batch of 16 students and 04 periods for theory per Week shall be allotted.
2) Student has to submit duly certified record book at the time of examination.
3) Every student has to submit one assignment and also participate in group discussion.

4) In Group Discussion, applications of Unit I, II, III & IV should be discussed.
5) Students will have to perform any **Four** of the following. Project work is compulsory.

Practical:
CODE:1P6

1) Well-Being Scale
2) Psychological Counseling Need Scale
3) Psychological Hardiness Scale
4) Big Five Personality Inventory
5) Type A/B Behavioural pattern Scale
6) Retroactive Inhibition
7) Verbal Intelligence Test
8) Research Project

Distribution of Marks for practical:
Record Book …… 10
Conduct of Test…… 10
Viva Voice …… 10
Report of the Test…… 10
Internal Assessment…… 10
==========
Total Marks…… 50

References:

Baumgardner, S. R. (2012): Positive Psychology. New Delhi, Pearson

DiMatteo, M. R. and Martin, L. R. (2002): Health Psychology. New Delhi, Pearson.

Nimbalkar, K. P. (2016): Psychology Experiments and Tests (in Marathi), Psychoscan, Wardha

Rao, S. N. (2003): Counselling and Guidance (2nd Ed) New Delhi: Tata McGraw Hill.

Snyder, C. R. & Lopez, S. J. (2007): Positive Psychology: The Scientific & practical explorations of human strengths. Thousand Oaks, CA: Sage.

Taylor, S. E. (2006): Health Psychology (6th Ed.) New York:Tata McGraw Hill.

RASHTRASANT TUKDOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR

Directon No. 1 of 2017

DIRECTION GOVERNING THE EXAMINATION LEADING TO THE DEGREE OF Bachelor of Business Administration (BBA) (CREDIT BASE SEMISTER PATTERN) FACULTY OFCOMMERCE

WHEREAS the Maharashtra Universities Act No. XXXV of 1994 has come into force with effect from 22nd July, 1994.

AND

WHEREAS the amendment to the said Act came to be effected from 12th May,2000.

AND

WHEREAS the Faculty of Commerce in its meeting held on 14.3.2016 have decided to restructure the syllabus for the award of the degree of **Bachelor of Business Administratoin (BBA)** Examination commensurate with the curricula existing in the various Universities in India and with a view to include the latest trends in the commerce stream as well as to design it to suit to the needs of the industries and corporate houses as provided under Section 38(a) of the Act.

AND

WHEREAS all the Board of Studies in Faculty of Commerce in its meeting held on 5.4.2016 restructured the existing syllabi and recommended the new scheme of examination.

AND

WHEREAS the recommendations made by the all four Board of studies under Faculty of Commerce were approved by the Academic Council, in its meeting held on 8.6.2016.

AND

WHEREAS no ordinance is in existance prescribing THE EXAMINATION LEADING TO THE DEGREE OF Bachelor of Business Administration (BBA) (CREDIT BASE SEMISTER PATTERN).

WHEREAS the Special Task Committee in its meeting on 23-11-2016 decided **to prepare a draft of new direction & syllabus of BBA (CBS).**

WHEREAS the Special Task Committee in its meeting on **04-01-2016 considered & approved the draft of new direction and syllabus of BBA (CBS) submitted by the sub-committee & recommended it to the Hon'ble** Vice-Chancellor for his approval.

AND

WHEREAS the matter involved is required to be implemented urgently for the purpose of prescribing examinations leading to the degree of **Bachelor of Business Administration (BBA) (CBS)** in the Faculty of Commerce.

WHEREAS the preparation of ordinance to regulate the matter relating to the examinations leading to the degree of **Bachelor of Business Administration (BBA) (CBS) is time consuming process**

AND

Now, therefore, I,Dr. SiddharthvinayakP. Kane, Vice-Chancellor, Rastrasant Tukdoji Maharaj Nagpur University, Nagpur in exercise of the powers vested in me under Section 14(8) of the Maharashtra University Act of 1994 do hereby issue the following direction.

Scheme of Examination

1. This direction may be called **'Examination leading to the Degree of Bachelor of Business Administration (BBA)CREDIT BASE SEMISTER PATTERN) in the Faculty of Commerce (Amendment),**---Number----------
2. This direction shall come into force with effect from the date of its approval by the Management Council & shall be applicable from academic session 2016-17.

3. There shall be Six Examinations leading to the degree of Bachelor of Business Administration (BBA)namely :

   (1) The **Bachelor of Business Adminstration (BBA)** – 1st Semester Examination,
   (2) The **Bachelor of Business Adminstration (BBA)** – 2nd Semester Examination,
   (3) The **Bachelor of Business Adminstration (BBA)** – 3rd Semester Examination,
   (4) The **Bachelor of Business Adminstration (BBA)** – 4th Semester Examination,
   (5) The **Bachelor of Business Adminstration (BBA)** – 5th Semester Examination and
   (6) The **Bachelor of Business Adminstration (BBA)** – 6th Semester Examination.

4. The duration of the Degree Course under this shall be of three academic years divided into six semesters with the BBA 1st and 2nd Semester Examinations during the first academic year, the BBA 3rd and 4th Semester Examinations during the second year and the BBA 5th and 6th Semester Examinations during the third year.

5. The Examinations Specified in paragraph 3 above shall be held twice a year at such places and on such dates as may be fixed by the University.

6. The details of eligibility for **BBA Sem I** examination:

(A) For the **BBA 1st Semester,** Examinee shall have Passed the 12th Standard Examination of the Maharashtra State Board of Secondary and Higher Secondary Education, with English at Higher or Lower level and any Modern Indian Language at higher or lower level with any combination of optional subjects;

OR

XII Standard Examination of Maharashtra State Board of Secondary and Higher Secondary Education in Vocational Stream with one language only; OR any other examination recognized as equivalent thereto; in such subjects and with such standards of attainments as may be prescribed Minimum Competition vocation course (MCVC).

OR

Any other Equivalent Examination of any State in (10+2) pattern with any combination of subjects.

7. A collegiate candidate shall have pursued a regular course of study for not less than 90 days of the academic session before being examined for any semester examination of **BBA** in any recognized institution and or college affiliated to Rashtrasant Tukdoji Maharaj Nagpur University where the course is conducted.

8. An applicant for the Bachelor of Business Administration 1st, 2nd, 3rd, 4th, 5th or 6th Semester Examination shall have passed an examination specified in Clauses (A), (B), (C), (D), (E) and (F) of paragraph 6 respectively, not less than one academic year prior to his admission to the respective examination.

9. Without prejudice to the other provisions of Ordinance No. 6 relating to the Examinations in General, the provisions of Paragraphs 5, 7, 8, 10, 26 and 31 of the said Ordinance shall apply to every collegiate candidate.

10. The fees for the examination shall be as prescribed by the University from time to time and whenever any change is made in the fees prescribed for any particular examination that shall be notified through a notification for information of the examinees concerned.

11.With the issuance of this Direction, The Direction No 15 of 2014 and 47 of 2016 shall stand repealed.

Sd/-

Nagpur
Date : 7.1.2017

Dr. S. P. Kane
Vice-Chancellor

12. Teaching and Examination Scheme for examinees of Bachelor of Business Administration 1st, 2nd, 3rd, 4th, 5th and 6th Semester Examinations shall be as mentioned below:

Teaching and Examination Scheme
Bachelor of Business Administration (BBA)
Three Year Degree Course (Semester Pattern)
With effect from 2016-17

(A)

BBA 1st Semester Examination

Sr. No.	Subjects	Course Code	Teaching Scheme	Examination Scheme				Total Marks	Credits
			Total Periods per Week	Max. Marks(TH)	Max. Marks (IM)	Total Marks	Min. Passing Marks		
1	English	BB 1	5	80	20	100	40	100	4
2	Fundamentals of Business Management	BB 2	5	80	20	100	40	100	4
3	Computer Applications for Business	BB 3	5	80	20	100	40	100	4
4	Cost Accounting	BB 4	5	80	20	100	40	100	4
	Total		**20**	**320**	**80**	**400**	**160**	**400**	**16**

Note : 1. Duration of each theory class should be minimum 48 minutes.
2. TH = Theory, IM = Internal Marks.
3. Minimum marks for passing the subject will be 40.
4. There would be combined passing for theory and internal assessment taken together.
5. One credit is equivalent to one hour of Teaching, that is to say,
For each subject, 48 Minutes * 5 = 240 Minutes = 4 Hours i.e. 4 Credits.
6. Each semester will consist of 15 to 18 weeks of Academic Work equivalent to 90 actual teaching days.

(B)

BBA 2nd Semester Examination

Sr. No.	Subjects	Course Code	Teaching Scheme	Examination Scheme				Total Marks	Credits
			Total Periods per Week	Max. Marks(TH)	Max. Marks (IM)	Total Marks	Min. Passing Marks		
1	Principles of Marketing Management	BB 5	5	80	20	100	40	100	4
2	Financial & Management Accounting	BB 6	5	80	20	100	40	100	4
3	Micro-Economic Fundamentals	BB 7	5	80	20	100	40	100	4
4	English	BB 8	5	80	20	100	40	100	4
	Total		**20**	**320**	**80**	**400**	**160**	**400**	**16**

Note : 1. Duration of each theory class should be minimum 48 minutes.
2. TH = Theory, IM = Internal Marks.
3. Minimum marks for passing the subject will be 40.
4. There would be combined passing for theory and internal assessment taken together.
5. One credit is equivalent to one hour of Teaching, that is to say,
For each subject, 48 Minutes * 5 = 240 Minutes = 4 Hours i.e. 4 Credits.
6. Each semester will consist of 15 to 18 weeks of Academic Work equivalent to 90 actual teaching days.

(C)

BBA 3rd Semester Examination

Sr. No.	Subjects	Course Code	Teaching Scheme	Examination Scheme				Total Marks	Credits
			Total Periods per Week	Max. Marks(TH)	Max. Marks (IM)	Total Marks	Min. Passing Marks		
1	Principles of Financial Management	BB 9	5	80	20	100	40	100	4
2	Basic Statistical Techniques	BB 10	5	80	20	100	40	100	4
3	Evolution of Business & Commercial Geography	BB 11	5	80	20	100	40	100	4
4	Environment Management	BB 12	5	80	20	100	40	100	4
	Total		**20**	**320**	**80**	**400**	**160**	**400**	**16**

Note : 1. Duration of each theory class should be minimum 48 minutes.
2. TH = Theory, IM = Internal Marks.
3. Minimum marks for passing the subject will be 40.
4.There would be combined passing for theory and internal assessment taken together.
5. One credit is equivalent to one hour of Teaching, that is to say,
For each subject, 48 Minutes * 5 = 240 Minutes = 4 Hours i.e. 4 Credits.
6. Each semester will consist of 15 to 18 weeks of Academic Work equivalent to 90 actual teaching days.

(D)

BBA 4th Semester Examination

Sr. No.	Subjects	Course Code	Teaching Scheme	Examination Scheme				Total Marks	Credits
			Total Periods per Week	Max. Marks(TH)	Max. Marks (IM)	Total Marks	Min. Passing Marks		
1	Principles of Human Resource Management	BB 13	5	80	20	100	40	100	4
2	Money, Banking & Finance	BB 14	5	80	20	100	40	100	4
3	Introduction to Sociology & Psychology	BB 15	5	80	20	100	40	100	4
4	Business Legislations	BB 16	5	80	20	100	40	100	4
	Total		**20**	**320**	**80**	**400**	**160**	**400**	**16**

Note : 1. Duration of each theory class should be minimum 48 minutes.
2. TH = Theory, IM = Internal Marks.

3. Minimum marks for passing the subject will be 40.
4. There would be combined passing for theory and internal assessment taken together.
5. One credit is equivalent to one hour of Teaching, that is to say,
For each subject, 48 Minutes * 5 = 240 Minutes = 4 Hours i.e. 4 Credits.
6. Each semester will consist of 15 to 18 weeks of Academic Work equivalent to 90 actual teaching days.

(E)

BBA 5th Semester Examination

Sr. No.	Subjects	Course Code	Teaching Scheme	Examination Scheme				Total Marks	Credits
			Total Periods per Week	Max. Marks(TH)	Max. Marks (IM)	Total Marks	Min. Passing Marks		
1	Entrepreneurship Development	BB 17	5	80	20	100	40	100	4
2	Principles of Operations Management	BB 18	5	80	20	100	40	100	4
3	International Business Environment	BB 19	5	80	20	100	40	100	4
4	Research Methodology	BB 20	5	80	20	100	40	100	4
	Total		**20**	**320**	**80**	**400**	**160**	**400**	**16**

Note : 1. Duration of each theory class should be minimum 48 minutes.
2. TH = Theory, IM = Internal Marks.
3. Minimum marks for passing the subject will be 40.
4. There would be combined passing for theory and internal assessment taken together.
5. One credit is equivalent to one hour of Teaching, that is to say,
For each subject, 48 Minutes * 5 = 240 Minutes = 4 Hours i.e. 4 Credits.
6. Each semester will consist of 15 to 18 weeks of Academic Work equivalent to 90 actual teaching days.

(F)

BBA 6th Semester Examination

Sr. No.	Subjects	Course Code	Teaching Scheme	Examination Scheme				Total Marks	Credits
			Total Periods per Week	Max. Marks(TH)	Max. Marks (IM)	Total Marks	Min. Passing Marks		
1	Elective Paper – 1	BBEL 1	5	80	20	100	40	100	4
2	Elective Paper – 2	BBEL 2	5	80	20	100	40	100	4
3	Project Work	BBPW	10	150	50	200	80	200	8
	Total		**20**	**310**	**90**	**400**	**160**	**400**	**16**

Note : 1. Duration of each theory class should be minimum 48 minutes.
2. TH = Theory, IM = Internal Marks.
3. Minimum marks for passing the subject will be 40 and for Project Work it will be 80.
4. There would be combined passing for theory and internal assessment taken together.
5. One credit is equivalent to one hour of Teaching, that is to say,
For each subject, 48 Minutes * 5 = 240 Minutes = 4 Hours i.e. 4 Credits.

6. Each semester will consist of 15 to 18 weeks of Academic Work equivalent to 90 actual teaching days.

Elective Subjects (Any one of the following to be selected by the student):

Every student appearing for BBA – 6th Semester Examination has to select any one of the specialization as elective subject before commencement of the academic session:

a) **Elective A - Financial Management**
   a. Paper 1 – Fundamentals of Business Finance
   b. Paper 2 – Advanced Financial Management

b) **Elective B - Human Resource Management**
   a. Paper 1 – Fundamentals of Human Resource Management
   b. Paper 2 – Advanced Human Resource Management

c) **Elective C - Marketing Management**
   a. Paper 1 – Fundamentals of Marketing Management
   b. Paper 2 – Advanced Marketing Management

12. Assessment

- The final total assessment of the candidates is made in terms of an internal assessment (Sessional) and an external assessment for each course/subject taken together.
- For each paper, 20 marks will be based on internal assessment and 80 marks for semester end examination (external assessment) to be conducted by the R T M Nagpur University, unless otherwise stated.

1a	Attendance of the student during a particular semester	05 marks
1b	An assignment based on curriculum to be assessed by the teacher concerned	05 marks
1c	Subject wise class test conducted by the teacher concerned	05 marks
1d	Subject presentation/viva-voce seminar conducted during the semester	05 marks
1	**Internal assessment Total marks**	**20**
2	**Semester wise End Examination marks**	**80**
Total Marks Per Course		**100**

- There shall be no separate / extra allotment of workload to the concerned teacher. He/ She shall conduct the internal assessment activity during the regular teaching days / periods as a part of regular teaching activity.
- The internal marks will be communicated to the University at the end of each semester, but before the semester end examinations / as instructed by University. These marks will be considered for the declaration of the results.
- The record of internal marks, evaluation & result should be maintained for a period of one year by respective institute/college for verification by competent authority.
- The maximum and minimum marks which each subject carries in BBA Semester - I, Semester - II, Semester – III, Semester – IV, Semester - V & Semester - VI Examination are as indicated in Paragraph 11. A, B, C, D, E & F respectively.

13. (A) The scope of the subjects and pattern of examination shall be as indicated in the Syllabus.

(B) The Medium of instructions and examinations shall be in ENGLISH only.

(C) The Maximum/minimum marks which each subject carries & workload in BBA 1st, 2nd, 3rd, 4th, 5th and 6th Semester Examination shall be as indicated in Examination & Teaching Scheme (item no 11) "A", "B", "C", "D", "E" and "F" respectively.

14. Evaluation of Project

- Project Work shall carry 200 marks
- Evaluation Pattern

	Max. Marks
Project Report Evaluation by External Examiner appointed by the University	100
Presentation and Open Defense Seminar (External Examiner)	50
Presentation and Open Defense Seminar (Internal Examiner)	50
Total	200

(i) For Project worka batch of Maximum **TWENTY** students per guide /supervisor has to be allotted by the Institute. The Guide/Supervisor shall act as an internal examiner for project Examination.

(ii) The guide or the supervisor shall be appointed by the institute and should be full time approved faculty to BBA / MBA Programme or PhD supervisor in Business Management.

(iii) **The External examiner shall be appointed from the list of full time approved teaching faculty of the BBA/ MBA program by the University.**

(iv) **Each such External examiner shall examine a maximum of TWENTY students.**

(v) One copy of Project work (Printed or Type Written) shall be submitted to the University through the supervisor of the candidate and the Principal/ Director / Head of the Institute, at least **One Month** prior to the date of commencement of Semester-VI Examination **or** following the instructions issued by University at that time and one copy will be retained by the college/Department for internal evaluation purpose.

(vi) A Candidate shall submit with his/her project work, a certificate from the Supervisor to the effect-

a. That the candidate has satisfactorily completed the Project work for not less than one session and

b. That the Project work is the result of the candidates own work and is of sufficiently high standard to warrant its presentation for examination.

(vii) Candidate shall submit his declaration that the Project is the result of his own research work and the same has not been previously submitted to any examination of this University or any other University. The Project shall be liable to be rejected and /or cancelled if found otherwise.

(viii) The Project work shall be evaluated through seminar and open defense and Viva-voce at the College/ Department by internal and external examiners appointed by university **before Semester-VI** Examination.

A student appearing for BBA Semester VI Examination will have to pay additional fees as prescribed by the University from time to time.

15. Standard of Passing

The scope of the subject, percentage of passing in Theory and Project and Internal Assessment will be governed as per following rules:

(i) In order to pass at the Bachelor of Business Administration (B.B.A.) 1st, 2nd, 3rd, 4th, 5th and 6th Semester Examinations, **an examinee shall obtain not less than 40 % marks in each paper, that is to say combined in the written Examination conducted by the University and in internal assessment put together.**

(ii) An examinee who is unsuccessful at the examination shall be eligible for admission to the subsequent examinations on payment of a fresh fee prescribed for the examination together with the conditions of the ordinance in force from time to time.

16. Credit and Grade Point System:

Conversion of Marks to Grades and Calculations of SGPA (Grade Point Average) and CGPA (Cumulative Grade Point Average): In the Credit and Grade Point System, the assessment of individual Courses in the concerned examinations will be on the basis of marks only, but the marks shall later be converted into Grades by some mechanism wherein the overall performance of the Learners can be reflected after considering the Credit Points for

any given course. However, the overall evaluation shall be designated in terms of Grade. There are some abbreviations used here that need understanding of each and every parameter involved in grade computation and the evaluation mechanism. The abbreviations and formulae used are as follows:-

Abbreviations and Formulae Used

G: Grade
GP: Grade Points
C: Credits
CP: Credit Points
CG: Credits X Grades (Product of credits & Grades)
SGPA = ΣCG: Sum of Product of Credits & Grades points / ΣC: Sum of Credits points
SGPA: Semester Grade Point Average shall be calculated for individual semesters. (It is also designated as GPA)
CGPA: Cumulative Grade Point Average shall be calculated for the entire Programme by considering all the semesters taken together.
After calculating the SGPA for an individual semester and the CGPA for entire programme, the value can be matched with the grade in the Grade Point table as per the ten (10) Points Grading System and expressed as a single designated GRADE such as O, A+, A, B+, B, etc.

Marks	Grade	Grade Points
80 and above	O (Outstanding)	10
70 –79	A+ (Excellent)	9
60 –69	A (Very Good)	8
55 –59	B+ (Good)	7
50 –54	B(Above Average)	6
45 –49	C (Average)	5
40 –44	P (Pass)	4
00 –39	F (Fail)	0
	AB (Absent)	0

A student obtaining Grade F shall be considered failed and will be required to reappear in the examination.

(A) There shall be no classification of examinees successful at the Bachelor of Business Administration (BBA) Semester - I, Semester - II, Semester - III, Semester - IV, Semester - V and Semester - VI Examinations whereas SGPA will be notified.

(B) Division at the Bachelor of Business Administration (BBA) Semester - VI Examination shall be declared on the basis of the aggregate marks at the BBA Semester - I, Semester - II, Semester - III, Semester - IV, Semester - V and Semester - VI Examination taken together and the CGPA will be calculated and notified.

(C) Successful examinees at the Bachelor of Business Administration (BBA) Semester - VI Examination shall be awarded division based on CGPA as follows :

CGPA	Grade	Division
8.5 - 10	O	Distinction (Outstanding)
7.5 – 8.4	A	Distinction
6.0 – 7.4	B	First
4.5 – 5.9	C	Second
4.0 – 4.4	D	Pass
00 – 3.9	F (Fail)	Fail

17. The percentage of passing marks in each subjects shall be as indicated in Examination Scheme (item no 11) "A", "B", "C", "D", "E" and "F" respectively.

18. Unsuccessful examinees at the above examinations can be readmitted to the same examination on payment of a fresh fee and such other fees as may be prescribed.

19. Provisions of Ordinance No. 3 of 2007 relating to the award of Grace Marks for passing an examination, securing higher division / class and for securing distinction in subject(s) shall be applicable.

20. Notwithstanding anything to the contrary in this Direction, no person shall be admitted to an examination under this Ordinance, if he/ she has already passed the same examination or an equivalent examination of any other University.

21. Examinees passing all the **Bachelor of Businesss Adminsitration (BBA)**Examination shall on payment of the prescribed fees shall receive a Degree in the prescribed form signed by the Vice-Chancellor.

22. The aforesaid Amendment shall come into force from the date of its issuance and shall remain in force till the relevant Ordinance come into being in accordance with the provisions of the Maharashtra University Act, 1994.

23. The marks for internal assessment should be communicated to University within time limit as per University norms. The record of conduct of such examination, evaluation and marks for internal assessment should be maintained for a period of at least **one** year by the respective college / Department for the verification by the competent authority.

24. Promotion to Higher Semester (A.T.K.T.): The unsuccessful candidate of any semester examination shall be ALLOWED TO KEEP THE TERM (ATKT) in accordance with the following table: (Theory and Internal assessment of that theory subject shall be jointly considered as single passing head).

Admission to academic year	Candidate should have passed All Subjects of the following examination	Candidate should have filled the examination form for the following examinations	Candidate should have passed in Minimum **50%** **passing heads** of the following examination

1st Semester	H.S.S.C/equivalent	-----	-------
2nd Semester	------	**1st Semester**	**-----**
3rd Semester	**-----**	**2nd Semester**	**4 subjects/ passing heads of 1st and 2nd Semesters taken together**
4th Semester	**-----**	**3rd Semester**	**-----**
5th Semester	**1st and 2nd Semesters**	**4th Semester**	**4 subjects/ passing heads of 3rd and 4th Semesters taken together**
6th Semester*	**------**	**5th Semester**	**----**

Note: (*) A candidate admitted to Final Semester can appear for Final Semester examination however the result of the Final Semester examination will be withheld unless the candidate clears all the lower examinations of the **BBA Course**.

25. Pattern of Question Papers of BBA year end Examination:

a. The question paper should be set in such a manner so as to cover the complete syllabus as prescribed by the University.

b. The Semester End examination shall be held as per the schedule notified by the University.

c. The question paper shall be of 80 marks & the time duration of the Semester End examination would be 3 hours.

d. The question paper shall have 4 long answers questions corresponding to Four Units of each course. Each long answer question shall carry 8 marks. There will be internal choice for each question for these long answer questions which means that the student has to mandatorily attempt one question from each unit of the syllabus. Hence, there would be 8 long answer questions in the question paper but the student has to attempt 4 questions with an internal choice for each question from each unit of the syllabus. The students shall get due credit for precise answers as per Marking Scheme given by the paper setters/ moderators.

e. Question no. Five shall include Four compulsory questions from any of the six units carrying 4 marks each.

f. The paper setters /moderators shall submit the proposed marking scheme (Memorandum of Instructions) along with question paper so that the students can be given due credit for precise answers.

Illustrative Question Paper for BBA Program*

Question No.	Unit	Nature	Max. Marks
1	I	a. Long Answer Question b. Long Answer Question OR c. Long Answer Question d. Long Answer Question	8 Marks each
2	II	a. Long Answer Question b. Long Answer Question OR c. Long Answer Question d. Long Answer Question	8 Marks each
3	III	a. Long Answer Question b. Long Answer Question OR c. Long Answer Question d. Long Answer Question	8 Marks each

4	IV	a. Long Answer Question b. Long Answer Question OR c. Long Answer Question d. Long Answer Question	8 Marks each
5	I II III IV	a. Short Answer Question b. Short Answer Question c. Short Answer Question d. Short Answer Question	4 Marks each
TOTAL MARKS			80

(*) This pattern of question paper is not applicable for the following papers for which the question paper patterns are prescribed separately along with the detailed syllabus of respective subjects.

- BBA 1st Semester Examination – Cost Accounting
- BBA 1st Semester Examination – English
- BBA 2nd Semester Examination - English
- BBA 2nd Semester Examination – Financial & Management Accounting
- BBA 3rd Semester Examination – Basic Statistical Techniques
-

26. Absorption Scheme for Examinees of BBA Old Course (Introduced in 2014):

1. The students of the BBA Course (Introduced in 2014) immediately preceding the new course under this direction shall be given chance to appear for three more consecutive examinations according to old syllabus (Introduced in 2014). The University shall conduct the examination of old course for three more consecutive examinations after the new scheme of examination is introduced as per following table:

BBA Examination	Attempt 1	Attempt 2	Attempt 3
BBA Part I	Winter 2016	Summer 2017	Winter 2017
BBA Part II	Winter 2017	Summer 2018	Winter 2018
BBA Part III	Winter 2018	Summer 2019	Winter 2019

The students are required to clear all their papers within the stipulated time. The students clearing all the papers of old scheme of Examination (Introduced in 2014) shall be awarded Degree according to old scheme of Examination. But, the students who failed to clear their course in three consecutive attempts as per this clause, will be required to appear afresh for BBA (CBS) examination provided under this direction.

2. The absorption of students of old course (Introduced in 2014) referred above shall be made to the new course in the following manner:

Status of Student in Old Course	Absorption Scheme
A student who has failed in one or more subjects of BBA Part I examination of old course (Introduced in 2014).	Shall be required to appear a fresh in BBA 1st and 2nd Semester Examination of this direction and shall be eligible for the exemptions in the subjects he/she had passed in old course subject to the equivalence mentioned hereinafter.
A student who has failed in one or more subjects of BBA Part II examination of old course (Introduced in 2014).	Shall be required to appear a fresh in BBA 3rd and 4th Semester Examination of this direction and shall be eligible for the exemptions in the subjects he/she had passed in old course subject to the equivalence mentioned hereinafter.
A student who has failed in	Shall be required to appear a fresh in BBA 5th and 6th

one or more subjects of BBA Part III examination of old course (Introduced in 2014).	Semester Examination of this direction and shall be eligible for the exemptions in the subjects he/she had passed in old course subject to the equivalence mentioned hereinafter.

3. The equivalence & exemption of subjects for the students absorbed in the new course shall be as follows:

BBA New Course Examination (Semester Pattern)	Name of Subject in New Course Examination (Semester Pattern)	BBA Old Course Examination (2014)	Equivalent Subject in Old Course	Status of Exemption
Semester I	English	BBA Part I	English & Business Communication	Yes
	Fundamentals of Business Management	BBA Part I	Principles of Management	Yes
	Computer Applications for Business	BBA Part I	Computer Applications for Business	Yes
	Cost Accounting	BBA Part I	Financial & Cost Accounting	Yes
Semester II	Principles of Marketing Management	BBA Part II	Principles of Marketing Management	Yes
	Financial & Management Accounting	BBA Part I	Financial & Cost Accounting	Yes
	Micro-Economic Fundamentals	BBA Part I	Business Economics	Yes
	English	BBA Part I	English & Business Communication	Yes
Semester III	Principles of Financial Management	BBA Part II	Management Accounting & Financial Management	Yes
	Basic Statistical Techniques	BBA Part II	Statistical Methods for Business	Yes
	Evolution of Business & Commercial Geography		**----**	**No***
	Environment Management	BBA Part II	Environment Management	Yes
Semester IV	Principles of Human Resource Management	BBA Part II	Human Resource Management	Yes
	Money, Banking & Finance	BBA Part I	Business Economics	Yes
	Introduction to Sociology & Psychology		**----**	**No***
	Business Legislations	BBA Part II	Business & Industrial Laws	Yes
Semester V	Entrepreneurship Development	BBA Part III	Entrepreneurship Development	Yes
	Principles of Operations Management	BBA Part III	Production & Operations Management	Yes
	International Business Environment		**---**	**No***
	Research Methodology	BBA Part II	Research Methodology	Yes
Semester VI	Financial Management – Paper 1	BBA Part III	Financial Management – Paper 1	Yes
	Financial Management – Paper 2	BBA Part III	Financial Management – Paper 2	Yes
	Human Resource	BBA Part III	Human Resource	Yes

	Management – Paper 1		Management – Paper 1	
	Human Resource Management – Paper 2	BBA Part III	Human Resource Management – Paper 2	Yes
	Marketing Management - Paper 1	BBA Part III	Marketing Management -Paper 1	Yes
	Marketing Management - Paper 2	BBA Part III	Marketing Management -Paper 2	Yes

(*) All these subjects have no equivalent subjects in the BBA Old Course Examination (introduced in 2014). Hence, students desiring for absorption in New Course under this Direction are mandatorily required to appear for these subjects in respective semesters.

4. The University examination & Internal examination marks awarded in the equivalent subjects of the BBA old course shall be carried in the mark sheet of the BBA new semester scheme of examination.
5. As stated above, a student failing in one or more subjects & could not pass it in three attempts of any year exam of old annual pattern syllabus (2014), is required to appear a fresh in the corresponding semester exam subject to exemptions as mentioned above. The final Mark lists of such students are to be prepared on the basis of semester pattern by presenting the marks against equivalent papers.
6. If a student who had opted for final year 'Service Sector Management' specialization papers of old syllabus (2014) & could not pass it in three attempts, he shall appear for a new specialization subject as per semester pattern scheme.
7. The above absorption scheme of B.B.A. shall be effective till the introduction of new Syllabus.

27. Guidelines for Project Work :

Objective

Every student will be assigned a project in 6th Semester of BBA and it will be pursued by him/her under the supervision of an internal supervisor. The objective of the Project Work is to help the student develop his/her ability to apply multi-disciplinary concepts, tools and techniques to solve organizational problems and/or to evolve new/innovative theoretical frame work.

Type of Project

The Project may take any one of the following forms:

i) Comprehensive case study (covering single organization/multifunctional area problem, formulation, analysis and recommendations)

ii) Inter-organizational study aimed at inter-organizational comparison/ validation of theory/survey of management services.

iii) Evolution of any new conceptual / theoretical framework.

iv) Field study (Empirical study).

v) Software analysis, Design and solutions for organizational achievement (Applicable to IT)

Selection of Project Topic:

- Project topic has to be selected with respect to the programme of study and area elected by the student.
- Title of the project should clearly specify the objective and scope of the study. It should be specific and neither too vague nor centralistic. The topics should be designed meticulously. It can be designed like "Employee Welfare Measures" – A case study of XYZ Ltd.
- Project selection has to be made in consultation with the supervisor who will act as a Project guide for the student.

Scope of Work

The student is expected to carry out following activities in the project:

1. Prepare a synopsis and get it approved by the supervisor as assigned by the respective Institutes.
2. Undertake a detailed literature survey on the subject matter.
3. Make relevant data collection/observation.
4. Consult experts of the field.
5. Visit related organizations/institutions/industries.
6. Compile data in proper format.
7. Make proper conclusion/recommendations.
8. Prepare a Project Report.
9. The volume of the project-report should be ranging from 60-80 pages.
10. Obtain approval of Project Report by project supervisor.
11. Submit two hard bound copies of the Project Report at the Institute.
12. Submission of the Project Report shall be one month prior to the date of the commencement of the 6th Semester Examinations for BBA.

General Format of the Report

The project report should preferably be written in the following format:

a) Executive Summary
b) Introduction to topic
c) Research Methodology
d) Analysis and Findings of the study
e) Conclusions and Recommendations of the study
f) Bibliography
g) Appendices – to include questionnaire, if any

Examination and Evaluation

The Project is to be treated as a paper of study of the BBA-6th Semester comprising of 200 marks. The external assessment shall be done on the basis of the project report and Viva Voce. The Project shall be evaluated by an External faculty for 150 marks and of which 100 marks will be allocated to the Written Report Content and Presentation and 50 marks for Viva Voce. The Project work shall be evaluated by internal and external examiners for 100 marks (as mentioned above) at the respective institute / college as per the scheduled fixed by the university. One such External Examiner shall not examine more than 20 students in one academic year.

28. This direction shall come into force phase wise from the academic session 2016-17.

Appendix A

Subject/Paper Summary for BBA Program

Semester	Subject Code	Name of Subject
I	BB1	English
	BB2	Fundamentals of Business Management
	BB3	Computer Applications for Business
	BB4	Cost Accounting
II	BB5	Principles of Marketing Management
	BB6	Financial & Management Accounting
	BB7	Micro-Economic Fundamentals
	BB8	English
III	BB9	Principles of Financial Management

	BB10	Basic Statistical Techniques
	BB11	Evolution of Business & Commercial Geography
	BB12	Environment Management
IV	BB13	Principles of Human Resource Management
	BB14	Money, Banking & Finance
	BB15	Introduction to Sociology & Psychology
	BB16	Business Legislations
V	BB17	Entrepreneurship Development
	BB18	Principles of Operations Management
	BB19	International Business Environment
	BB20	Research Methodology
VI	BBEL1	Elective – Paper 1
	BBEL2	Elective – Paper 2
	BBPW	Project Work

Appendix B

List of Elective Subjects

Group Area	Paper	Name of Subject
Financial Management	1	Fundamentals of Business Finance
	2	Advanced Financial Management
Human Resource Management	1	Fundamentals of Human Resource Management
	2	Advanced Human Resource Management
Marketing Management	1	Fundamentals of Marketing Management
	2	Advanced Marketing Management

Appendix C

Detailed Syllabus

Bachelor of Business Administration (BBA) Examination

Semester – I

BB 1 – English

Unit I: Basic Grammar – Tense, Forms of the Verb, Preposition, Articles, Punctuation, Single Word for a Group of Words, Sentence Construction, Comprehension.

Unit II: Business Letter Writing- Enquiries and replies, Placing and fulfilling orders , Complaints and follow-up letters , Sales letters, Circular letters, Application for employment and Resume.

Unit III: Business Manners- Body Language, Gestures, Telephone etiquette, E-mail etiquette.
Textbook:
1) The Bet – Anton Chekov
2) Socrates and the Schoolmaster – F. L. Brayne

Unit IV: Textbook:
1) An Astrologer's Day – R. K. Narayan
2) The Gift of the Magi – O' Henry
3) With the Photographer – Stephen Leacock

Reference Books:

1. Textbook entitled 'Prism: Spoken and Written Communication, Prose & Poetry' published by Orient Longman
2. Orient Longman, Raj N Bakshi 2003-2007.
3. The grammar Tree, MridulaKaul, BeenaSugathan, ArchanaGilani- Oxford university press 2011
4. Grammar for All, N Ramlingam, Himalaya Publishing House, 2nd Edition 2014.
5. John Eastwood, Oxford Practice Grammar with answers
6. High School English Grammar & Composition, Wren & Martin Revised by NDV Prasad Rao, S Chand Publication
7. Business Correspondence & Report Writing, R C Sharma &Krisha Mohan, 3rd Edition, Tata Mcgrall Hill
8. Communication, C S Rayudu, Himalaya Publication July 2008
9. Business Communication, UrmilaRai, S M Rai, Himalaya Publication 9th Edition.

BB 1- ENGLISH

QUESTION PAPER PATTERN

[Maximum Marks – 80

1. (A) Comprehension of Unseen Passage (**UNIT-I**)
   (Four Very Short Answer Questions based on the given Passage)
   4 X 2 Marks= 8 Marks

(B) Four items out of Six based on any one of the Grammar/Vocabulary items prescribed in **UNIT-I**

4 X 1 Mark = 4 Marks

(C) Four items out of Six based on any one of the Grammar/Vocabulary items prescribed in **UNIT-I**

4 X 1 Mark = 4 Marks

2. (A) ONE out of TWO Questions from **UNIT-II** (Business Letter Writing)

1 X 8 Marks = 8 Marks

(B)ONE out of TWO Questions from **UNIT-II** (Business Letter Writing)

1 X 8 Marks = 8 Marks

3. (A) ONE out of TWO Questions from **UNIT–III** (Business Manners)
   1 X 8 Marks = 8 Marks
   (B) ONE out of TWO Long Answer Questions (to be answered in about 150 words) based on the prescribed Lessons in **UNIT-III** from the textbook ***Prism***
   1 X 8 Marks = 8 Marks
4. (A) TWO Short Answer Questions (to be answered in about 75 words) out of THREE based on the Lessons Prescribed in **UNIT-III**

   2 X 4 Marks = 8 Marks

   (B) ONE out of TWO Long Answer Questions (to be answered in about 150 words) based on the prescribed Lessons in **UNIT-IV** from the textbook ***Prism***

   1 X 8 Marks = 8 Marks

5. (A) TWO Short Answer Questions (to be answered in about 75 words) out of THREE based on the prescribed Lessons in **UNIT-IV** from the textbook ***Prism***

   2 X 4 Marks = 8 Marks

   (B) FOUR **Very Short Answer Questions** out of SIX to be answered in one or two sentences each from the prescribed Lessons (from ***Prism***) in **UNIT-III**&**UNIT-IV**

   4 X 2 Marks = 8 Marks

BB 2 – Fundamentals of Business Management

Unit I: Introduction -Nature, function, definition and importance of management, Definition, nature, purpose and scope of management, Functions of a manager, is management a science or art? Development of Management Thought -Scientific management; Contribution of Taylor, Fayol, Mary Follet, Elton Mayo; Hawthorne experiments, Contingency approach.

Unit II: Management and Administration-Management and administration, Management as a profession, Professionalism of management in India, Management ethics and management culture, Skills required of manager, Classification of skills, Methods of skills development.

Unit III: Management Planning-Concept of planning, objectives, Nature, Types of plan, Stages involved in planning, Characteristics of a good plan, Importance, Limitations of planning, Making planning effective, Strategic planning in Indian Industry.

Unit VI: Decision Making-Concept, characteristics of decisions, Types of decisions, Steps Involved in decision making, Importance of decision making, Methods of decision making, Committee Decision Making. Organisation -Concepts, Principle of organization, Importance, Features of good organization structure, Types of Organisation structure.

Reference Books:

1. Essential of Business Administration - K.Aswathapa Himalaya Publishing House
2. Management: Concept and Strategies By J. S. Chandan, Vikas Publishing
3. Principles of Management, By Tripathi, Reddy Tata McGraw Hill
4. Principles of Management By Ramasamy T, Himalaya Publishing House
5. Principles of Management, Dr.NeeruVashisht&Dr.Namita Rajput, Taxmann

BB 3 – Computer Applications for Business

Unit I: Introduction to Computers - Generation of Computers, Block Diagram, Working of Computer, Hardware and Software, Programming and Flow Charts concepts, Operating systems (MSDOS, Windows, UNIX, Linux), Networking concepts.

Unit II: Working with Computers - Introduction to Word, Excel, PowerPoint, Internet,. Lab Activity would be based on the following topics: a. MS Word b. MS Excel c. MS PowerPoint

Unit III: Introduction to e-Commerce, e-Learning and e-Business, M-Commerce. Introduction to Basic Web Page designing Language (HTML), using Tags: - Structural, Formatting, List tags and Table.

Unit IV: IT Consulting – Basic concepts of business, strategy and operation; Business / Strategic Consulting: Reengineering, BPR; Operations Consulting: domain knowledge concept, domain-consulting. IT Enabled Services (ITES) – Processes, Outsourcing Function, Call Centres; BPO's: Captive BPO's (GE and Dell) and Third Party BPO's (Infosys BPO, Wipro BOP, Mphasis, Daksh and EXL etc).

Reference Books:

1. E-Commerce- ParagDewan (Excel Books),
2. P.K.Sinha –Computer Fundamentals.
3. World Wide Web –design with HTML –C Xavier ,
4. Computer Application in Management –NirupmaPathak ,
5. BPO- SarikaKulkarni,
6. BPO' Processes & Challenges By Harsh Bharghav& Deepak Kumar,
7. IT Enabled Retailing by k. Suresh,
8. IT Strategies for Business- FarhaKulkarni
9. Computer Applications in Management- UshaDahiya&SapnaNagpala, Taxmann

BB 4 – Cost Accounting

Unit –I: Introduction -Meaning of Cost, Costing and Cost Accounting, Features, Scope and Functions of Cost Accounting, Advantages and Limitations of Cost Accounting; Concept of Cost; Analysis and

Classification of Costs; Elements of Cost; Preparation of Cost Sheet (Statement of Cost); Quotations and tender. Introduction and need for reconciliation between financial accounts and cost account, reasons for disagreement in Profit; Preparation of Reconciliation Statement.

Unit –II: Process Costing: Meaning, features and applicability, difference between process and job costing, wastage and by-products, normal and abnormal loss. Preparation of process accounts

Unit III: Operating Costing: Classification of costs, Features of operating costing: Transport costing (Standard charge, running and operating cost, maintenance charges and log sheet)

Unit IV Marginal Costing: Introduction, Application of Marginal costing in terms of cost control, level of activity planning- Break-even-analysis: Application of BEP for various business problems.

Simple Numerical will be based on Unit II, III and IV

Reference Books:

1) Management Accounting, Bhagwati&Pillai, Second Edition, S. Chand &. Company ltd.
2) Cost & Management Accounting, Ravi M Kishore, Taxmann Publications Pvt. Ltd.
3) Cost and Management Accounting V. K. Saxena& C. D. Vashist, Sultan Chand & Sons Publication.
4) Cost Accounting, Text and Problems, MC Shuka, TS Grewal and MP Gupta, S Chand Publications

Question Paper Pattern for BB4 – Cost Accounting

Question No.	Unit	Nature	Max. Marks
1	I	a. Theory Question b. Theory Question OR c. Numerical Question	8 Marks 8 Marks 16 Marks
2	II	a. Numerical Question b. Numerical Question OR c. Numerical Question	8 Marks 8 Marks 16 Marks
3	III	a. Numerical Question b. Numerical Question OR c. Numerical Question	8 Marks 8 Marks 16 Marks
4	IV	a. Numerical Question b. Numerical Question OR c. Numerical Question	8 Marks 8 Marks 16 Marks
5	I II III IV	Short Answer Theory Question Short Answer Theory Question Short Answer Theory Question Short Answer Theory Question	4 Marks each
TOTAL MARKS			80

Bachelor of Business Administration (BBA) Examination

Semester – II

BB 5 – Principles of Marketing Management

Unit I Marketing : Definition, nature, scope & importance, Marketing Management, Core concepts of marketing, selling concept, production concept, modern marketing concept.

Unit II Segmentation: Concept, basis of segmentation, Importance in marketing; Targeting : Concept Types, Importance; Positioning: Concept, Importance, Brand positioning, Repositioning.

Unit III Marketing Mix: Product : Product Mix, New Product development, levels of product, types of product, Product life cycle, Branding and packaging, different types of distribution channels.

Unit IV Price: Meaning, objective, factors influencing pricing, methods of pricing. Promotion : Promotional mix, tools, objectives, media selection & management. Process & Scope Marketing **Information Systems :** Meaning Importance and Scope Consumer Behaviour : Concept, Importance and Factors influencing consumer behaviour.

Reference Books:

1. Marketing Mgt. by Philip Kotler (PHI)
2. Marketing Management by RajanSaxena
3. Marketing Management by Namaswamy&Ramakumari.

BB 6 – Financial & Management Accounting

Unit –I: Introduction - Meaning, Scope and importance of Financial Accounting. Financial Accounting - concepts and conventions, classification of accounts, Rules and principles governing Double Entry Book-keeping system (Preparation of Journal), Nature and function of financial Reporting, GAAP.

Unit –II: Final Accounts of Companies - Final Accounts of Joint Stock Companies – contents and preparation of Trading and Profit and Loss Account, Profit and Loss Appropriation Account and Balance sheet with adjustment, Closing Entries (Simple entries)

Unit III: Management Accounting - Meaning, Scope, Importance, and Limitations of Management Accounting, Difference between Financial Accounting and Management Accounting, Break even analysis, Analysis of Financial Statements (using ratio analysis-simple ratios)

Unit IV: Budgetary Control - Business budgets and budgetary control – Types of budget and its utility, preparation of cash & flexible budgets.

Note: Simple Numericals will be based on all Units.

Reference Books:

1. S. N Maheshwari : Financial Accounting Theory and problems – S.Chand (G/L) & Company Ltd,
2. Pillai R. S. N. – Management Accounting – S. Chand & Co. Pvt. Ltd.
3. Shukla and Grewal : Advanced Accounts (S. Chand & Ltd. New Delhi)
4. Management Accounting & Financial Management :-Arora M N (Himalaya Publishing
5. House Pvt. Ltd.)
6. Accounting for Management- Dr. Ashok Sehgal& Dr. Deepak Sehgal, Taxmann

Illustrative Question Paper Pattern for BB6 – Financial & Management Accounting

Question No.	Unit	Nature	Max. Marks
1	I	a. Theory Question b. Theory Question OR c. Numerical Question	8 Marks 8 Marks 16 Marks
2	II	a. Numerical Question b. Numerical Question OR c. Numerical Question	8 Marks 8 Marks 16 Marks

3	III	a. Numerical Question b. Numerical Question OR c. Numerical Question	8 Marks 8 Marks 16 Marks
4	IV	a. Numerical Question b. Numerical Question OR c. Numerical Question	8 Marks 8 Marks 16 Marks
5	I II III IV	Short Answer Theory Question Short Answer Theory Question Short Answer Theory Question Short Answer Theory Question	4 Marks each
TOTAL MARKS			80

BB 7 – Micro-Economic Fundamentals

Unit I: Introduction to Micro Economics- Meaning, Definition, Importance of Micro Economics, Factors affecting Micro Economics. Difference between Micro-Economics & Macro Economics.

Unit-II Demand and Supply Analysis - Concept of Demand, Law of Demand-Meaning, Definition, Assumptions & Exceptions. Elasticity of Demand- Meaning, Types and Factors affecting Elasticity of Demand; The Indifference Curve Theory; Supply- Concept of Supply, Elasticity of Supply, Types and Factors affecting Elasticity of Supply.

Unit III: Production & Cost Analysis - Production & Production Function: Concept, Forms of Production function, Law of Variable Proportions, Returns to scale. Cost Concepts, Short term and Long term cost output relationship, The Isocost and Isoquant Approach, Economic Region and Economies & Diseconomies of scale.

Unit IV: Market Structures- Characteristics and price determination in various market structures - Perfect Competition, Monopoly, Monopolistic Competition, Oligopoly. Pricing: Meaning, Types of Pricing.

Reference Books:

1. AgarwalaS.K.,Microeconomic Theory, Excel Books, New Delhi
2. Appannaiah, Reddy &Shanthi, BBM Semester Economics, 2006, Himalaya Publishing House, Mumbai.
3. Dholkia R H &Oza A.N., 1996, Oxford University Press, New Delhi
4. Dominick Salvatore, Managerial economics in a Global economy, 2006, Thomson learning Press
5. Jhingan, 2004, M.L.,Microeconomic Theory, Veranda Publishers, New Delhi.
6. Ravindra R Dholakia, Ajay N Oza, Micro –Economics for Management Studies, Oxford University Press, Delhi
7. Robert S.Pindyck, Daniel L Rubinfeld, PremL.Mehta, Microeconomics, 2006, Pearson, New Delhi.
8. Suma Damodran, Managerial Economics, 2006, Oxford University Press, New Delhi
9. Sundharam K P. M, microeconomics, Sultan Chand & Sons.

BB 8 - ENGLISH

(To be implemented from the Session 2016-2017 onwards)

1	Unit I	Basic Grammar& Vocabulary : • Subject-Verb-Agreement / Concord of Nouns, Pronouns and Possessive Adjectives • Spotting errors and rewriting sentences correctly. • Phrasal Verbs, Collocations and Idioms (based on the exercises at the end of the prescribed lessons from *Golden Harvest* • Words Often Confused	Reference Books: 1. Macmillan Foundation English by R. K. Dwivedi and A. Kumar (Macmillan/Trinity) 2. Learners' English Grammar and Composition by N. D. V. Prasad Rao (S.Chand Publication) 3. Developing Communication Skills by Krishna Mohan and MeeraBanerji (Trinity)
2	UNIT II	Business Communication • Memorandum Writing • Notice, Agenda and Minutes	1. Developing Communication Skills by Krishna Mohan and MeeraBanerji (Trinity)
		• Writing Advertisements for: Rent, Sale, Situations Vacant	2. Write Right by SaritaManuja (Macmillan/ Trinity)
3	UNIT III	Prose Items: • A Real Good Smile: Bill Naughton • What India Inc Wants: a. Our Muddled Generation: Dinesh Kumar b. Employers Look for Potential Employees, not	Prescribed text : *Golden Harvest* by Orient BlackSwan

		Exam Results: Manish Sabharwal • The Thief: Ruskin Bond	
4	UNIT IV	Prose Items: • A Simple Philosophy: Seathl • Go, Kiss the World: SubrotoBagchi • My Struggle for an Education: Booker T. Washington	Prescribed text : *Golden Harvest* by Orient BlackSwan

BB 8 - ENGLISH

(QUESTION PAPER PATTERN)

[Maximum Marks – 80]

1. (A) FIVE items out of SEVEN based on Subject-Verb- Agreement/Concord (fill in the blanks)- **UNIT-I** 5 x 1 Mark = 5 Marks

   (B) FIVE items out of SEVEN based on Spotting Errors and Rewriting Sentences correctly. – **UNIT-I** 5 x 1 Mark = 5 Marks

   (C) FIVE items out of SEVEN based on Phrasal Verbs/ Collocations/Idioms - **UNIT-I** 5 x 1 Mark = 5 Marks

   (D) FIVE items out of SEVEN based on Words Often Confused (fill in the blanks) – **UNIT- I** 5 x 1 Mark = 5 Marks

2. (A) ONE out of TWO items on Memorandum Writing - **UNIT-II** 1 X 5 Marks = 5 Marks

   (B) ONE out of TWO questions based on Notice, Agenda and Minutes - **UNIT-II** 1 X 10 Marks = 10 Marks

   (C) ONE out of TWO questions based on Writing Advertisements- **UNIT-II** 1 X 5 Marks = 5 Marks

3. (A) ONE out of TWO Long Answer Questions to be answered in about 150 words - **UNIT–III** (Prescribed Text) 1 X 10Marks = 10 Marks

   (B) TWO out of THREE Short Answer Questions to be answered in about 75 words - **UNIT-III** (Prescribed Text) 2 X 5 Marks = 10 Marks

4. (A) ONE out of TWO Long Answer Questions to be answered in about 150 words - **UNIT–IV** (Prescribed Text) 1 X 10 Marks = 10 Marks

(B) TWO out of THREE Short Answer Questions to be answered in about 75 words - **UNIT-IV** (Prescribed Text) 2 X 5 Marks = 10 Marks

Bachelor of Business Administration (BBA) Examination

Semester – III

BB 9 – Principles of Financial Management

Unit –I: Introduction of Business Finance - Meaning, Scope and importance of Business Finance. Finance Functions. Goals & objectives of financial management

Unit –II: Sources of Financing - LONG TERM: Equity shares, Preference Shares, debentures,/ Bonds (Types, features & utility), term loans, lease & hire purchase, retained earnings,; SHORT TERM: trade credit, bank finance, commercial paper, factoring & bills discounting.

Unit III: Cost of Capital - Cost of capital, Cost of different sources of finance, weighted average cost of capital, Concept of Leverage, Concepts of Capital Structure.

Unit IV: Working Capital Management - Meaning, Scope, Importance, and Limitations of Working Capital, Factors affecting Working Capital needs, Various Approaches for financing Working Capital. Concept of Operating Cycle, Estimation of Working Capital Requirement

Note: Simple Numerical will be based on Unit III and IV only.

Reference Books:

1) Financial Management by Ravi Kishore, Taxmann Publications Pvt Ltd
2) Financial Management – I M Pandey – S. Chand & Co. Pvt. Ltd. (Old editions in Vikas Publications)
3) Financial Management , Theory, Concepts and Problems by Dr. R. P. Rustagi, Taxmann Publications Pvt Ltd
4) Financial Management, Text, Problems and Cases, by M Y Khan and P K Jain, McGraw-Hill Publications

BBA Sem III
BB 10 – Basic Statistical Techniques

Unit I – Definition, functions, scope and role of statistics in business and importance of statistics. Classification of data, tabulation, frequency distribution, diagrams & graphs.

Unit **II** – Importance and requisites of a good statistical average, types of averages – arithmetic mean, median, mode, geometric mean, harmonic mean, weighted average, relationship amongst different averages.

Unit III – Meaning and significance of dispersion, methods of measuring dispersion – range, quartile deviation, mean deviation, standard deviation and coefficient of skewness.

Unit IV – Definition of correlation, significance of correlation, types of correlation, merits and limitations of coefficient, Calculation of coefficient of correlation and probable error for simple series, calculation of coefficient of correlation and probable error for continuous series.

Numerical shall be based on Unit II, Unit III, and Unit IV

Reference Books:

1. Fundamentals of statistics : D. V. Elhance&VeenaElhance
2. Statistices : V. K. Kapoor – S. Chand & Sons
3. Statistics : B. New Gupta – SahityaBhavan Agra
4. Statistics Methods : S.P. Gupta – S. Chand & Sons
5. Fundamental of Statistics : S. C. Gupta – Himalaya Publishing House
6. Business Mathematics & Statistics : NEWK Nag & S.C. Chanda – Kalyani Publishers

Illustrative Question Paper Pattern for BB10 – Basic Statistical Techniques

Question No.	Unit	Nature	Max. Marks
1	I	a. Theory Question b. Theory Question OR c. Theory Question d. Theory Question	8 Marks each
2	II	a. Theory Question b. Numerical Question OR c. Numerical Question	8 Marks 8 Marks 16 Marks
3	III	a. Theory Question b. Numerical Question OR c. Numerical Question	8 Marks 8 Marks 16 Marks
4	IV	a. Numerical Question b. Numerical Question OR c. Numerical Question	8 Marks 8 Marks 16 Marks
5	I II III IV	Short Answer Theory Question Short Answer Theory Question Short Answer Theory Question Short Answer Theory Question	4 Marks each
TOTAL MARKS			80

BB 11 – Evolution of Business & Commercial Geography

Unit I–Evolution of Business & Economy: Industrial revolution (1820-1850); Rise of European business (1850-1900); Impact of First World War on International Business; The Great Depression and its effect on International Business; Impact of Second World War on International Business.

Unit II – Evolution of Business in post WWII Scenario: Cold War and its impact on International Business; OPEC Crises and its impact on International Business; Gulf War and its impact on International Business; Dawn of IT era and its impact on business & economy.

Unit III – Commercial Geography: Geography - meaning & its relation with Commerce & Commercial Geography - Nature and scope. Approaches of commercial Geography. 2. Geographical Environment & Commerce - Relationship between geographical environment and Commerce, Economic activities, Determinism and possibilism, Physical environment - Location, size and shape of

the country relief, climate, water bodies, soils, vegetation, animals, minerals, Cultural environment, settlements, transport, communication and technology.

Unit IV -Industries : Role of industries in Economic development; Factors of industrial location - Raw material, power, market, transport and communication, land capital, technology; Webers theory of industrial location, Iron & steel industry - India & USA, Cotton textile industry - India & USA. Engineering industry in India - Major industrial regions of the world and India.

Reference Books:

1. Global Governmentality – Edited by Wendy Larner& William Walters, Routledge Resource
2. The Origins of Globalisation – Karl Moore & David Charles Louis, Routledge Resource
3. British Business History (1720-1994) – John F Wilson, Manchester University Press
4. The History of Family Business (1850-2000) – Andrea Colli, Cambridge University Press
5. Exporting the American Model: The Post war transformation of European Business – Marie-Laure Djelic, Oxford University Press
6. Order and Disorder after the Cold War – Brad Roberts, MIT Press
7. Commercial Geography - Sir Dudley Stamp.
8. Fundamentals of Economic Geography - Van Royen&Bengston.
9. Economic Geography - J. Alexander
10. Economic Geography - Jones &Darkenwald.

BB 12 – Environment Management

Unit I: Introduction to Environment Management: Definition, Scope importance, Need for public awareness, sustainable development, Natural Resources- renewable and non- renewable resources, role of individual in conservation of natural resources(Forest, water, land, energy, mineral)

Unit II: Environment Pollution: Types of pollution- air, water, soil, noise, thermal and Nuclear, causes effectsna control measures, Global warming, green house effect, Ozone layer depletion, Acid rains

Unit III: Human Population: Global population growth, variations among nations, Population explosion- causes and impact, Family welfare Programs-methods of sterilization; Infectious diseases, water related diseases, risk due to chemicals in food, Cancer and environment

Unit IV: Social Issues in Environment: Construction of dams: problems and concerns of resettlement, rehabilitation of affected people; Environmental ethics– issues and possible solutions, resource consumption patterns and need for equitable utilization; Equity disparity in western and eastern countries; Urban and rural equity issues; Need for gender equity.

Reference Books:

1. A text book of environmental by K M Agrawal, P K Sikdar, S C Deb", published by Macmillan
2. Environment management by N K Uberoi", published by Excel Books
3. Environment management by Dr. Swapan Deb", published by Jaico Publishing House.
4. Environmental Management by S K Agrawal", published by A.P.H. publishing Corporation.

Bachelor of Business Administration (BBA) Examination

Semester – IV

BB 13 – Principles of Human Resource Management

Unit 1 : Introduction to Human Resource Management: Definition, concept and Scope of H. R. M., Difference between Personnel Management and H.R.M., Importance and Functions of H.R.M. Role of H.R Department.

Unit 2 : Job Analysis, Job Design: Meaning of Job Analysis, Uses, Process and methods of collecting data for job analysis, Job Description, Job Specifications. Meaning of Job Design, Techniques of Job Design

Unit 3 : Human Resource Planning - Recruitment – Selection: Definition and objectives of Human Resource planning, process of Human Resource planning factors influencing estimation of Human Resources, Concept of Recruitment & Selection, sources of recruitment, Selection Procedure

Unit 4 : Induction & Training : Concept of Induction, Training- Need for training, benefits of training, identification of training needs and methods/ types of training. Evaluation of effectiveness of training programs.Placement, Transfer, Promotion, Demotion.

Reference Books:

- Dr. S S Khanka : Human Resource Management,
- Aswathappa, K.; Human Resource and Personnel Management (Text and Cases), Tata McGraw Hill Publishing Company
- Dessler,Gary; Human Resource Management;Prentice Hall
- SubbaRao, Personnel and Human Resources management, HPH.
- Human Resource Management- Text and Cases-- VSP Rao

BB 14 – Money, Banking and Finance

Unit I: Money - Concept and functions of Money, Origin and development of Money, Limitations of Barter System, Classification of Money, Importance of Money, Qualities of Good Money, Defects of money.

Unit-II – Banking and Finance - Commercial Banking- Role and functions of Commercial Banks, Credit creation and its limitations Central Banking-Functions of Central Bank. Reserve Bank of India – Role in Indian Economy, Monetary & Non-Monetary functions of RBI.

Unit III: National Income Determination- Meaning, Method & Difficulties of Measuring National Income; Concept of GDP, GNP, NNP, PI, DPI. Inflation and Deflation- Types, Causes and Measures to Control.

Unit IV: Monetary and Fiscal Policy- Concept, Objectives, Instruments, Limitations of Monetary and Fiscal policy, Public Finance- Meaning, Scope and Importance of Public Finance, Public Finance Vs Private Finance.

Reference Books:

1. Appannaiah, Reddy &Shanthi, BBM Semester Economics, 2006, Himalaya Publishing House, Mumbai.
2. Chaturvedi D., Macro Economics, 2005, Galgotia Publishing Company, New Delhi.
3. Dominick Salvatore, Managerial economics in a Global economy, 2006, Thomson learning Press
4. Datt, Ruddar and K P M Sundharam, 2005, Indian Economy, S.Chand and Co. Pvt. Ltd. New Delhi

5. Jhingan, 2004, M.L., Money Banking International Trade and Public Finance, Ed. 8, Veranda Publishers, New Delhi.
6. Mithani D. M., Money, Banking, International trade and Public Finance,2006, Himalaya Publishing House, Mumbai
7. Samuelson, Paul Anthony and William D. Nordhaus, 1998, Economics, Ed. 6 New Delhi: Tata McGraw Hill Publishing Company Ltd, New Delhi.
8. Somashekhar N T., Money, Banking, International trade and Public Finance,2006,Himalaya Publishing House, Mumbai
9. Suma Damodran, Managerial Economics, 2006, Oxford University Press, New Delhi.

BB 15 – Introduction to Sociology & Psychology

Unit I: Sociology as the Science of Society: (a) Sociology – Meaning and Definitions, (b) Characteristics of Sociology as a science (empirical, theoretical, cumulative and nonethical), (c) Development of Modern Industrial Society – Characteristics, industrialism, capitalism, urbanism, liberal democracy, (d) Postmodern Society – Nature and Characteristics, (e) Culture – Meaning and elements, (cognitive elements, beliefs, values and norms and signs), Meaning, stages and agencies of socialisation.

Unit II: Social Structure and Social Change: (a) Structural aspects of social system – Institutions, groups, subgroups, roles, norms and values, (b) Social change – Its sources – Internal and External, (c) Types of Social Change – Changes in social values with reference to pattern variab les, changes in occupational structure and demographic changes

Unit III: Introduction to Psychology: (a) Definition, Nature, Scope and Applications of Psychology. (b)Methods: Introspection, Observation, Experimental, Interview, Questionnaire and Case Study. (c)Contemporary Perspectives: Biological, Cognitive, Psychoanalytical, Humanistic, Evolutionary and Cross-cultural. (d)Biological Bases of Behaviour: Evolution, Genes and Behaviour. The Response Mechanism: Receptors, Effectors and Adjustors. (e)The Nervous System: The Basic Structure, Functions and Divisions of the Peripheral and Central Nervous System.

Unit IV: Social Psychology: (a)Introduction: Nature and Scope; Methods of Studying Social Behaviour: Observation, Experimental, Field Study, Survey, Sociometry and Cross-cultural. (b)Socialization: Agents and Mechanisms, Socialization and Deviation. (c)Perceiving Others: Forming Impressions; Role of Non-verbal Cues, Group stereotypes, Central Traits; Primary and Recency Effects; Models of Information Integration; Attribution of Causality: Biases and Theories (Jones and Davis, Kelley).

Reference Books:

1. Inkeles, Alex, "What is Sociology?", Prentice Hall of India, New Delhi, 1987
2. Jayaram N., "Introduction to Sociology", Macmillan India, Madras, 1988
3. Ghode R.N. and Bhau Daydar, "Sociology: Basic Concepts", Spectrum Publications, Nagpur
4. Atkinson and Hilgard (2002). Introduction to Psychology. New York: Thomson Wadsworth
5. Feldman, R. S. (2006). Understanding Psychology. India: Tata McGraw Hill.
6. Feldman, R. S. (1985). Social Psychology: Theories, Research and Application.New York: McGraw Hill.
7. Myers, David, G (1994). Exploring Social Psychology. New York: McGraw Hill.

B 16 – Business Legislations

Unit I: Administration of law & legal system in India - Introduction to legal aspects of Business in general; Freedom of Trade, Profession and Occupation (Constitutional Provisions).

Unit II: Indian Contract Act (1872) - a) Definition (Sec.2) b) Essential elements of a valid contract c) Competency to enter in contracts (Sec. 11 & 12).d) Consent – Free consent, Coercion, undue influence, fraud, misrepresentation, mistake (sec 13-23).Void Agreement (sec 24-30) f) Consequences of breach of contract (sec73-75).

Unit III: The Companies Act (1956) - Definition & characteristics of a company, Company distinguished from partnership, Kinds of Companies, Provisions relating to incorporation, lifting the Corporate Veil. Memorandum of Association, Doctrine of ultra-vires, Articles of Association, Doctrine of indoor management & constructive notice, Concept of Prospectus.**Company Management And Board Meeting :** Administrative Hierarchy, Board of Director – Director- Legal Position, Appointment, Qualification, Disqualification, Removals Power, duties, Liabilities etc. Managing Director – Meaning, Appointment, and Disqualification.Manager-Meaning, Disqualification.Company Meetings Meaning of meeting-General Body meeting – statutory Meeting, Annual General meeting, Extra ordinary meeting Board Meeting.

Unit IV: The Consumer Protection Act,1986 Salient features of Act. Definitions- Consumer, Complaint, Services, Defect and Deficiency, Complainant. Rights and Reliefs available to consumer.Procedure to file complaint.Consumer Disputes Redressal Agencies.(Composition, Jurisdiction, Powers and Functions.) Procedure followed by Redressal Agencies. Introduction to GST

Reference Books:

1) Business and Commercial Laws-Sen and Mitra.
2) An Introduction to Mercantile Laws-N. D. Kapoor
3) Business Laws-N. M. Wechlekar
4) Company Law-Avatar Singh
5) Law of Contract-Avtar Singh
6) Consumer Protection Act in India .Niraj Kumar
7) Consumer protection in India. V.K.Agrawal
8) Consumer Grievance Redressal under CPA. Deepa Sharma.

Bachelor of Business Administration (BBA) Examination

Semester – V

BB 17 – Entrepreneurship Development

Unit I:Entrepreneur & Entrepreneurship: Evolution of the concept of Entrepreneurs, Characteristics of an Entrepreneur, Distinction between an entrepreneur and a manager; functions of an entrepreneur, types of entrepreneurs, concept of intrapreneurs; growth of entrepreneurship in India, role of entrepreneurship in economic development,.

Unit II:Entrepreneurial growth: Factors - Economic factors, non-economic factors, Government actions; Entrepreneurial competencies – meaning, major competencies, developing competencies; Entrepreneurship Development Programs (EDPs) - Need, objectives, course content of EDPs, phases of EDPs, evaluating EDPs.

Unit III:Small Enterprises: An introductory framework: Definition, characteristics, relationship between small and large units, rationale, objectives, scope, opportunities for entrepreneurial career, problems of SSIs; Project Identification and Selection (PIS) - Meaning of project, project identification,

project selection, contents of project reports, formulation of project reports; Project Appraisal - Concept, methods, economic analysis, financial analysis, market analysis, technical feasibility, managerial competence.

Unit IV:Institutional & financial support to Entrepreneurs: Need for institutional support, various institutions supporting entrepreneurship in India – MIDC, MSME, MCED, DIC, SSIB, MSSIDC, BIFR; Financial support to entrepreneurs: Commercial banks, other financial institutions – IDBI, IFCI, SFCs, SIDBI, venture capital.

Reference Books:

1. Entrepreneurship 6 th edition. Robert D Hisrich , Tata McGraw-Hill.
2. Kuratko- Entrepreneurship – A Contemporary Approach, (Thomson Learning Books)
3. Small-Scale Industries and Entrepreneurship. Desai, Vasant (2003). Himalaya Publishing House, Delhi.
4. S.S. Khanka – Entrepreneurial Development (S. Chand & Co.)
5. Exploring Entrepreneurship, Blundel& Lockett, Oxford University Press
6. Entrepreneurship, Roy, Oxford University Press

BB 18 – Principles of Operations Management

Unit I: Introduction to Operations Management: Introduction to Operations Management, its Nature, Scope, Importance and Functions. Difference between production, manufacturing and service. Concept and types of production, mass, job-based, batch and assembly line production system. Types of services.

Unit II: **Facilities and Production Planning** : Factors affecting plant location, types of plant layouts – product layout, process layout, fixed position layout, cellular layout, types of service layouts. Concept of production planning, definitions of capacities, master production schedule, material planning. Introduction to maintenance.

Unit III: **Material Management:** Scope of materials management, Purchase and Stores Functions, Introduction to warehouse management, Concept of Lead time, re-order level, minimum and maximum stock, Basic concepts of Inventory management, inventory costs, ordering and carrying cost.

Unit IV: Quality Management and Productivity: Introduction to quality, dimensions of quality, concept of product, process and service quality. Introduction to Quality Management System, concept of TQM, ISO, Kaizen, Quality circles, Six-sigma.Concepts of productivity, machine, labour and cost productivity.

Reference Books:

1. Operations Management by Shridhar, Himalaya Publishing House
2. Operations Management Nair: TMH
3. Production and Operations Management, Adam & Ebert, Prentice Hall India
4. Operations Management by Chary ,Mcgraw Publications, 4th edition.
5. Production and Operations Management, K.Aswathappa&K.ShridharaBhat, Himalaya Publication
6. Production and Operations Management, R.Panneerselvam, 3rd Edition, Eastern Economy Edition.

BB 19 – International Business Environment

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Unit I: Introduction to International Business: Importance, nature and scope of International business; Modes of entry into International Business; Internationalization process and managerial implications; Issues in foreign investments, technology transfer, pricing and regulations; International collaborative arrangements and strategic alliances; Concept and significance of balance of payments account

Unit II: International Business Environment: Economic, Political, Cultural and Legal environments in International Business. Framework for analyzing international business environment.

Unit III: Global Trading and Investment Environment: World trade in goods and services – Major trends and developments; World trade and protectionism – Tariff and non-tariff barriers; Foreign investments-Pattern, Structure and effects; Movements in foreign exchange and interest rates and their impact on trade and investment flows.

Unit IV: International Economic Institutions and Agreements: WTO, WTO and Developing Countries, IMF, World Bank, UNCTAD, International commodity trading and agreements. Structure and functioning of EC and NAFTA, Regional Economic Groupings in Practice: Levels of Regional Economic Integration; Regionalism vs. Multilateralism; Important Regional Economic Groupings in the World.

Reference Books:

1. Bennet, Roger, International Business, Financial Times, Pitman Publishing, London.
2. Bhattacharya, B., Going International: Response Strategies of the Indian Sector, Wheeler Publishing, New Delhi.
3. Czinkota, Michael R., et. al., International Business, the Dryden Press, Fortworth.
4. Danoes, John D. and Radebaugh, Lee H., International Business: Environment and Operations, Addison Wesley, Readings.
5. Hill, Charles W. L., International Business, McGraw Hill, New York.

BB 20 – Research Methodology

Unit I: Introduction - Meaning, Objectives and Types of research, Research Approach, Research Process, Relevance & scope of research in management. **Research Design -** Features of good Design, Types of Research Design,

Unit II: Sampling Design - Steps in sample Design, Characteristics of a good sample Design, Probability & Non Probability sampling. Hypothesis – Meaning, Types, Process, Formation of Hypothesis, Testing of Hypothesis

Unit III: Measurement & scaling techniques - Errors in measurement. Test of sound measurement, Scaling and scale construction technique. Attitude Measurement and Scales: Introduction to attitude - Various Methods to measure attitude.

Unit IV: Methods of data collection - Primary data – questionnaire and interviews; Collection of secondary data. **Interpretation of data -** Techniques of Interpretation, Report writing, Layout of a project report, preparing research reports.

Reference Books:

1. Research Methodology – C.R. Kothari
2. Business Research Methods – Naval Bajpai
3. Business Research Methodology – J K. Sachdev

Bachelor of Business Administration (BBA) Examination

Semester – VI

Elective A - Financial Management

Paper 1

BBEL1 – Fundamentals of Business Finance

Unit –I: Mathematics of Finance – Concept of Time Value of Money, Compounding and Discounting of single cash flow, series of cash flow and annuity. Simple problems based on Time Value of Money

Unit –II: Capital Budgeting - Premises of Capital Budgeting Decisions, Tools in Capital Budgeting, Pay Back Period, Average Rate of Return on Investments, Net Present Value, IRR.

Unit –III: Dividend decision and Management of Earnings - Relevance approach of dividend valuation models, Irrelevance approach of dividend valuation models, Stability of dividend, Factors determining dividend decisions.

Unit IV: Corporate Restructuring - Reasons & drivers of corporate restructuring, Methods of restructuring- mergers (types of merger), takeovers, acquisitions (Types of Takeover/ acquisition), divesting/ demerger, spin-off, split ups

Simple Numerical will be based on Unit I, II and III only.

Reference Books:

1) Financial Management by Ravi Kishore, Taxmann Publications Pvt Ltd
2) Financial Management – I M Pandey – S. Chand & Co. Pvt. Ltd. (Old editions in Vikas Publications)
3) Financial Management , Theory, Concepts and Problems by Dr. R. P. Rustagi, Taxmann Publications Pvt Ltd
4) Financial Management, Text, Problems and Cases, by M Y Khan and P K Jain, McGraw-Hill Publications

Paper 2
BBEL2 – Advanced Financial Management

Unit –I: Banking Services and Operations -Definition of banks, Functions of Commercial Banks, Banking Structure in India, Role of RBI vis-a-vis other commercial banks, Introduction to Bank Deposits, Types of Deposit Accounts, KYC

Unit –II: Insurance Services - Concept of insurance, principles of insurance, Traditional and Unit linked policies, individual and group policies, Different type of insurance products – whole life products, term assurance annuities, and endowment, Medi-Claim and health insurance products.

Unit –III: Mutual Funds – Organization Structure, Classification of Funds –Types of Funds – Equity Funds, Debt Funds, Liquid Funds, Balanced Funds, Monthly Income Plans, ETFs, Commodity Funds, Fund of Funds, Sectoral Funds, ELSS; Calculation of NAV; Systematic Investment Plans; Concept of Cost Averaging and Value Averaging.

Unit IV: Capital Market - Introduction to Capital Markets, Structure of Capital Market, Primary and Secondary Market, Stock Exchanges in India- BSE, NSE, OTCEI, ICSEI, Functions of Stock Exchange, SEBI and Role of SEBI in Capital Market

Reference Books:

1) Indian Financial System by Bharti V Pathak Pearson Publications
2) Indian Financial System by M Y Khan McGraw-Hill Publications

3) Financial Markets and Services , Gordon and Natrajan, Himalaya Publications
4) Financial Services, SandeepGoel, PHI Publications
5) Know Your Bank (volume I to VI) published by IIBF
6) Life and Health Insurance, 13th Edition by Kenneth Black Jr., Harold D. Skipper Jr., PHI Publications

Elective B–Human Resource Management

Paper 1

BBEL1 – Fundamentals of Human Resource Management

Unit 1 : Introduction: Concept, HRM ; Evolution of HRM; Challenges of HRM; Role of Human Resource Management in strategic management, Characteristics of Workforce today

Unit 2 : Performance Appraisal : Concept and Introduction, Importance, process – methods of performance appraisal – Traditional & Modern Methods.

Unit 3 : Job Evaluation & Compensation management: Concept, objectives and methods of Job Evaluation, Wages & Salary, components of employee remuneration – – base and supplementary. Wages & Salary Administration

Unit 4 : Legal Aspects : Introduction to Provident Fund Act, Employee State Insurance Corporation Act, Minimum Wages Act, Industrial Relations Act, Industrial Dispute Act.

ReferenceBooks :

- Dr. S S Khanka : Human Resource Management,
- Aswathappa, K.; Human Resource and Personnel Management (Text and Cases), Tata
- Rao,V S P,Human Resource Management,Text and Cases
- Dessler,Gary; Human Resource Management;Prentice Hall
- SubbaRao, Personnel and Human Resources management, HPH.
- SeemaSanghi , Human Resource Management

Paper 2
BBEL2 – Advanced Human Resource Management

Unit 1 : Job Analysis, Job Design & Job Evaluation: Job Analysis & Design - Job Analysis – Meaning, Uses, Competency approach to job analysis, Job Description, Job Specifications & Role Analysis, Factors affecting Job Design, Techniques of Job Design, Cases and Exercises in understanding Job Analysis. Job Evaluation –Concept, objective & methods.

Unit 2:Performance Appraisal: Nature, Objectives of Performance Appraisal, Performance Planning and Potential Appraisal, Pitfalls of Appraisal, Praise and Recognition; Rewards and Incentives; Promotions. HR Records, MIS HR Reports, HR Formats – Personnel Files, Attendance, Leave, Medical Records.

Unit 3 : Industrial Relations : Nature, Concept, scope, objectives & significance of Industrial Relations, Trade unions, Functions of Trade Unions - Forms of collective bargaining - Workers' participation in management, Nature & causes of Industrial Dispute and Settlement of Industrial Disputes.

Unit 4 : Ancillary Topics: Goal Setting, Promotions and Transfers; Separations- Retirement, VRS, Deputation, Death, Retrenchment, Pink Slips, Competency Mapping, Employee Manual / PPP Handbook. Concept of Retention and Attrition. Online recruitment; Employee referrals; Recruitment

process outsourcing Head hunting; Downsizing; Voluntary retirement schemes (VRS) HR outsourcing, Job Rotation & Transfer

Reference Books :

- Dr. S S Khanka : Human Resource Management,
- Aswathappa, K.; Human Resource and Personnel Management (Text and Cases), Tata
- Rao,V S P,Human Resource Management,Text and Cases
- Dessler,Gary; Human Resource Management;Prentice Hall
- SubbaRao, Personnel and Human Resources management, HPH.
- SeemaSanghi , Human Resource Management

Elective C–Marketing Management

Paper 1

BBEL1 – Fundamentals of Marketing Management

Unit – I: Integrated Communication Mix (IMC) -meaning, importance; Communication meaning, importance, process, communication mix-components, role in marketing,

Unit – II: Branding - meaning, brand recall, brand positioning. Importance of branding and advertising. Digital Marketing – Scope and Importance, Search Engine Optimisation (SEO), Out of home (OOH).

Unit – III: Sales Organisation and Relationship : Purpose of sales organization, Types of sales organization structures, Sales department external relations, Distributive network relations.

Unit – IV: Concept of services - Nature & characteristics of services, Marketing Mix and strategies in Service Marketing, Product decisions, pricing strategies, Promotion of services, Placing or Distribution methods of services, Service vision & Strategies: Includes Advertisements, Branding, Packaging of Services.

Reference Books:

1. Marketing Mgt. by Philip Kotler (PHI)
2. Marketing Management by RajanSaxena, Tata McGraw Hill, Education
3. Service Sector Management by S M Jha
4. Sales Management - Cundiff, Still, Govoni

Paper 2
BBEL2 – Advanced Marketing Management

Unit – I : Sales Management : - Evolution of sales function, Objectives of sales management positions, Functions of Sales executives, Relation with other executives, Salesmanship : Theories of personal selling, Types of Sales executives, Qualities of sales executives, Prospecting, pre-approach and post-approach, Organising display, showroom & exhibition

Unit – II: Distribution network Management: Product Distribution Channel & Types of Marketing Channels, Factors affecting the choice of channel, Types of middleman and their characteristics,

Wholesale and Retail, Supply Chain Management (SCM) and introduction to Supply Chain Management, Various types of Warehousing and transportation facilities.

Unit – III: Service Quality - Impact of service Quality, Approaches to service Quality, Ten original dimensions of Service Quality, How to improve service Quality, Service quality information systems, Benchmarking and certification. Marketing challenges in services business; Classification of services; End user, Profit orientation, Services tangibility, People based services, Expertise. Role of IT in service industry.

Unit – IV: Customer Retention & Relationship Marketing: CB-Services, Facts & Importance of CB in services, Evolution of Relationship Marketing, Enhancement of Internal & External relationships, Customer Retention (Operations, Delivery System). Various types of services offered to customers – hotel, hospital, transport, insurance, banking and education.

Reference Books:

1. Marketing Mgt. by Philip Kotler (PHI)
2. Marketing Management by RajanSaxena, Tata McGraw Hill Education
3. Service Sector Management by S M Jha
4. Sales Management - Cundiff, Still, Govoni

R.T.M.Nagpur University, Nagpur

Syllabus

BCCA

SEMESTER I

Paper - I: English and Business Communication - (1T1)

UNIT-1 Prose

Prescribed Textbook: **INSPIRATIONS – Raghav Publishers & Distributors, Nagpur**
Edited by : Board of Editors

PROSE-I Short Stories

1. Home coming Dr. Tapati Dey
2. The Lighthouse Keeper of Aspinwall-Henry Sienkiewicz
3. Ilyas-Leo Tolstoy

UNIT-II Prose

Textbook: INSPIRATONS published by Raghav Publishers & Distributors, Nagpur

1.Social Media- Dr.Sujata Chakravorty
2. World of Advertising- Dr.Pranjali Kane
3. OYO –Reinventing Hospitality

UNIT-III -Communication

Communication Process: Sender, Channel, Message, Receiver and Response

Types of Communication:

a.	According to mode:	a. Oral	b.	Written
b.	According to Medium:	a. Electronic	b.	Print
c.	According to number of participants :	a. Dyadic	b.	Group
d.	According to Direction:	a. One-way	b.	Two-way
e.	According to Purpose:	a. General	b.	Business (Specific)

UNIT-IV-Business Correspondence:

Application for Employment, Job Offer Letters, Sales letters, Claim and Adjustment Letters, Letter of Acceptance, Joining Letter

UNIT-V-Language Study

A. Comprehension of an Unseen Passage
B. Enriching Vocabulary: Synonyms and Antonyms, Single Word for a Group of Words, Change of Word from Noun to Adjective & vice-versa.

UNIT-I & II

Prescribed Textbook: **INSPIRATIONS – Raghav Publishers & Distributors, Nagpur**
Edited by : Board of Editors

Reference Books

UNIT-III

Business Communication and Management
Dr.K.R.Dixit (Vishwa Publishers, Nagpur)

Unit-IV

i) Business Communication: Urmila Rai, S.M. Rai- (Himalaya Publishing House)
ii) Business Correspondence and Report Writing – R. C. Sharma& Krishna Mohan (Tata McGraw-Hill)
iii) Developing Communication Skills – Krishna Mohan & Meera Banerji (Macmillan)

UNIT-V

i) English Grammar – N.D.V. Prasada Rao (S.Chand)
ii) Developing Communication Skills – Krishna Mohan &MeeraBanerji (Macmillan
iii) Synonyms & Antonyms from the prescribed text **INSPRATIONS**

QUESTION PAPER PATTERN

ENGLISH AND BUSINESS COMMUNICATION

Subject: English and Business Communication - I (1T1)

SEMESTER – I

Time: 3 Hours] **Total Marks: 80**

Q.1.(A)TWO out of THREE SAQs from prose section of Unit-I (2x4)= 08 Marks
(B).TWO VSAQs from prose section of Unit –I (2x2)= 04 Marks
(C) ONE PRQ out of TWO from Prose section of Unit -I (1x4) = 04 Marks

Q.2.(A)TWO out of THREE SAQs from prose section of Unit-II (2x4)= 08 Marks
(B).TWO VSAQs from prose section of Unit –II (2x2)= 04 Marks
(C) ONE PRQ out of TWO from Prose section of Unit -II (1x4) = 04 Marks

Q 3.A.ONE LAQ out of TWO from Unit III (1x8) = 08 Marks
B. TWO SAQs out of THREE from Unit III (2 x 4) = 08 Marks

Q 4.A. ONE out of TWO Letters
(Application for Employment/Job Offer Letters/ Acceptance letter/Joining Letter) from Unit IV 08 Marks

B. ONE out of TWO Letters
(Sales letters / Claim and Adjustment Letters) from Unit IV 08 Marks

Q 5.A. Comprehension of Unseen Passage from Unit -I (4x2)= 08 Marks
(Four VSAQs of 2 Marks each based on the Unseen Passage)

C. Two Questions on each component from Enriching Vocabulary -Unit V (B) = 08 Marks

Total= 80 Marks

N.B.LAQ- Long Answer Questions to be answered in about 150-200 words
SAQ-Short Answer Questions to be answered in about 75-100 words approximately.
VSAQ- Very short answer questions to be answered in one or two sentences.

INTERNAL ASSESSMENT OF ENGLISH AND BUSINESS COMMUNICATION: 20 MARKS

The Internal Assessment would be done on the basis of the assignments submitted by the student and his/her performance, attendance and conduct during the Semester. The concerned teacher shall provide, in advance, a list of topics/assessment items/Question Bank (to the students) based on the Units prescribed for the Theory Examination. Students shall finalize 2 topics/items from units from Units III, IV & V with the approval of the concerned teacher and submit the same within the prescribed deadline.

Students may be given freedom to submit a creative writing assignment on human values/world peace/environmental issues inspired by or related to the lessons prescribed in the syllabus and give a **powerpoint presentation/oral presentation.**

2 Assignments–5+5 = 10 Marks
Powerpoint Presentation/Oral Presentation–5 Marks
Attendance-5 Marks
TOTAL–20 MARKS

BCCA Part – I

Semester – II

Paper - I: English and Business Communication – II (2T1)

UNIT-1 Prose

Textbook :**INSPIRATIONS** published by **Raghav Publishers & Distributors, Nagpur**

PROSE-I Short Stories

1. The Dispenser of Holy Water- Guy de Maupassant
2. After Twenty Years-O.Henry
3. The Wall- Dr.Sunilkumar Navin

UNIT-II Prose

Textbook: INSPIRATONS published by Raghav Publishers & Distributors, Nagpur

1. Beware You are Being Tracked!-Dr.Supantha Bhattacharya
2. What is Integrity?-Subroto Bagchi
3. Unsung Women Achievers of Contemporary India-Dr.Subhashree Mukherjee

UNIT-III- **Communication**

- Elements of communication
- Objectives of communication
- Essentials of effective communication
- Barriers to effective communication
- Suggestions to overcome the barriers

UNIT IV-**Business Correspondence**

Inviting Quotations, Placing Orders, Cancelling order, Credit Letters - Granting/Refusing Credit, Letter to Bank for overdraft facility

UNIT V- Language Study

(A) Views and Opinions (Current, Social, Cultural, Political)

(B) Punctuation, Words often confused

Books

(For UNIT I & II)
Prescribed Text Book: INSPIRATIONS – Raghav Publishers & Distributors, Nagpur
Edited by : Board of Editors

REFERENCE BOOKS

(For UNIT III)
Business Communication and Management- Dr. K. R. Dixit (Vishwa Publishers, Nagpur)

(For UNIT IV)
1.Business Communication: Urmila Rai, S. M. Rai - (Himalaya Publishing House)
2. Business Correspondence and Report Writing – R. C. Sharma& Krishna Mohan (Tata McGraw-Hill)
3. Developing Communication Skills – Krishna Mohan & Meera Banerji (Macmillan)

(For UNIT V)
1.English Grammar – N. D. V. PrasadaRao (S.Chand)
2.Developing Communication Skills – Krishna Mohan &MeeraBanerji (Macmillan)

QUESTION PAPER PATTERN

ENGLISH AND BUSINESS COMMUNICATION

Subject: English and Business Communication- II (2T1)

SEMESTER – II

Time: 3 Hours **Total Marks: 80**

Q.1.(A)TWO out of THREE SAQs from prose section of Unit-I (2x4)= 08 Marks
(B).TWO VSAQs from prose section of Unit –I (2x2)= 04 Marks
(C) ONE PRQ out of TWO from Prose section of Unit -I (1x4) = 04 Marks

Q.2.(A)TWO out of THREE SAQs from prose section of Unit-II (2x4)= 08 Marks
(B).TWO VSAQs from prose section of Unit –II (2x2)= 04 Marks
(C) ONE PRQ out of TWO from Prose section of Unit -II (1x4) = 04 Marks

Q.3 A. One LAQ out of TWO from Unit III (1x8)= 08 Marks
B. TWO SAQs out of THREE from Unit III (2x4)= 08 Marks

Q4.A.ONE out of TWO Letters 08 Marks

(Inviting Quotations/Placing Orders/Cancelling Orders)From Unit IV

B. ONE out of TWO Letters 08 Marks

(**Credit Letters - Granting/Refusing Credit, Letter to Bank for overdraft facility) from Unit IV**

Q 5.A.Views and Opinions on Current Topics 08 Marks

B. Questions from Section B of Unit – 5 08 Marks

(Four items out of Eight on meanings of the Words often Confused - (1 x 4 Marks))

(Four items out of Eight on Punctuation –(1 x 4 Marks))

Total= 80 Marks

N.B.LAQ- Long Answer Questions to be answered in about 150 words
SAQ-Short Answer Questions to be answered in about 75 words approximately.
VSAQ**- Very short answer questions to beanswered in one or two sentences**

INTERNAL ASSESSMENTOF ENGLISH AND BUSINESS COMMUNICATION: 20 MARKS

The Internal Assessment would be done on the basis of the assignments submitted by the student and his/her performance, attendance and conduct during the Semester. The concerned teacher shall provide, in advance, a list of topics/assessment items/Question Bank (to the students) based on the Units prescribed for the Theory Examination. Students shall finalize 2 topics/items from 2 different units with the approval of the concerned teacher and submit the same within the prescribed deadline.

Students may be given freedom to submit a creative writing assignment on human values/world peace/environmental issues inspired by or related to the lessons prescribed in the syllabus and give a **powerpoint presentation/oral presentation.**

2 Assignments–5+5 = 10 Marks
Powerpoint Presentation/Oral Presentation–5 Marks
Attendance-5 Marks
TOTAL–20 MARKS

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY
NAGPUR

M. Sc. Botany Syllabus

Semester pattern with Choice Base Credits System

2017 -18 and Onwards

APPENDIX – 1
Scheme of teaching under choice based credit system for M. Sc. Program in Botany.

S. No.	Semester	Course Code / Paper	Title of the Paper	Course / Paper	Teaching Scheme		
					Theory (Hours)	Practical (Hours)	Number of Credits
1	One	1T1	Microbiology, Algae and Fungi	I	04	04	04
2	One	1T2	Bryophytes & Pteridophytes	II	04	04	04
3	One	1T3	Paleobotany and Gymnosperms	III	04	04	04
4	One	1T4	Cytology and Genetics	IV	04	04	04
5	One	1P1	Algae, fungi, Bryophytes	Pract. I	-	-	04
6	One	1P2	Pteridophytes, Gymnosperms, Paleobotany, Cytology & Genetics	Pract. II	-	-	04
7	One	1S1 Seminar					01
8	Two	2T1	Plant Physiology and Biochemistry	I	04	04	04
9	Two	2T2	Plant Development and Reproduction	II	04	04	04
10	Two	2T3	Cell and Molecular Biology-I	III	04	04	04
11	Two	2T4	Angiosperms-I and Ethnobotany	IV	04	04	04
12	Two	2P1	Plant Physiology, Plant Biochem., Plant Development & Reproduction	Pract. I	-	-	04
13	Two	2P2	Cell and Molecular Biology I, Angiosperms I	Pract. II	-	-	04
14	Two	2S1 Seminar					01
15	Three	3T1	Plant Ecology and Conservation Biology	I	04	04	04
16	Three	3T2	Angiosperms-II	II	04	04	04
17	Three	3T3	Elective -I	III	04	08	04
18	Two	3T4	Foundation I	IV	04	-	04

19	Three	3P1	Plant Ecology and Conservation Biology and Angiosperms II	Pract. I	-	-	04
20	Three	3P2	Elective	Pract. II	-	-	04
21	Three	3S1 Seminar					01
22	Four	4T1	Cell and Molecular Biology-II	I	04	04	04
23	Four	4T2	Plant Biotechnology and Plant Breeding	II	04	04	04
24	Four	4T3	Elective II	III	04	-	04
25	Four	4T4	Foundation II	IV	04	-	04
26	Four	4P1	Cell and Molecular Biology-II, Plant Biotechnology and Plant Breeding	Pract. I	-	-	04
27	Four	4P2	Project	Pract. II	-	08	04
28	Four	4S1 Seminar					01

1. In each semester student will have to give seminar on any topic relevant to the syllabus encompassing the recent trends and development in that field. The topic of the seminar will be decided at the beginning of each semester in consultation with supervising teachers. The students have to deliver the seminar, which will be followed by discussion. The seminar will be open to all the teachers of the department invitees and students.

2. The students will have to carry out the research based project work in lieu of practical in the fourth semester in the department or depending on the availability of placement; he/she will be attached to any of the national/ regional/ private research institute / organization for the duration of the fourth semester. The student will be randomly allotted the priority number for the selection of the supervisor in the third semester. The student in consultation with supervisor will finalize the topic of the project work at the third semester.

3. These course can be taught by person having post graduate qualification in relevant / equivalent subjects/ or having teaching / research experience in that particular area.

APPENDIX – 2

Scheme of the examination under choice based credit system for M. Sc. Program in Botany

S. No.	Semester	Course Code / Paper	Title of the Paper	Duration of Paper / hrs		Maximum Marks	Total Credits
				Theory	Practical		
1	One	1T1	Microbiology, Algae and Fungi	03		80 + 20	04
2	One	1T2	Bryophytes & Pteridophytes	03		80 + 20	04
3	One	1T3	Paleobotany and Gymnosperms	03		80 + 20	04
4	One	1T4	Cytology and Genetics	03		80 + 20	04
5	One	1P1	Algae, fungi, Bryophytes		06	100	04
6	One	1P2	Pteridophytes, Gymnosperms, Paleobotany, Cytology & Genetics		06	100	04
7	One	1S1	Seminar		01	25	01
8	Two	2T1	Plant Physiology and Biochemistry	03		80 + 20	04
9	Two	2T2	Plant Development and Reproduction	03		80 + 20	04
10	Two	2T3	Cell and Molecular Biology-I	03		80 + 20	04
11	Two	2T4	Angiosperms-I and Ethnobotany	03		80 + 20	04
12	Two	2P1	Plant Physiology, Plant Biochem., Plant Development & Reproduction		06	100	04
13	Two	2P2	Cell and Molecular Biology I, Angiosperms I		06	100	04
14	Two	2S1	Seminar		01	25	01
15	Three	3T1	Plant Ecology and Conservation Biology	03		80 + 20	04
16	Three	3T2	Angiosperms-II	03		80 + 20	04
17	Three	3T3	Elective -I	03		80 + 20	04
18	Two	3T4	Foundation I	03		80 + 20	04
19	Three	3P1	Plant Ecology and		06	100	04

			Conservation Biology and Angiosperms II				
20	Three	3P2	Elective		06	100	04
21	Three	3S1	Seminar		01	25	01
22	Four	4T1	Cell and Molecular Biology-II	I	03	80 + 20	04
23	Four	4T2	Plant Biotechnology and Plant Breeding	II	03	80 + 20	04
24	Four	4T3	Elective II	III	03	80 + 20	04
25	Four	4T4	Foundation II	IV	03	80 + 20	04
26	Four	4P1	Cell and Molecular Biology-II, Plant Biotechnology and Plant Breeding	Pract. I		100	04
27	Four	4P2	Project			100	04
28	Four	4S1	Seminar		01	25	01

1. In each semester student will have to give seminar on any topic relevant to the syllabus encompassing the recent trends and development in that field. The topic of the seminar will be decided at the beginning of each semester in consultation with supervising teachers. The students have to deliver the seminar which will be followed by discussion. The seminar will be open to all the teachers of the department, invitees and students.

2. The students will have to carry out the research based project work in lieu of practical in the fourth semester in the department or depending on the availability of placement; he/she will be attached to any of the national/ regional/ private research institute / organization for the duration of the fourth semester. The student will be randomly allotted the priority number for the selection of the supervisor in the third semester. The student in consultation with supervisor will finalize the topic of the project work at the third semester.

3. The regular full time teacher of the department / contributory teacher approved by university / scientist of government / private research laboratory appointed by university as a contributory teacher and having M. Phil. or Ph. D. degree can supervise the project work of the student.

Subject Wise Core Elective Papers:

M. Sc. Subject	Core elective paper to be opted in Semester III	Core elective paper to be opted in Semester IV
Botany	Molecular Biology and Plant Biotechnology - I	Molecular Biology and Plant Biotechnology - II
	Reproductive Biology of Angiosperms - I	Reproductive Biology of Angiosperms - II
	Advanced Phycology and Hydrobiology - I	Advanced Phycology and Hydrobiology - II
	Mycology and Plant Pathology - I	Mycology and Plant Pathology - II
	Plant Physiology - I	Plant Physiology - II
	Paleobotany - I	Paleobotany - II
	Palynology - I	Palynology - II

Foundation Course: (Candidate can opt for any one foundation course paper in the Semester III and IV; however, student shall opt for this paper from any other subject other than his /her main subject for post-graduation.

List of foundation courses is available in the Appendix - A of Direction No. 13 of 2017

SEMESTER I

PRACTICAL (1P1)

Time : 6 Hours Full marks : 100

Q. 1	To identify the given Cyanobacterial material A.	10
Q.2	To identify two algal forms B, C, from the given mixture.	10
Q.3	To identify the given fungal culture D	10
Q. 4	To identify the given plant pathogen in the given material E.	10
Q. 5	To prepare a temporary microprepration of the given Bryophytic Material F and identify it	10
Q. 6	Comment on the given spot G (Cyanobacteria/Bacteria), H (Algae), I (Fungi), J (Bryophyte)	10
Q.7	Viva-voce	20
Q. 8	Practical Recordand tour report	20

SEMESTER I

PRACTICAL (1P2)

Time : 6 Hours Full marks : 100

Q. 1	To prepare a double stained microprepration of the given Pteridophytic materialA and identify it.	10
Q.2	To prepare a double stained microprepration of the given gymnospermic material B and identify it.	10
Q.3	Comment on the given fossil specimen C	10
Q. 4	One experiment from Cytology and Genetics D	10
Q. 5	Comment on the given spot E (Pteridophyte), F (Gymnosperm), G (Fossils), H (Cytology/Genetics)	20
Q.6	Viva-voce	20
Q. 7	Practical Recordand tour report	20

SEMESTER II

PRACTICAL (2P1)

Time : 6 Hours Full marks : 100

Q. 1	To perform the given physiological experiment A and report the findings	10
Q.2	To quantify the given metabolite in the given sample B	5
Q.3	To study the cytohistological zonation in SAM of given material C	10
Q. 4	Toperform the given exercise based on plant development D	10
Q. 5	Write a note on given stage of micro-or megasporogenesis E	10
Q. 6	Spotting: F (Physiology), G (Plant development), H (Reproduction)	15
Q. 7	Viva-voce	20
Q. 8	Practical Record	20

SEMESTER II

PRACTICAL (2P2)

Time : 6 Hours Full marks : 100

Q. 1	One experiment from paper VII A	15
Q.2	One experiment from paper VII B	10
Q.3	One experiment from paper VIII C	15
Q. 4	One experiment from paper VIII D	10
Q. 5	Spotting	10
Q. 6	Viva-voce	20
Q. 7	Practical Record and field diary	20

SEMESTER III

PRACTICAL (3P1)

Time : 6 Hours Full marks : 100

Q. 1	To perform the given ecological exercise A	15
Q.2	To solve the given statistical problem B	15
Q.3	To describe the given plant in technical language with floral formula and floral diagram C	10
Q. 4	To prepare the generic/family key D	5
Q. 5	To identify species of the given plant using Flora	5
Q. 7	Spotting	10
Q. 8	Viva-voce	20
Q. 9	Practical Record	20

SEMESTER III

PRACTICAL 3P2 (ELECTIVE)

ADVANCED PHYCOLOGY & HYDROBIOLOGY

Time: 6 Hours Full Marks: 100

1. Isolation and identification of Two Procaryotes (Bacteria & Cyanobacteria) (A) 10
2. Isolation and identification of Two Eucaryotes (B) 10
3. To demonstrate Any One of the following Experiments: (C) 10

a. Separation of algal pigments.

b. Extraction and separation of amino acids of fats or carbohydrates

c. Count the density of phytoplanktons.

4. Analysis of water samples for Any One of the following : (D) 10

a. Dissolved Oxygen, pH & Temperature
b. Free Carbon dioxide pH and Temperature
c. Total alkalinity
d. Total Hardness
e. Calcium Hardness
f. BOD & COD
g. Chloride
h. Ammonical Nitrogen

5. Analysis of soil for Any One of the following : (E) 10

a. Chloride, d. Calcium

b. Phosphate, e. Magnesium

c. Nitrogen

6. Identify the spots giving reasons F,G 10

7. Viva-Voce 20

8. Practical Record and Field Report 20

PRACTICAL 3P2 (ELECTIVE)

REPRODUCTIVE BIOLOGY OF ANGIOSPERMS

Time: 6 Hours Full Marks: 100

1. Dissect and mount the endothecium/endosperm from the given materials. 10

2. Dissect and mount given stage of embryo from the material. 10

3. In vitro pollen germination percentage and pollen tube growth. Record the data under given conditions. 10

4. Study the Morphology of pollen grain. 10

5. A) Localize the Biochemical compounds in a given plant material. 5

B) Draw the camera lucida figure of a embryological stage focused under the microscope. 5

6. Identification and comment on the given spots.(2 Spots) 10

7. Practical record & field Report. 20

8. Viva-voce 20

PRACTICAL 3P2 (ELECTIVE)

APPLIED MYCOLOGY AND PLANT PATHOLOGY

Time: 6 Hours Full Marks: 100

1. Identify giving salient characters of fungi from the given culture. (A) 10

2. Identification of given diseased material, their symptoms and characters.(B) 10

3. Effects of different concentrations of sugar solutions on the conidial germination and

presentation of data on graph paper.	10
4. Drawing of camera lucida diagram of the given fungus/microorganism.	10
5. Demonstration of pure culture techniques /transfer techniques.	10
6. Spotting (two spots)	10
7. Practical record, Herbarium and field report	20
8. Viva-voce	20

PRACTICAL 3P2 (ELECTIVE)

MOLECULAR BIOLOGY AND PLANT BIOTECHNOLOGY

Time: 6 Hours Full Marks: 100

1. One Major Experiment from Group A	15
2. One Minor Experiment from Group A	10
3. One Major Experiment from Group B	15
4. One Minor Experiment from Group B	10
5. Identification and comments on given two spots	10
6. Practical record	20
7. Viva-voce	20

PRACTICAL 3P2 (ELECTIVE)

PLANT PHYSIOLOGY

Time: 6 Hours Full Marks: 100

1. One Major Experiment from Special paper- I A	15
2. One Minor Experiment from Special paper- IB	10
3. One Major Experiment from Special paper- II C	15
4. One Minor Experiment from Special paper- IID	10
5. Identification and comments on given two spots (E, F)	10
6. Practical record and Project/field report.	20
7. Viva-voce	20

PRACTICAL 3P2 (ELECTIVE)

PALYNOLOGY

Time: 6 Hours Full Marks: 100

1. Pollen preparation by standard method/s - Section 'A'.	15
2. Any ONE experiment from Section B.	15
3. Any ONE experiment from Section C.	15
4. Any ONE experiment from Section A/B/C (Minor) (Other than asked in Question 1 - 3)	5
5. Spotting	10
6. Practical Record, Permanent slides & field record	20
7. Viva-voce	20

PRACTICAL 3P2 (ELECTIVE)

PALAEOBOTANY

Time: 6 Hours Full Marks: 100

1. Preparation of ground section slide of a given fossil specimen	10
2. Preparation of slide by maceration technique	10
3. Preparation of a peel section of given fossil specimen. Draw a well Labelled Diagram and comment	10
4. Write monograph on the given specimen	10
5. Comment on Given Fossil wood	10
6. Comment on the spots	10
7. Practical record and Field Report	20
8. Viva-Voce	20

SEMESTER IV

PRACTICAL (4P1)

Time : 6 Hours | Full marks : 100

Q. 1	One experiment from Paper XIII A	15
Q.2	One experiment from Paper XIII B	10
Q.3	One experiment from Paper XIV C	15
Q. 4	One experiment from Paper XIV D	10
Q. 5	Spotting from Elective Paper II	10
Q. 6	Viva-voce	20
Q. 7	Practical record	20

M. Sc. Botany Syllabus

Semester I

1T1- Core : Microbiology, Algae and Fungi

Botany 1T1- Core : Microbiology, Algae and Fungi

Objectives:

Understanding & Application the structure, reproduction eco. imp. of bacteria, viruses and archaebacteria

Understanding & Application classification, life cycles, eco. imp. Of various groups of algae and fungi

Understanding & Application symptoms, histopathology, etiology and identification of plant diseases and measurements

Outcomes: After completion of the course, the student will be able to

Identify the structure, life cycles, economic importances etc of bacteria, virus, arhaebacteria, algae, fungi and apply this knowledge

Based on symptoms, identify plant diseases and apply knowledge for control of diseases

Perform various microbial culture techniques and apply for development of various cultures.

Module I: Prokaryotes and viruses

General Microbiology: History- Contributions made by Leeuwenhoek, Pasteur, Robert Hook, Jenner, Waksman, Iwanowsky. Koch's Postulates.

Bacteria: Structure, morphology, reproduction.

Viruses: General account; Morphology and ultrastructure of TMV, Bacteriophage; Introduction to viroids, prions and interferon.

Archaebacteria and bacteria: General account; ultrastructure, nutrition and reproduction, biology and economic importance; Cyanobacteria:*Microcystis, Lyngbya*, *Nostoc*, *Scytonema*, *Gloeotrichia* and *Stigonema*.

Module II: Phycology

Criteria for classification of algae: Chlorophyta, Charophyta, Xanthophyta, Bacillariophyta, Pheophyta and Rhodophyta; pigments, reserved food, flagella.

Algae in diversified habitats (terrestrial, freshwater, marine), thallus organization; cell ultrastructure; reproduction (vegetative, asexual, sexual); algal blooms, algalbiofertilizers; algae as a food, feed and uses in industry.

Module III: Mycology

General account: Classification of Fungi (recent trends and criteria used in classification); Physiology of Fungi (with reference to biotrophs, hemibiotrophs, symbionts); Fungal Cytology; Heterothallism, heterokaryosis, parasexual cycle.

Comparative study, classification and evolutionary trends in the following: Myxomycota: Protist characters and general account with special reference to *Physarium* and *Plasmodiophora*

Eumycota: i. Oomycetes: *Saprolegnia, Synchytrium, Phytophthora, Peronospora,*

ii. Zygomycetes: *Mucor, Rhizophus, Syncephalastrum, Cunninghamella*

Module IV: Mycology and plant pathology

Mycology contd….: Comparative study, classification and evolutionary trends in the following: iii. Ascomycetes: *Saccharomyces, Phyllactinia, Chaetomium, Xylaria*

iv. Basidiomycetes: *Melampsora, Puccinia, Ravenelia, Ustilago, Polyporus*.

v. Deuteromycetes: *Helminthosporium, Fusarium, Colletotrichum.*

Plant Pathology: Symptomology, histopathology, etiology and identification of diseases with reference to following fungal, bacterial and viral diseases (Paddy blast, wheat rust, bunt of wheat, smut of jowar, black arm of cotton, red rot of sugarcane, citrus canker, gummosis, leaf curl of papaya, potato blight.)

Practicals

Classification and type study of the following classes:

Prochlorophyta: *Prochloron,* Chlorophyta:*Pandorina, Eudorina, Stigeoclonium, Ulva, Chlorella,* Scenedesmus, Caulerpa, Valonia, Acetabularia; Phaeophyta:*Spacelaria, Padina,Turbinaria*; Rhodophyta: *Nemalion, Gelidium, Gracilaria, Corallina, Polysiphonia*; Euglenophyta:*Euglena, Phacus*; Bacillariophyta:*Cyclotella, Synedra, Cymbella, Navicula, Gomphonema.*

Morphological Studies of Fungi (any 15 of the following)

Stemonities, Perenospora, Phytopthora, Albugo, Mucor, Rhizopus, Yeast, Aspergillus, Penicillium, Chaetomium, Taphrina, Peziza, Erisyphe, Phyllactenia, Uncinula, Melamosora, Uromyces, Drechslera,Ravenallia, Ustilago, Polyporus, Morchella, Cyathus, Alternaria, Helminthosporium, Curvularia, Colletotrichum, Phoma, Plasmodiophora, Cercospora, Fusarium, Claviceps.

Symptomology of some diseased plants (any 7 of the following).

White rust of Crucifers, Downy mildew, powdery mildew, Rusts, Smuts, Ergot, Groundnut leaf spot (Tikka disease), False smut of paddy, red rot of Sugarcane, Wilt disease, Citrus canker, Angular leaf spot of cotton, Potato blight, Leaf mosaic of bhindi/ papaya, Leaf curl of tomato/Potato/Papaya, Little leaf of brinjal.

Identification of Fungal cultures (Any 5)

Rhizopus, Mucor, Aspergillus, Penicillum, Drechslera, Curvularia. Phoma, Colletotrichum, Alternaria, Helminthosporium.

Field study: For collection and studying fungal flora

Suggested Readings:

1. Kumar HD (1988) Introductory Phycology. Affiliated East-West Press Ltd. New Delhi
2. Morris I (1986) Introduction to the Algae. Cambridge University Press, UK
3. Round FE 1986 The Biology of Algae. Cambridge University Press, UK
4. Mandahar CL 1978 Introduction to Plant Viruses. Chand & Co. Ltd., New Delhi
5. Agrios, G.N. (1980) Plant Pathology, academic Press, INC, New York.
6. Ainsworth, G.C. and A.S.Sussman (eds). The Fungi, An advance Treatise Vol.I, II, III & IV Academic Press, New York.
7. Alexopoulos, C.J. (1962). Introductory Mycology John Wiley Eastern Pvt.Ltd.
8. Alexopoulos, C.J. and Mims C.W. (1979). Introductory Mycology 3rd Edition, John Wiley and Sons, Inc. Wiley, New York.
9. Alexopoulos, C.J., Mims and Black well (1996) 4th ed. John Wiley and Sons, Inc. Wiley, New York
10. Aneja, K.R. (1993) Experimental in Microbiology, Plant Pathology & Tissue Culture, Wiswa Prakashan, New Delhi.
11. Bessey, E.A. (1950) Morphology and Taxonomy of Fungi. The Blakiston co. Philadelphia.
12. Bilgrami, K.S. and H.C.Dube (1985) A text Book of Modern Plant Pathology, Vikas Publication House, New Delhi.
13. Barnett, J.H. (1968) Fundamentals of Mycology. The English Language Book Society and Edward Arnold Publication, Limited.
14. Dube, R.C. and D.K.Maheshwari (1999) A.Text Book of microbiology, S.Chand & Co. Ltd.
15. Dube, R.C. and D.K.Maheshwari (2000) Practical Microbiology -S.Chand & Co. Ltd.
16.Gupta, V.K. and M.K.Behl (1994) Indian Plant Viruses and Mycoplasma Kalyani Publishers, 1/1, Rejinder Nagar, Ludhiana.
17. Jha, D.K. (1993) A Text Book of Seed Pathology, Vikas Publication House.
18. Mehrotra, R.S. (1989) Plant Pathology, Tata McGraw Hill.
19. Mehrotra, R.S. and K.R.Aneja (1998) An Introduction to Mycology, New Age Intermidiate Press.
20. Pelzer, M.J. , Jr.Cahn, E.C.S. and N.R.Krieg (1993) Microbiology, Tata McGraw Hill.
21. Preece and Dickeson. Ecology of leaf surface microorganism Academic Press, New York.

22. Rangaswamy, G. and A.Mahadevan (1999) Diseases of Crop Plant in India, Prentice Hall of India.
23. Raychoudhari, S.P. and Nariani, T.K. (1977) Virus and Mycoplasma Diseases of Plant in India, Oxford and IBH Publication Co.
24. Schlegel, H.G. (1996) General Microbiology, 7th Edition, Cambridge University Press.
25.Snowdon, A.L. (1991) A colour Atlas of Post harvest diseases & disorders of fruits & vegetables Vol.I & II Wolfe Scientific, London.
26. On line Journals available on UGC -VSAT

Semester I

1T2- Core: Bryophytes & Pteridophytes

Objectives:

- **Understanding general characters, ecology, fossil history, classification, various types of bryophytes, pteridophytes.**
- **Learn evolutionary trends of various orders of Bryophytes, Pteridophytes and their different organs**

Outcomes:
After successful completion of the course the students will be able to

- **Learn various types of bryophytes, Pteridophytes characters for identification in lab and nature.**
- **Understand various types of fossils in bryophytes and Pteridophytes**
- **Understand evolutionary trends in bryophytes and pteridophytes**

Module I: Bryophytes

General characters, distribution, classification, ecology of Bryophytes, fossil history of bryophytes, cytology of bryophytes, regeneration in bryophytes, evolution of sporophyte-Retrogressive and Progressive theory.

Module II: Bryophytes contd…..

General account of-Hepaticopsida: Sphaerocarpels, Takakiales; Anthocerotopsida: Anthocerotales; Bryopsida: Sphagnales, Polytrichales.

Module III: Pteridophytes

General characters, distribution, classification, evolution of stele, heterospory and seed habit, apospory and apogamy; Important contributions of Indian Pteridologists, General account of Ryniopsida, Psilopsida, Lycopsida [protolepidodendrales, Lycopodiales, Selaginales, Isoetales].

Module IV: Pteridophytes contd…

General account and evolutionary trends of Sphenopsida [Hyeniales, Equisetales], Filicopsida [Ophioglossales, Filicales, Salvinales, Marsileales], Tracheophyta [Progymnospermosida].

Practicals

Bryophytes:

Study of morphological and reproductive characters of representative members mentioned in the syllabus using cleared whole mount preparations, dissections and sections. Preparation of permanent slides is necessary.

Study of bryophytes in their natural habitats.

Botanical excursion outside the state is compulsory to study the bryophytes in their natural conditions.

Pteridophytes:

Study of fossil forms (specimens and permanent micropreparations).

Study of living forms: Morphological, anatomical and reproductive characters of the forms mentioned in the syllabus. Anatomical characters to be studied either by taking free hand sections (t.s./l.s.) and by observing the permanent micropreparations. Preparations of permanent slides are essential.

Study of pteridophytes in their natural habitats.

Botanical excursion outside the state is compulsory to study the pteridophytes in their natural conditions.

Suggested Readings

1. Andrews H.N. Jr. (1961) Studies in Paleobotany (Jonh Wiley & Sons, New York)

2. Arnold C.A. (1947) An introduction to Paleobotany (McGraw Hill, New York)

3. Banks H.P. (1968) The early history of Land plants. In evolution and environment, ed. E.T. Drake. New Haven: Yale Univ. Press, pp, 73-107.

4. Banks H.P. (1970) Evolution and plants of past. (Belmont, California, Wadsworth).

5. Banks, H. P. (1975). Reclassification of Psilophyta, Taxon.24, 401-13.

6. Berrie, G. K. (1963). Cytology and Phylogeny of liverwoets. Evolution 17, 347-357.

7. Bierhorst D.W (1971) Morphology of vascular plants, New York (Mac Millan)

8. Campbell, D. H. (1961). The evolution of the Land Plants (central Book Depot, Allahabad)

9. Cavers, F. (1910). The interrelationship of Bryophyta I-IV.New Phytologist.

10. Cavers, F. (1911). The interrelationship of Bryophyta VII-IX.New Phytologist.

11. Chrysler M.A. (1910) The fertile spike in Ophioglossaceae. Ann. Bot. 24:1-18.

12. Delevoryas T. (1962) Morphology and Evolution of fossil plants (Holt, Rinehart and Winston, New York).

13. Eames A.J (1936) Morphology of vascular plants, lower groups (McGraw Hill, New York).

14. Foster A.S.and E.M Gifford Jr. (1959) Comparative morphology of vascular plants Freeman, San Fransisco.

15. Grolle, R. (1963). Takakia in Himalayas, Ost. Bot. Zeitscher, 110:444-447.

16. Gupta K.M. (1962) Marsilea, Botanical monograph no. 2 (CSIR, New Delhi).

17. Ingold, C. T. (1939). Spores discharge in land plants (Oxford London)

18. Kashyap S.R. (1929). Liverworts of the western Himalayas and The Punjab Plain 1 (Chronica Botanica)

19. Kashyap S.R. (1933). Liverworts of the western Himalayas and The Punjab Plain 2(Chronica Botanica)

20. Lacey, W. A. (1969). Fossil Bryophytes.Biological Reviews, 44,189-205.

21. Mehra, P.N. and O. N. Handoo (1953). Morphology of Anthoceros erectus and A. himalayensis and the phylogeny of the anthocerotales. Bot. Gaz.114:371-382.

22. Parihar N. S. (1976). An introduction to Embryophyta, Bryophyta (Centaral Book House, Allahabad)

23.Parihar N.S. (1977) The biology and morphology of the Pteridophytes (Central Book Depot, Allahabad).

24.Pichi-Sermolli REG (1959) Pteridophyta in vistas in botany, WB Turrill, ed. (Pergamon Press, London) pp 421-493.

25. Proskauer J. (1951). Study in Anthocerotales, III, The Bryologist 53,165-172.

26. Puri Prem (1985) Bryophytes-A broad perspective.

27. Ramanujam CGK (1992) Origin and evolution of lycopods Paleobotanist 41, 51-57.

28. Rashid A. (1982) (4th edn) An introduction to pteridophyta (Vikas Publ House Pvt Ltd.)

29.Schuster R. (1966). The Hepaticae and Anthocerotae of North America.East of the Hundredth meridian, Newyork (Colombia University Press).

30. Scott D.H. (1908) Studies in fossil botany. London, Black Part 2.

31. Scott D.H. (1920-1923) Studies in fossil botany. (A & C Black London.)

32. Sharma O.P (1996) Textbook of pteridophyta (Mac Millan India Ltd, New Delhi)

33. Smith A. J. E. (1986). Bryophyte phylogeny fact or Fiction? Journal of Bryology, 14,83 89.

34.Smith G. M. (1955). Cryptogamic Botany-vol. 2 Bryophyta and Pteridophyta (McGraw Hill Book compony, Newyork)

35. Smith W.N. and G. W. Rothwell (1993). Paleobotany and the evolution of plants (Cambridge Univ. press)

36. Sporne K.R. (1962) The morphology of pteridophyta (Hutchinson Univ. Library, London)

37. Steil W.N. (1939) Apogamy, Apospory and Parthenogenesis in the pteridophyta, Bot. rev, 5, 433-453.

38. Steward W.N. (1983) Paleobotany and the evolution of plants. ed. New York, (Cambridge Univ. press)

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43. Walton J. (1925) Carboniferous Bryophyta I. Hepaticae. Annals of Botany, 39, 563-72.

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45. Walton J. (1940) An introduction to the study of fossil plants. A& C Black, London.

46. Watson E.V. (1967) The structure and life of Bryophytes, 2nd ed, London, Hutchinson.

47. Wilson C.W. (1942) The telome theory and the origin of the stamen. Am. J Bot., 29, 759 764.

48. Zimmermann W. (1952) Main results of the "Telome theory". The Paleobotanist, Birbal Sahni Memorial Volume, 456-70.

Semester I

1T3- Core: Paleobotany and Gymnosperms

Objectives:

- **Understand fossils formation, history, preservation, geological time scale, reconstruction and nomenclature of various types of fossils**
- **Learn the origin of gymnosperms, classification, evolution, eco. imp. of gymnosperms**

Outcomes:

After successful completion of the course the students will be able to

- **Identification, nomenclature, reconstruction of fossils and their significance in time scale**
- **Identification of various gymnosperms, evolution of gymnosperms and their relationships**

Module I: Paleobotany

Introduction; Plant fossils- Preservation, preparation, age determination, geological time scale; Fossil record- systematics, reconstruction and nomenclature; Applied aspects of paleobotany.

Module II: Gymnosperms

General account; distribution (living, Fossil); origin; systems of classification; economic importance.

Comparative morphology and evolutionary tendencies of:

1.Pteridospermales- Lyginoptridaceae (*Calymotheca hoeninghausii, Hetarngium, Spherostoma*); Medullosaceae (*Medullosa, Trignocarpus*).

2. Cycadales- Cycadaceae; Fossil history (*Baenia, Nilssonia, Androstrobus*)

3. Cycadeoidales- Williamsoniaceae, Cycadoeoidaceae

Module III:**Gymnosperms contd…**

General account and relationships of- Cordaitales, Caytoniales, Glossopteridales, Pentoxylales, Gnetales

Module IV: **Gymnosperms contd…**

Ginkgoales (*Ginkgo, Baiera, Trichopitys*); Coniferales (General characters, Embryogeny and phylogeny, evolution of ovuliferous scales, phylogeny); Taxales (*Taxus*, taxonomic position of taxales with respect to coniferales)

Laboratory exercise

Comparative Study of vegetative and reproductive parts of: *Cycas, Zamia, Cedrus,Abies, Pinus, Cupressus, Cryptomeria, Taxodium, Podocarpus, Agathis, Thuja, Gnetum,Ephedra, Juniperus,Cephalotaxus, Taxus*. Permanent micropreparatious to be submitted by the students.

Ginkgo: Morphology to be studied from Museum specimens & anatomy from permanent slides only.

Study of important fossil gymnosperms from material and permanent slides.

Visit to palaeobotanical Institutes, localities and collection of specimens.

Field visits to ecologically different localities to study living gymnosperms.

Suggested Reading

1. Stewart, W.N. and Rothwell G.W. (1993), Palaeobotany and the Evolution of Plants, Cambridge University Press.

2. Foster A.S. & Gifford F.M. (1967): Comparative morphology of vascular plants, FreemanPublishers, San Fransisco.

3. Eames, A.J.(1974): Morphology of Vascular Plants-lower groups, Tata Mc-Graw Hill publishing Co., New Delhi.

4. Arnold, C.A. (1947): Introduction to Palaeobotany, Mc-Graw Hill Book Co. Inc., New York and London.

5. Kubitzki K. (1990), The families and genera of vascular plants Pteridophytes and Gymnosperms, Springer Verlag, New York

6. Agashe, S.N. (1995), Palaeobotany, Oxford & IBH, New Delhi.

7. Biswas, C & Johri, B.N. (2004), The Gymnosperms, Narosa Publishing House, New Delhi.

8. Coulter J.M. & Chamberlain C.J.(1978): Morphology of Gymnosperms, Central Book Depot, Allahabad.

9. Kakkar, R.K.and Kakkar, B.R. (1995), The Gymnosperms (Fossils & Living), Central Publishing House, Allahabad.

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11. Siddiqui, K.A. (2002) Elements of Palaeobotany, Kitab Mahal, Allahabad.

12. Bhatnagar, S.P. and Moitra A. (1996), Gymnosperms, New Age International Pvt. Ltd., New Delhi.

13. Singh, H. (1978), Embryology of Gymnosperms, Encyclopedia of Plant Anatomy X, Gebryder, Bortragear, Berlin.

14. Pant, D.D. (2003): Cycas and allied Cycadophytes, BSIP, Publications.

15. Bierhorst D.W. (1971): Morphology of vascular plants McMillan, New York.

16. Thomas, B.A. & Spicer R.A. (1987): The Evolution and Palaeobiology of land plants. Discordies Press, Fortland, USA.

17. Spicer, R.A. & Thomas, B.A. (1986) Systematic and taxonomic approaches in Palaeobotany. Systematic Association Special Volume.

18. Chamberlain C.J. (1986); Gymnosperms, structure and Evolution, CBS publishers anddistributors, New Delhi.

19. On line Journals available on UGC -VSAT

Semester I

1T4- Core: Cytology and Genetics

Objectives:

- **Understand the laws of inheritance, various modifications, types of chromosomal inheritance patterns**
- **Understand multiple alleles and multiple gene inheritance, cytopplasmic inheritance**
- **Learn structural and numerical changes in chromosomes, mutations and inheritance patterns in various biological organisms and in their populations**

Outcomes:
After successful completion of the course the students will be able to

- **Know various types of inheritances in biological organisms and analyse inheritance patterns**
- **Understanding population genetics and equilibrium affecting various factors**
- **Understand the molecular mechanism of mutations and its role in crops improvement**

Module I

Mendel's laws of inheritance; Deviations from Mendel's findings: incomplete dominance, co-dominance,penetrance, expressivity, multiple alleles and isoalleles (example Corn, Drosophila and *Nicotiana*), gene interactions (non-epistatic and epistatic), Linkage; Chromosome theory of inheritance; Modifiers, suppressors and pleiotrpic genes; multigene families (globin and immunoglobin genes); sex determination in plants, *Drosophila, C. elegans*.

Module II

Cytoplasmic inheritance and maternal effect

Chromatin organization: Chromosome structure and packaging of DNA, molecular organization of centromere and telomere, rRNA genes, euchromatin and heterochromatin; Karyotype analysis and evolution, banding patterns; C-value paradox, Cot curve and its significance; specialized types of chromosomes: polytene, lampbrush, B-chromosome, sex chromosome; molecular basis of chromosome pairing.

Module III

Structural and numerical (heteroploidy) changes in chromosomes; origin, breeding behaviour of duplications, deficiency, inversion and translocation heterozygotes; effect of aneuploidy on plants; transmission of trisomics and monosomics and their use in chromosome mapping; complex translocation heterozygotes, translocation tester sets; Robertsonian translocation.

Population genetics: Hardy-Weinberg equilibrium; Factors affecting Hardy-Weinberg equilibrium; Quantitative trait loci (Kernel colour in wheat, corolla length in *Nicotiana longifera*).

Module IV

Mutations: Spontaneous and induced; physical and chemical mutagens- classification, mode of action; molecular basis of gene mutations; transposable genetic elements; site directed mutagenesis- definition, applications and PCR based oligonucleotide mutagenesis; role of mutations in crop improvement; induction of polyploidy

Epigenetics: Introduction; histone code; base modification; paramutations in maize; Callipygh sheep; Epigenetics and Lamarckism; Epigenome and epigenomics (Introduction).

Practicals

1. To study cell division (mitosis and meiosis) in the given material.
2. To study the effect of mutagen treatment on germination and seedling height.
3. To study effect of mutagen on the rate of cell division.
4. To study effect of mutagen on genetic material by scoring the chromosomal aberrations.
5. To study the translocation heterozygote in *Rheo discolor* or any other suitable material.
6. To study polytene chromosomes in *Chironomas* larvae.
7. To solve the given problems on interaction of genes (atleast five).
8. To study the karyotype of given organism.
9. To study the chiasma frequency in the given material.
10. To solve the given problem on population genetics (atleast three).

Suggested Reading

Gupta P K 2007 Genetics: Classical to Modern. Rastogi Publications, Meerut.

Hexter W and Yost Jr. H T 1977 The Science of Genetics. Prentice Hall of India Pvt. Ltd.,

New Delhi.

Hartl D L and Jones E W 1998 Genetics: Principles and Analysis (4thed.). Jones and Barflett Publishers, USA.

Khush G S 1973 Cytogentics of Aneuploids.Academic press, New York.

Snustad D P and Simmons M J 2000 Principles of Genetics (2nded.) John Wiley and Son Inc., USA.

Semester II

2T1- Core: Plant Physiology and Biochemistry

Objectives:

- **Understanding photosynthesis and respiration in plants.**
- **Understanding mechanistic underpinnings of the plant hormones and sensory photobiology.**
- **Understanding Enzymology.**
- **Understanding the solute transport system and metabolism.**

Outcomes:

After successful completion of the course the students will be able to

- **Understand the aspects of plant respiration and photosynthesis.**
- **Understand the aspects of metabolism of different components**
- **Perform and check the enzymatic activities of different components.**

Module-I

The Scope of plant physiology

Photosynthesis: Evolution of photosynthetic apparatus, pigments, Light, light harvesting complex, Mechanism of electron transport, Photo protective mechanism, CO2 fixation, C3, C4 and CAM pathway, Photorespiration, the chemiosmatic-coupling hypothesis and ATP Synthesis, , ATP Synthesis in chloroplast

Respiration:- introduction, ,Glycolysis, Citric acid cycle, oxidative pentose phosphate pathway, Plant mitochondrial electron transport and ATP synthesis (oxidative phosphorylation) alternate oxidase.

Module-II

Plant hormones:- biosynthesis, storage , breakdown and transport of hormones, physiological effect and mechanism of action of hormones auxins, gibberellins and cytokinine

Sensory photobiology:- structure, function and mechanism of phytochromes, cryptochromes and phototropins, stomatal movement. Photoperiodism and biological clock

Module-III

Enzymes: Nomenclature and classification of Enzymes enzyme kinetics, Michaelis –Menten equation, mode and mechanism of Enzyme action (Regulation of Enzyme activity), Activators & Inhibitors of enzymes, properties of Enzymes, factors affecting Enzyme activity, isozymes.

Solute transport and photo-assimilate translocation:-uptake transport and translocation of water, ion, solutes and macromolecules from soil through cell, across membranes, through xylem and phloem , transpiration, mechanism of loading and unloading of photo -assimilates

Module –IV

Carbohydrate Metabolism: Composition, structure and function of carbohydrates, synthesis of starch and

Sucrose, catabolism (degradation) of starch and sucrose

Lipid Metabolism: Composition, structure and function of lipids, fatty acid biosynthesis, membrane Storage lipids.

Protein metabolism: Composition, structure (Ramchandra plot. secondary, tertiary and quaternary structure)and function of Proteins

Metabolism of amino acids: Composition, structure and function of amino acids, amino acid biosynthesis in Plants.

Nitrogen metabolism: Nitrate and ammonium assimilation

Secondary metabolites: Biosynthesis of terpenes, phenols. Nitrogenous compounds and their roles

Suggested laboratory exercises

1. To study the effect of time and enzyme concentration on the rate of reaction of enzyme (e.g. phosphatase, nitrate reductase).

2. To study the effect of substrate concentration on activity of enzyme and determination of its Km value.

3. Demonstration of the substrate inducibility of the enzyme nitrate reductase.

4. Determination of succinate dehydrogenase activity, its kinetics and sensitivity to inhibitors.

5. To determine the total carbohydrate content in the given sample

6. Estimation of Pectic Substances-gravitic method .

7. To prove Berr-Lambert.s law using a suitable solution.

8. Extraction of chloroplast pigments from leaves and preparation of the absorption spectrum ofchlorophyll and carotenoids.

9. To determine the chlorophyll a/ cholorophyll b ratio in C3 and C4 plants.

10. Isolation of intact chloroplasts and estimation of choloroplast proteins by spot protein assay.

11. Preparation of standard curve of protein (BSA) and estimation of protein content in extractsof plant material by Lowry's or Bradford's method.

12. Preparation of Leaf Protein Concentrates from green vegetables.

13. Determination of reducing sugars by Nelson – Somogyi Method.

Suggested reading (for laboratory exercises)

1 Bajracharya, D. 1999. Experiments in Plant Physiology: A Laboratory Manual. Narosa Publishing House, New Delhi.

2 Cooper, T.G. 1977. Tools in Biochemistry.John Wiley, New York, USA.

3Copeland, R.A. 1996. Enzymes: A Practical Introduction to Structure, Mechanism andData Analysis. VCH Publishers, New York.

4Dennison C. 1999.A guide to Protein Isolation. Kluwer Academic Publishers, Dordrecht,The Netherland.

5Devi, P. 2000. Principles and Methods of Plant Molecular Biology, Biochemistry and Genetics. Agrobios, Jodhpur, India.

6 Dryer, R. L. and Lata, G. F. 1989.Experimental Biochemistry. Oxford UniversityPress, New York.

7Hames, B.D.(Ed.).1998. Gel Electrophoresis of Proteins: A Practical Approach, 8th edition. PAS, Oxford University Press, Oxford, UK.

8Harborne, T.C. 1981. Phytochemical Methods: A Guide to Modern Techniques of Plants Analysis. Chapman& Hall, London.

9Moore, T.C. 1974. Research Experiences in Plant Physiology: A Laboratory Manual.Springer-Verlag, Berlin.

10Ninfa, A. J. and Ballou, D. P. 1998. Fundamental Laboratory Approaches forBiochemistry and Biotechnology. Fitzgerald Science Press, Inc., Maryland, USA.

11 Plummer, D.F. 1988. An Introduction to Practical Biochemistry. Tata McGraw-Hill Publishing Co. Ltd., New Delhi.

12Scott, R.P.W. 1995. Techniques and Practice of Chromatography.Marcel Dekker, Inc., New York.

13Wilson, K. and Goulding, K.H.(Eds), 1986. A Biologists Guide to Principles and Techniques of Practical Biochemistry. Edward Arnold, London,UK.

14Wilson, K. and Walker, J. 1994. Practical Biochemistry: Principles and Techniques, 4th edition. Cambridge University Press, Cambridge, UK.

15 Sadasivam and Manikum: Biochemical Methos , New Age International (p) Limited Publishers 4835/24, Ansari Road, Daryaganj, New Delhi-110002

Suggested readings (for theory)

1 Buchanan, B. B., Gruissem, W. and Jones, R.L. 1989.Biochemistry and Molecular Biology of plants.American Society of Plant Physiologists, Maryland, USA.

2Dennis, D.T., Turpin, D. H., Lefebvrc, D.D. and Layzell, D.B. (eds).1997. Plant Metabolism (2nd Ed.)Longman, Essex, England.

3 Gaiston, A.W.1989. Life Processes in Plants. Scientific American Library, Springer-Verlag, New York, USA.

4 Hooykass P.J.J., Hall, M. A. and Libbenga, K.R.(eds).1999. Biochemistry and Molecular Biology of plant Horm. Elsevier, Amsterdam, The Netherlands.

5 Hopkins, W.G. 1995. Introduction to Plant Physiology.John Wiley & Sons, Inc., New York, USA.

6 Jones R, Ougham H, Thomas H and Waaland S 2013 The Molecular life of plants. Wiley-Blackwell Publ., USA

6 Lodish, H., Berk, A., Zipursky S.L., Matsudaira, P., Baltimore, D and Darnell, J. 2000.Molecular Cell Biology (4thed). W. H. Freeman and Company. New York ,USA.

7 Moore, T.C. 1989. Biochemistry and Physiology of Plant Hormones (2nded). Springer-Verlag, New York, USA.

8 Nobel, P.S.1999. Physicochemical and Environmental Plant Physiology (2nd ed). Academic Press, Diego, USA.

9 Salisbury, F.B. and Ross, C.W.1992: Plant Physiology (4thed). Wadsworth Publishing Co., California, USA.

10 Singhal G.S., Renger, G., Sopory, S.K., Irrgang, K.D. and Govindjee.1999: Concepts in Photobiol Photosynthesis and Photomorphogenesis. Narosa Publishing House, New Delhi.

11 Taiz, L. and Zeiger, E. 1998: Plant Physiology. Sinaucr Associates, Inc., Publishers, Massachus, USA.

12 Thomas,B. and Vince-Prue,D.1997: Photoperiodism in Plants (2nd ed). Academic Press, San Diego, USA.

13 Westhoff, P.1998: Molecular Plant Development: From gene to plant. Oxford University Press, Oxford, UK.

14 Dey, P. M. And Harborne, J. B. 2000: Plant Biochemistry ,Harcourt Asia PTE Ltd. A Harcourt Publishers International Company, 583 Orchard Road 09-01 Forum Singapore

15 Ranjan, purohit, Prasad 2003: Plant Hormones Action and Application, Agrobios(India), agro house, behind Nasrani cinema Chopasani Road, Jodhpur -34

Semester -II

2T2- Core: Plant Development and Reproduction

Objectives:

- **Understanding the basic growth kinetics and growth patterns in plants**
- **Understanding the plant growth regulators with respect to plant growth and metabolism**
- **Understanding dormancy, senescence and their influences on plant growth and reproduction.**

Outcomes:
After successful completion of the course the students will be able to

- **Know the basic growth kinetics and role of phytohormones in plant development**
- **Know the molecular mechanism of growth and differentiation of root, leaf flowers and seeds**
- **Learn to use biomolecules for flower formation, seed setting, senescence effects.**

Module I: Plant development

Plant growth kinetics and patterns of growth.

Seedling growth: Tropisms; Photomorphogenesis of seedling; hormonal control of seedling growth.

Shoot Development: Organization of shoot apical meristem (SAM); cytological and molecular analysis of SAM; regulation of cell fate in meristem; tissue differentiation in the shoot.

Phytohormones: Classification, chemical nature and their role in plant development.

Module II:Plant development contd…..

Leaf growth and differentiation: Determination; phyllotaxy; control of leaf form; differentiation of epidermis (with special reference to stomata & trichomes) and mesophyll.

Root Development: Organization of root apical meristem (RAM); vascular tissue differentiation; lateral root hairs; root microbe interactions.

Flower Development: Physiology of flowering, florigen concept and photoperiodism, Genetics of floral organ differentiation; homeotic mutants in *Arabidopsis* and *Antirrhinum*.

Pollination mechanisms and vectors.

Module III: Reproduction

Male Gametophyte: Structure of anther, microsporogenesis, tapetum; pollen development and gene expression; male sterility; sperm dimorphism; pollen germination; pollen tube growth and guidance.

Female Gametophyte: Ovule types; megasporogenesis; organization of embryo sac; structure of embryo sac cells.

Pollen-pistil interaction, self-incompatibility and fertilization; Structure of the pistil; pollen-stigma interactions, double fertilization; *in vitro* fertilization.

Module IV:Reproduction contd…..

Seed Development and fruit growth: Endosperm development; embryogenesis; ultrastructure and nuclear cytology; storage proteins of endosperm and embryo; polyembryony; apomixes; embryo.

Fruit development and growth

Latent life: Dormancy; Importance and types of dormancy; seed dormancy; overcoming seed dormancy; bud dormancy.

Senescence and Programmed Cell Death (PCD): Basic concepts; types of cell death, PCD in life cycle of plants; metabolic changes associated with senescence and its regulations; influence of hormones and environmental factors on senescence.

Suggested readings

1) Bhojwani, S.S. and Bhatnagar, S.P. 2000. The Embryology of Angiosperms (4th revised and enlarged edition). Vikas Publishing House, New Delhi.

2) Fageri, K. and Van der Pol, L. 1979. The Principles of Pollination Ecology. Pergamon Press, Oxford.

3) Fahn, A. 1982. Plant Anatomy, (3rd edition). Pergamon Press, Oxford.

4) Fosket, D.E. 1994. Plant Growth and Development.A molecular Approach. Academic Press, San Diego.

5) Howell, S.H. 1998, Molecular Genetics of Plant Development. Cambridge University Press, Cambridge.

6) Leins, P., Tucker, S.C. and Endress, P.K. 1988. Aspects of Floral Development. J. Cramer, Germany.

7) Lyndon, R.F., 1990. Plant Development.The Cellular Basis. Unnin Hyman, London.

8) Murphy, T.M. and Thompson, W.F. 1988. Molecular PlantDevelopment. Prentice Hall, New Jersey.

9) Proctor, M. and Yeo, P. 1973. The Pollination of Flowers.William Collins Sons, London.

10) Raghavan, V. 1997. Molecular Embryology of Flowering Plants. Cambridge University Press, Cambridge.

11) Raghavan, V. 1999. Developmental Biology of Flowering Plants.Springer -Verlag, New York.

12) Raven, P.H., Evert, R.F. and Eichhorn, S.E. 1992. Biology of Plants (5th Edition).worth, New York.

13) Steeves, T.A. and Sussex, I.M. 1989. Patterns in Plant Development (2nd edition). Cambridge University Press, Cambridge.

14) Sedgely, M. and Griffin, A.R. 1989. Sexual Reproduction of Tree Crops, Academic Press, London.

15) Waisel, Y., Eshel, A. and Kafkaki, U. (eds) 1996. Plant Roots: The Hidden Hall (2nd edition.) Marcel Dekker, New York.

16) Shivanna, K.R. and Sawhney, V.K. (eds) 1997. Pollen Biotechnology for Crop Production and Improvement, Cambridge University Press, Cambridge.

17) Shivana, K.R. and Rangaswamy, N.S. 1992. Pollen Biology: A Laboratory Manual. Springer-Verlag, Berlin.

18) Shivana, K.R. and Johri, B.M. 1985. The Angiosperm Pollen: Structure and Function. Wiley Eastern Ltd., New York.

19) The Plant Cell. Special issue on Reproductive Biology of Plants, Vol. 5(10) 1993.The American Society of Plant Physiologists, Rockville, Maryland, USA.

20) On line Journals available on UGC -VSAT

Suggested Laboratory / Field Exercises (Any 12)

1. Tissue systems, meristem, vascular and cork cambium.

2. Internal structure of root, stem and leaf (dicot and monocot), advanced secondary growth in dicot stem and root.

3. Anomalies in primary and secondary structure of stem.

4. Study of living shoot apices by dissections using aquatic plants such as *Ceratophyllum* and *Hydrilla*.

5. Study of cytohistological zonation in the shoot apical meristem (SAM) in sectioned and double-stained permanent slides of a suitable plant such as *Coleus, Kalanchoe*, Tobacco.

6. Examination of shoot apices in a monocotyledon in both T.S. and L.S. to show the origin and arrangement of leaf primordia.

7. Study of alternate and distichous, alternate and superposed, opposite and superposed; opposite and decussate leaf arrangement.

8. Examination of rosette plants (*Launaea, Mollugo, Raphanus, Hyoscyamus* etc.) and induction of bolting under natural conditions as well as by GA treatment.

9. Microscopic examination of vertical sections of leaves such as *Cleome, Nerium*, Maize and Wheat to understand the internal structure of leaf tissues and trichomes, glands etc. Also study the C3 and C4 leaf anatomy of plant.

10. Study of epidermal peels of leaves such as *Coccinia, Gaillardia, Tradescantia, Thunbergia*, etc. to study the development and finalstructure of stomata and prepare stomatal index. Demonstration ofthe effect of ABA on stomatal closure.

11. Study of whole roots in monocots and dicots. Examination of L.S. of root from permanent preparation to understand the organization of root apical meriste m and its derivatives. (use maize, aerial roots of banyan, *Pistia, Jussieua* etc.).

12. Origin of lateral roots.

13. Study of leguminous roots with different types of nodules.

14. Study of microsporogenesis and gametogenesis in sections of anthers.

15. Examination of modes of anther dehiscence and collection of pollen grains for microscopic examination (Maize, Grasses, *Crotolaria, Tradescantia, Brassica, Petunia, Solanum melongena*, etc.)

13. Tests for pollen viability using stains and in vitro germination. Pollen germination using hanging drop and sitting drop cultures, suspension culture and surface culture.

14. Estimating percentage and average pollen tube length *in vitro*.

15. Role of transcription and translation inhibitors on pollen germination and pollen tube growth.

16. Pollen-pistil interaction, self-incompatibility, *in vitro* pollination.

17. Study of ovules in cleared preparations; study of monosporic, bisporic and tetrasporic types of embryo sac development through examination of permanent stained serial sections.

18. Field study of several types of flower with different pollination mechanisms (wind pollination, thrips pollination, bee/butterfly pollination, bird pollination).

19. Emasculation, bagging and hand pollination to study pollen germination, seed set and fruit development using self compatible and obligate outcrossing systems.

20. Study of cleistogamous flowers and their adaptations.

21. Study of nuclear and cellular endosperm through dissections and staining.

22. Isolation of zygotic globular, heart-shaped, torpedo stage and mature embryos from suitable seeds and polyembryony in citrus, jamun (*Syzygium cumini*) etc. by dissections.

23. Study of seed dormancy and methods to break dormancy.

Semester II

2T3 - Core: Cell and Molecular Biology-I

Objectives:

- **Understanding the structures and functions of the cell wall, plasma membrane and plasmodesmata**
- **Understanding the structures and functions of cell organelles, cytoskeleton, nuclear envelope, and structure of DNA**
- **Understanding various types of stresses and defense mechanisms in plants and apply this knowledge.**

Outcomes:

After successful completion of the course the students will be able to

- **Know the cell wall & cellular organization of the eukaryotic and prokaryotic cells**
- **Learn the cell cytoskeleton and its role**
- **Learn and apply techniques of stress related problems in plants**

Module I:

Cell wall: Structure; function; biogenesis and growth.

Plasma membrane: Membrane architecture (fluid mosaic model); sites for ATPases; membrane transport-ion carriers, channels, pumps and aquaporins; receptors.

Plasmodesmata: Structure, role in movement of molecules and macromolecules; comparison with gap junction.

Module II:

Cellular organelles: Ultra-structure and function of golgi complex, lysosomes, peroxisomes, endoplasmic reticulum, mitochondria, chloroplast and plant vacuoles.

Cell shape and motility: The cytoskeleton; organization and role of microfilaments, intermediate filaments and microtubules; motor movements, implications in cell division, flagellar & other movements.

Module III:

Nucleus: Ultrastructure, nuclear pores, nucleolus, DNA structure A, B and Z forms, replication in prokaryotic and eukaryotic cells, DNA replication proteins, damage and repair.

Module IV:

Stress biology: Definition and classification of stress.

Biotic stress: Plant defence mechanism (passive and active); HR and SAR; modulation of plant metabolism in response to biotic stress: early and late response; production of ROS, induction of enzymes; PR proteins; R-genes.

Abiotic stress: Effect of water, temperature, salt and light stress on plants; developmental and physiological mechanisms protecting plants against environmental extremes.

Suggested readings

Atherly, A.G., Griton, J.R. and Mc Donald, J. F. 1999.The Science of Genetics.Saunders College Pub. Fort Worth, USA

Buchanan, B.B., Gruissem, W. and Jones, R. L. 2000 Biochemistry and Molecular Biology of Plants. American Soc. Of Plant Physiologists, Maryland, USA.

Bush, H. Rothblum, L. 1982. Vol. X. The Cell Nucleus RDNA part A. Academic Press.

Dc, D. N. 2000 Plant cell vacuoles: An introduction. CSIRO Publication, Collingwood, Australia.

De Robertis, E.D.P. and De Robertis, E.M.F. Cell and Molecular Biology 8Ed. B. I. Waverly Pvt. Ltd., New Delhi.

Jones R, Ougham H, Thomas H and Waaland S 2013 The Molecular life of plants. Wiley-Blackwell Publ., USA

Karp, G. 1999 Cells and Molecular Biology; Concepts and Experiments. John Wiley & Sons, Inc., USA.

Kleinsmith, L.J. and Kish, V.M. 1995 Principles of Cell and Molecular Biology (2nd Edi.)Harper Collins Coll. Publisher, New York, USA.

Krishnamurthy, K.V. 2000 Methods in Cell wall Cyto-chemistry. CRC Press, Boca Raton, Florida

Lodish, H., Berk, A. Zipursky, S. L. Matsudaira, P., Baltimore, D. and Dar nell, J. 2000 Molecular Cell Biology Edi. W.H. Freeman and Co., New York, USA

Russel, P. J. 1998 Genetics (5th Edi.) The Banjamin/ Cummings Publishing Com. Inc., USA

Wolf, S.L. 1993. Molecular and Cellular Biology, Wadsworth Publishing Co., California, USA

Taiz, L. and Zeiger, E. 1998: Plant Physiology. Sinaucr Associates, Inc., Publishers, Massachus, USA

Practicals

1. To study salivary gland chromosomes of Chironomas and Drosophila.
2. To isolate mitochondria and determine the activity of its marker enzyme SDH.
3. To isolate bacterial and plant DNA and quantify them by spectrophotometric method.
4. To demonstrate the semi-permeability of the plasma membrane.
5. To study the activity of Na/K ATPase.
6. To demonstrate different components of cytoskeleton in the suitable material.

7. To perform flagellar staining.

8. Isolation of DNA and preparation of Cot-curve.

9. Demonstration of vital structure and functions of cell

10. To study the activity of PAL in the seedlings challenged with elicitors.

11. To study the induction of antioxidant enzymes in the seedlings challenged with elicitors.

12. To study the effect of water stress on the seedling growth and its chlorophyll content.

13. To study the effect of temperature stress on the seedling growth and its chlorophyll content.

14. To study the effect of salt stress on the seedling growth and its chlorophyll content.

Suggested readings (for laboratory exercises)

Fukui, K. and Nakayama, S. 1996. Plant Chromosomes: Laboratory Methods. CRS Press, Boca Raton, Florida.

Glick, B. R. and Thompson, J.E. 1993. Methods in Plant Molecular Biology and Biotechnology.CRC Press, Boca Raton, Florida USA.

Goswami, H. K. 1986. Practical cytology – Applied Genetics and Biostatistics Himalaya Pub. House, Bombay.

Gunning, B.E.S. and Steer, M.W. 1996. Plant Cell Biology: Structure and Function. Jones and Barlett Publishers, Boston, Massachusetts.

Hall, J.L. and Moore, A.L. 1983.Isolation of Membranes and Organelles from Plant Cells Academic Press, London, U.K.

Harris,N. and Oparka, K.J. 1994. Plant Cell Biology: A Practical Approach. IRL Press, at Oxford University Press, Oxford, U.K.

Sharma, A.K. and Sharma, A. 1999. Plant Chromosomes: Analysis, Manipulation and Engineering. Har Academic Publishers, Australia.

Shaw, C.H. (Ed.), 1988. Plant Molecular Biology: A Practical Approach. IRL Press, Oxford.Techniques, 2nd edition. PAS, IRL Press at Oxford University Press, Oxford.

References: Online journals available on UGC V-SAT programme.

Review Journals:

Annual Review of Plant Physiology and Molecular Biology

Biochemistry and Cell Biology

Cell Death and Differentiation

Cell Motility and the Cytoskeleton

Cellular Physiology and Biochemistry

Current Advances in Plant Sciences

European Journal of Cell Biology Journal of Cell Science

Nature Reviews: Molecular and Cell Biology

Protoplasma-An International Journal of Cell Biology

Trends in Cell Biology

Trends in Plant Sciences

Semester II

2T4 –Core :Angiosperms-I and Ethnobotany

Objectives:

- **Understanding the morphology of flowers of dicot and monocots for proper identification of angiosperm plants**
- **Understanding plant taxonomy and modern trends in taxonomy and conservation methods of ethnobotanical plants**

Outcomes:

After successful completion of the course the students will be able to

- **Learn basic structure of flowers for identification and distinguish them**
- **Apply taxonomic tools in taxonomic classification, modern and numerical taxonomy and phylogeny**

Module I:

Angiosperm Morphology, structural units and floral symmetry, dicot and monocot flower; structure, diversity origin and evolution of stamen, carpels; placentation types and evolution.

Floral adaptation to different pollinators

Module II:

Angiosperm Taxonomy: Scope, aims, principles of taxonomy, historical development of plant taxonomy, relative merits and demerits of major systems of classifications. Taxonomic structure: taxonomic hierarchy, concept of taxa, concept of species, concept of genus and family; Taxonomic character: HETEROBATHMY, ANALYTIC versus synthetic character, qualitative versus quantitative characters.

Module III:

Taxonomic evidence: Morphology, anatomy, embryology, palynology, cytology, phytochemistry, genome analysis.

Taxonomic tools: herbarium, floras, monographs, botanical gardens, biochemical and molecular techniques, computers and GIS.

Module IV:

Biosystematics: The population concept phenotypic plasticity, biosystematic categories, methods of biosystematics studies. Numerical taxonomy: principles, aims and objectives, cladistics in taxonomy, polarity of characters, homology, homoplasy, monophyly, polyphily.

Plant nomenclature: Salient features of ICBN

Ethnobotany:Definition; scope and significance; Sacred groves and their role in conservation.

Practicals

1. To study the floral symmetry in various taxa.

2. To study and work out the differences in dicot and monocot flower.

3. To study the variation in stamens and carpels.

4. To study placentation types in various taxa.

5. To study the floral adaptations for pollination.

6. To study anatomical features of various taxa.

7. To study embryological features of various taxa.

8. To study palynological features of various taxa.

9. To study cytological features of various taxa.

10. To prepare a cladogram on the basis of various morphological features of the species belonging to a genus.

Suggested Readings

Devis, P.H. and Heywood, V. H. 1973.Principles of angiosperms taxonomy. Robert E. Kreiger Pub. Co. Newyork.

Grant, V. 1971.Plant Speciation, Columbia University press, London.

Grant W. F. 1984. Plant Biosystematics.Academic press, London.

Harisson, H.J. 1971. New concept in flowering plant Taxonomy. Hickman educational books Ltd. London.

Hislop-Harisson, J. 1967.Plant Taxonomy.English Language Book Sco.And Edward Arnold Pub.Ltd, UK.

Heywood, V. H. and Moore, D. M. 1984. Current concepts in Plant Taxonomy. Academic Press, London.

Joncs, A. D. and Wibins, A. D. 1971. Variation and adaptation in Plant species Hickman and Co. New York.

Jones, S. B., Jr.and Luchsinger, A. E. 1986. Plant Systematics (gd edition). McGraw -Hill Book Co., New York.

Nordentam, B., El Gazaly, G. and kassas, M. 2000.Plant systematic for 21st century.Portland press.Ltd, London.

Radford, A. E. 1986. Fundamentals of plant systematic.Harper and Raw publication, USA.

Solbrig, O.T. 1970. Principles and methods of plant Sytematics. The Macmillan Co. Publication Co. Inc., USA.

Woodland, D. W. 1991. Contemporary Plant Syatematics, Pentice Hall, New Jersery.

Takhtajan, A. L. 1997. Diversity and classification of Flowering Plants. Columbia University Press, New York.

Stebbins, G. L. 1974. Flowering Plants-evolution Above species Level. Edvard Arnold Ltd, London.

Joncs, A. D.; Wibins, A. D. 1971. Variation and adaptation in Plant species Hickman and Co.

Jones, S. B., Jr.and Luchsinger, A. E. 1986. Plant Systematics (gd edition). McGraw Hill Book Co., New

Semester III

3T1 - Core : Plant Ecology and Conservation Biology

Objectives:

- **Understanding the concept of community, ecological succession trends and climax.**
- **Understanding the structures and functions of ecosystem**
- **Understanding and applying various methods of plant conservation; importace and maintenance of National parks, sanctuaries, Biospheres, botanical gardens etc.**

Outcomes:

After successful completion of the course the students will be able to

- **Learn structure and function of ecosystems and their succession and climax formation**
- **Learn and apply the knowledge of conservation methods.**

Learn and apply techniques of Botanical gardens etc.

Module I:

Vegetation organization: Concepts of community and continuum, analysis of communities (analytical ad synthetic characters): interspecific associations, concept of ecological niche.

Vegetation development: Temporal changes (cyclic and non-cyclic); mechanism of ecological succession (relay floristics and initial floristic composition; facilitation, tolerance and inhibition models).

Community function- Dynamics and succession, laboratory model, trends in succession, climax concept, General introduction to autecology.

Module II:

Ecosystem organization: Structure and functions; primary production (methods of measurement, global pattern, controlling factors); energy dynamics (trophic organization, energy flow pathways, ecological efficiencies); litter fall and decomposition (mechanism, substrate quality and climatic factors); global biogeochemical cycles of C, N, P and S. Nutrient budget in forest and aquatic ecosystem.

Module III:

Ecosystem stability: Concept (resistance and resilence); Ecological perturbations (natural and anthropogenic) and their impact on plants and ecosystems; ecology of plant invasion; environmental impact assessment; ecosystem restoration.

Ecological management: Concepts; sustainable development; sustainability indicators.

Module IV:

IUCN- General account, categories, Commissions, role in conservation; Red Data Book

Protected areas- Sanctuaries, National parks, Biosphere reserves.

Wetlands and Mangroves

Coral Reefs- Types, importance, artificial reefs, conservation measures

Botanical gardens, Seed Banks; *In-vitro* repositories; Cryobanks,

Practicals

Based on Biostatistics

1. Calculate mean, variance, standard deviation and coefficient of variation for comparing two means related to given ecological data.
2. Calculate mean, variance, and to use t-test for comparing two means related to given ecological data.
3. To find out association between important grassland species from the given data using chi-square test.
4. To find out relationship between two ecological variables using correlation analysis.
5. To perform the one-way ANOVA from the given data.

Based on Ecology

1. A trip to the grass land/ forest/ water body to get acquainted with their plant species.
2. Distribution pattern of different plant species determined by Quadrate/Transect/ Point centered Quarter methods.
3. To determine minimum size and number of quadrats required to study grassland.
4. Qualitative parameters of distribution of plant species, Frequency, Density, Basal cover, dominance, Abundance and IVI.
5. To determine diversity indices (Shanon-Weiner, species richness, B-diversity) from given data.
6. To estimate DO content in the eutrophic and oligotrophic water samples by azide modification of Winklers method.
7. To determine gross and net phytoplankton productivity by light and dark bottle method.
8. To estimate chlorophyll content in SO_2 fumigated and unfumigated leaves.
9. Analysis of soils of two different areas i.e. Cropland and forest/ grassland for certain nutrients, CO3, NO3, Base deffiency.
10. To study ecological adaptations of the given plants

Suggested readings

1. Ambasht R.S. 1968. Freshwater ecosystem-Manual of Ecology 123-137 (See Misra KC et al 1968)

2. Ambasht R.S. 1966 Conservation Ecology, Abs Proc School on Plant Ecol (Full paper in press Oxford and IBH Calcutta).

3. Ambasht R.S. 1995 A text book of plant ecology Student and co. Varanasi-5

4. Anderson JM Ecology for environmental sciences: biosphere ecosystems and man

5. Billings WB 1964 Plants and the ecosystem Macmillan & co, London.

6. Clements FE 1916 Plant succession, An analysis of the development of vegetation. Carnegie Institute of Washington.

7. Cragg JB 1968 The theory and practice of conservation, IUCN Publ, New Series No. 12, 25-35.

8. Dash MC 1993 Fundamentals of Ecology WB Saunders and co. Philadelphia USA.

9. Deangelis DL Energy flow, nutrient cycling and ecosystem resilience. Ecology 56, 23843.

10. Dwivedi Rama Shankar 1968. The decomposer system manual of ecology See Misra KC et al 1970)

11. Frankel OH, Soule ME, 1981, Conservation and Evolution, Cambridge Univ Press.

12. Grace J 1983, Plant atmosphere relationships. Champman & Hall.

13. Greig Smith P 1983, Quantitative plant ecology, Univ California Press, California.

14. Hutchings MJ (ed) 1988, Plant population biology, Blackwell.

15. Hutchinson GE 1978, An introduction to population ecology. Yale Univ. Press.

16. Kochhar PL 1986 Plant Ecology Ratan prakashan, Mandi, Agra.

17. Krebs GJ 1972 Ecology Harper and Row Publ, New York.

18. Kumar HD 1994 Modern concepts of ecology. Vikas publishing house pvt ltd, New Delhi.

19. May RM (ed) 1981 Theoretical Ecology, Blackwell.

20. Odum EP 1963 Ecology Holt Reinhart and Winston Inc.

21. Odum EP 1983 Basic Ecology, Saunders Publ Philadelphia.

22. Reynolds CS 1984 The ecology of phytoplankton, Cambridge Univ Press

23. Silverton JW 1982 Introduction to plant population ecology, Longman.

24. Southwick CH 1983 (ed) Global Ecology Sinauer.

25. Whittaker RH 1975 Communities and Ecosystems (2nded) MacMillan, New York.

Semester III

3T2 - Core : Angiosperms-II

Objectives:

- **Understanding the morphology and descriptions of various dicot and monocots groups for proper identification of angiosperm plants**
- **Understanding plant biodiversity concept, role**

Outcomes:

After successful completion of the course the students will be able to

- **Learn and apply knowledge basic structure of flowers for identification and distinguish them family-wise.**
- **Training in usage of floras for identification of species, field trips for preparation of field notes and compilation of plant data.**

Module I

General account, distinguished characters, floral variation and evolution, affinities of:- Magnolidae, Hamamelidae, Dilleniidae, Rosidae, Asteridae, circumscription as per Cronquist,1968

Module II

Alismatidae, commelinidae, Aracidae, Lilidae; Interesting features and systematic position of Cucurbitaceae, Cactaceae, Asteraceae, Amentiferae, Lemnaceae, Palmae, Orchidaceae.

Module III

Probable ancestors of angiosperms, primitive living angiosperms, speciation and extinction, IUCN categories of threat, distribution and global pattern of biodiversity.

Module IV

Biological diversity concept and levels, role of biodiversity in ecosystem functions and stability, Endemism, hotspots and hottest hotspots, invasions and introductions, local plant diversities and its socioeconomic importance.

Practicals

1. Description of specimens from representative, locally available families.

2. Description of a species based on various specimens to study intra specific variation: collective exercise.

3. Description of various species of a genus, location of key characters and preparation keys at generic level.

4. Location of key characters and use of keys at family level.

5. Field trips within and around the campus; compilation of field notes and preparation herbarium sheets of such plants, wild or cultivated as are abundant.

6. Training in using floras herbaria for identification of specimens described in the class.

7. Demonstration of the utility of secondary metabolites in the taxonomy of some appropriate genera.

8. Comparison of different species of a genus and different genera of a family to calculate similarity coefficients and preparation of dendrograms.

Suggested readings

Devis, P.H. and Heywood, V. H. 1973.Principles of angiosperms taxonomy. Robert E. Kreiger Pub. Co. Newyork.

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Jones, S. B., Jr.and Luchsinger, A. E. 1986. Plant Systematics (gd edition). McGraw -Hill Book Co., New York.

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Radford, A. E. 1986. Fundamentals of plant systematic.Harper and Raw publication, USA.

Solbrig, O.T. 1970. Principles and methods of plant Sytematics. The Macmillan Co. Publication Co. Inc., USA.

Woodland, D. W. 1991. Contemporary Plant Syatematics, Pentice Hall, New Jersery.

Takhtajan, A. L. 1997. Diversity and classification of Flowering Plants. Columbia University Press, New York.

Stebbins, G. L. 1974. Flowering Plants-evolution Above species Level. Edvard Arnold Ltd, London.

Joncs, A. D. and Wibins, A. D. 1971. Variation and adaptation in Plant species Hickman and Co.

Jones, S. B., Jr.and Luchsinger, A. E. 1986. Plant Systematics (gd edition). McGraw Hill Book Co., New Delhi.

Semester III

3T3- Core Elective I:(Molecular Biology and Plant Biotechnology- I)

Objectives:

- **Understanding the structures, replication and damage and repair mechanisms of the DNA, transcription, translation.**
- **Knowledge on recombinant DNA technology & its tools**
- **Practical knowledge and analysis skills in usage of various bioinformatic tools.**

Outcomes:

After successful completion of the course the students will be able to

- **Learn the structure, replication of DNA etc.**
- **Learn the transcription, translation etc.**
- **Learn and apply bioinformatic tools for analysis of bioinformation data.**

Module I

a. DNA replication: DNA replication in prokaryotic organism– Initiation, elongation, and termination, DNA replication in eukaryotes – origin, replication form, replication proteins, Comparative account of DNA replication in prokaryotes and eukaryotes, DNA replication proteins

b. DNA damage and repair:Types of DNA damage, factors for DNA damage, Repair system: Single base change, direct repair, mismatch repair, SOS response.

Gene expression and regulation: Transcriptional, translational and post-translational regulation

Module II

a. Tools of rDNA technology: DNA manipulation enzymes- Nucleases, polymerases, ligases, kinases and phosphatases; methods of gene isolation.

b. Molecular probing: Recombinant DNA libraries (gDNA and cDNA, oligonucleotide probes); nucleic acid hybridization (southern, northern, dot-blot and slot-blot); antibodies as probe for proteins (immunoblotting or western blotting, immunoprecipitation, southwestern screening).

Module III

a. Splicing of foreign DNA into cloning vector: Vectors for prokaryotes; ligation.

b. Introduction of foreign DNA into host cell: Transformation; transfection; transgenesis

c. Isolation of genes or protein products from clones: Expression vectors-Characteristics; vectors producing fusion proteins

d. Polymerase chain reaction: The basic techniques and its modifications; applications of PCR in molecular biology

Module IV

a. Sequence alignment and phylogenetic trees: Pairwise (dot-matrix method, dynamic programming method, Word or k-tuple method) and multiple alignment, Local and global alignment, significance of alignment, phylogeny and phylogenetic trees.

b. Genomics: Definition; Structural, functional and comparative genomics.

c. Proteomics: Description of protein structure; classification of proteins on the basis of structure and sequence similarity; prediction of a protein structure.

Suggested readings

Alberts, Bruce; Johnson Alexander; Lewis, Julian; Raff, Martin; Roberts, Keith; Walter, Peter, C. 2002 Molecular Biology of the Cell, Garland Science, New York and London.

Baxevanis, A. D. and Ouellate, B. F. F. 2009 Bioinformatics: A Practical Guide to the analysis of genes and proteins. John-Wiley and Sons Publications, New York.

Baxevanis, A. D., Davison, D. B.; Page, R. D. M.; Petsko, G. A.; Stein, L. D. and Stormo, G. D. 2008 Current Protocols in Bioinformatics

Bergman, N.H 2007 Comparative Genomics. Humana Press Inc., Part of Springer Science+ Business Media

Brown, T. A. 1999. Genomes, John Wiley &Sons(Asia) Pvt. Ltd., Singapore

De Robertis, E.D.P. and De Robertis, E.M.F. Cell and Molecular Biology 8th Ed. B. I. Waverly Pvt. Ltd., New Delhi.

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Hackett, P. B. Fuchs, J. A. and Messing, J. W. 1988. An Introduction to Recombinant DNA Techniques.Basic Experiments in Gene Manipulation. The Benjamin/cummings Publishing Co., Inc. Menlo Park, California.

Jolles, O. and Jornvall, H. (eds) 2000. Proteomics in Functional Genomics.Birkhauser Verlag, Basel, Switzerland.

Karp, G. 1999 Cells and Molecular Biology; Concepts and Experiments. John Wiley & Sons, Inc., USA.

Lehninger. Principles of biochemistry-Nelson, Cox, 4th Edn., W.H.Freeman and Co.,2005.

Lewin, B. 2000 Gene VII Oxford Univ. press, New York.

Lewin, B. 2010 Gene X Oxford Univ. press, New York.

Lodish, H., Berk, A. Zipursky, S. L. Matsudaira, P., Baltimore, D. and Darnell, J. 2000 Molecular Cell Biology Edi. W.H. Freeman and Co., New York, USA

Mount W. 2004 Bioinformatics and sequence genome analysis 2nd Edi. CBS Pub. New Delhi

Old and Primrose , 1994, Principles of gene manipulation. Blackwell Scientific Publ.

Raymond Schuler and Zielinski, E. 2005, Methods in plants Molecular biology.Acad. Press.

Russel, P. J. 1998 Genetics (5th Edi.) The Banjamin/ Cummings Publishing Com. Inc., USA

Sambrook and Russel. 2001. Molecular cloning Vol. 1-3 CSH press.

Shaw, C.H. 2006, Plant Molecular Biology: A practical approach. Panima Pub. Corp.

Stryer, Berg, Biochemistry-6th Edition, W. H. Freeman and Co.,2007.

Voet, D.; Voet, J.; Biochemistry – 3rd Edn. John Wiley and sonsInc., 2004.

Wilson Keith and Walker John 2005 Principles and techniques of biochemistry and molecular biology, 6th Ed. Cambridge University Press, New York.

Wolf, S.L. 1993. Molecular and Cellular Biology, Wadsworth Publishing Co., California, USA

Practicals

Group A

1. To detect the damage caused by mutagens to the DNA.
2. To detect molecular polymorphism in different species using a suitable technique.
3. To demonstrate the presence of a particular polypeptide by Western blotting.
4. To design PCR primers to isolate the given gene for cloning it in the given vector.
5. To amplify and sequence the nrDNA by PCR
6. To find the sequences of a given protein in the protein database
7. To work out the sequence from given autoradiogram and to identify it from GeneBank by BLAST method.
8. Todownload the DNA sequences from databases and generate pairwise and multiple sequence alignment.
9. Todownload the protein sequences from databases and generate pairwise and multiple sequence alignment.
10. To generate phylogenetic tree using given sequences.
11. To predict a protein from given sequence by using online tools from NCBI.

Group B

12. To demonstrate *Agrobacterium tumefaciens* mediated gene transfer in a suitable plant.
13. To perform ELISA testing of Bt gene in cotton.
14. To raise the suspension culture using a callus and plot the growth curve.
15. To induce the secondary metabolite synthesis in suspension culture.
16. To isolate the secondary metabolites from suitable plant material by gel filtration method.
17. To purifythe plant metabolite/ protein by column chromatography.

18. To demonstrate the use of molecular markers to detect polymorphism in different varieties of plants/strains of microbes.
19. To isolate and develop the protein profile of different plant species by SDS-PAGE.
20. To demonstrate bacterial transformation and selection of transformed cells.
21. To perform DNA ligation and analysis of ligated DNA on agarose gel.
22. To study of expression of inducible genes at biochemical level.
23. To demonstrate Organogenesis using appropriate explants.
24. To demonstrate somatic embryogenesis using appropriate explants and prepare artificial seeds.
25. To demonstrate preparation of artificial seeds.
26. To demonstrate the anther culture.
27. To study the effect of heavy metals on the growth of plants.
28. To screen the hyperaccumulator plants for a given heavy metal.

Suggested readings (for laboratory exercises)

Baxevanis, A. D. and Ouellate, B. F. F. 2009 Bioinfor matics: A Practical Guide to the analysis of genes and proteins. John-Wiley and Sons Publications, New York.

Baxevanis, A. D., Davison, D. B.; Page, R. D. M.; Petsko, G. A.; Stein, L. D. and Stormo, G. D. 2008 Current Protocols in Bioinformatics. McEntyre, J.; Ostell, J., editors Bethesda (MD) The NCBI Handbook: National Library of Medicine (US), NCBI; 2002-2005

Sambrook and Russel. 2001. Molecular cloning Vol. 1-3 CSH press.

Tools & updated literature available atwww.ncbi.com

References: Online journals available on UGC V-SAT programme.

Semester III

3T3- Core Elective I: (Reproductive Biology of Angiosperms - I)

Objectives:

- **Understanding of need of reproductive system as experimental material.**
- **Understanding of structure of male and female reproductive parts and thei developmentin Angiosperms.**
- **Understanding & Application of knowledge of male sterility .**
- **Understanding of pollen mechanism, pollen-pistil interaction and incompatability.**

Outcomes: After completion of the course, the student will be able to

- **Learning the structure, and developmental variation in the sexual organs in Angiosperms.**
- **Analysis of causes for male sterility.**
- **Understanding and application of knowledge of reproduction for human welfare**

Module I

General: Need for reproductive system as experimental material, Interdisciplinary approaches: genetic and molecular perspective,

Anther: Structure, anther wall; endothecium, middle layer, tapetum-Structure, typesstructure-function relationship, role of tapetum, microsporogenesis-sporogenous cells cytoplasmic reorganization during sporogenesis (Ultrastructural changes), molecular biology of meiosis, DNA and RNA synthesis, Protein synthesis, meiosis specific genes. Pollen tetrad development, pollen wall proteins, adaptive significance of pollen wall.

Module II

Male gametophyte development: formation of vegetative and generative cells, differential behaviour of sperms, gene expression during pollen development.

Pollen: Physiological and biochemical aspects, pollen storage, viability, causes for loss of viability. Pollen abortion and male sterility: structural, developmental and functional aspects of male sterility environmental factors, role of mitochondrial genome in male sterility, gametocides.

Module III

Pistil: Carpel determination, ovule and its structural details.

Megasporogenesis: Meiosis, functional megaspores, organization of female gametophyte structure of the embryo sac, egg, synergid-ultrastructure, role central cell, antipodal cell, haustoria, cytoskeleton of the embryo sac, enzymatic isolation of embryo sac, types of embryo sac, nutrition of embryo sac.

Module IV

Pollination: pollination mechanism, biotic and abiotic pollination, floral attractants and rewards,

Pollen-pistil interaction: The stigma-Types and structure, stigmatic exudates, style-transmitting tissue, canal cell, post pollination events (stigma receptivity, pollen adhesion, pollen hydration, pollen germination and pollen tube growth, biochemistry of pollen germination, RNA and protein metabolism during pollen tube, calcium gradient in the pollen tube (Chemotropism) pollen allelopathy.

Incompatibility: General concept, self incompatibility (Intraspecific type) heteromorphic, homomorphic types, mechanism of self compatibility, importance of self compatibility, methods of overcoming self incompatibility, Parasexual hybridization,

Suggested readings

1. Asker S. 1979, Progress in apomixis research. Hereditas 91, 231-240.

2. Barnier, G. 1986, The flowering process as an example of plastic development. Soc. Expt.. Biol. 40: 257-286.

3. Barth, F.G. 1991, insects and flowers, Princeton Univ. Press. Princeton.

4. Battaglia, E. 1963. Apomixis In recent advances in the embryology of angiosperms (ed P. Maheshwari), pp-264, Intt. Soc. Plant Morphologists, Univ. Delhi.

5. Bhandari N. N. 1984, The microsporangium in embryology of angiosperms (ed B.M. Johri) Springer-Verlag, Berlin, pp. 53-121.

6. Bhandari N.N., M. Bhargava and P. Chitralekha 1986, Cellularization of free nuclear endosperm of Pappaver somniferum L. Phytomorphology, 36, 357-366.

7. Bhojwani S.S. and M.K. Rajdan 1983, Plant tissue culture Theory and Practice Elsevier, Amsterdam.

8. Boesewinkel F.D. and Boman F. 1984, The seed structure in embryology of angiosperms (ed B.M.Johri), Springer-Verlag, Berlin, pp. 567-610.

9. Bouman F. 1984 The ovule in embryology of angiosperms (ed B.M.Johri), Springer-Verlag, Berlin, pp. 123-157.

10. Cartson P.S., Smith N.H., Dearing R.D. (1972) Parasexual interspecific plant hybridization. Proc. Nat. Acad. Sci. USA, 69, 2292-2294.

11. Cartson P.S. (1973) The use of protoplasts of genetic research. Proc. Nat. Acad. Sci. USA, 70, 598-602.

12. Chitralekha P. and N.N. Bhandari 1991, Post fertilization development of antipodal cells in Ranunculus scferatus. Phytomorphology 41, 200-212.

13. Ciampolini F.M., Nepi and E. Pacini 1993, tapetum development in Cucurbita pepo (Cucurbitaceae) Pt. Syst. Evol. (Suppl) 7-13-22.

14. Cocking E.C. 1960, A method for the isolation of plant protoplasts and vacuoles. Nature (London) 187-927-929.

15. Cocking E.C. 1970, Virus uptake, cell wall regeneration and virus multiplication in isolated plant protoplasts. Int. Rev. Cytol 28-89-124.

Practicals

1) Study from the permanent preparations.

a) Development and structures of anther pollen.

b) Structure of ovule, types, megasporogenesis, embryo sac types.

c) Development of endosperm, types.

d) Structure and development of embryo-types

e) Pericarp and seed coat structure from sections and macerations.

f) Sketching of ovular structure, embryo sac, anther wall, embryo with the help of camera lucida.

2) Techniques, Familiarity with phase contrast, polarizing, fluroscence and electron microscopy, wholemounts, fissection and macerations, permanent double stained microtome sections, photo microscopy.

3) Preparation of dissected wholemounts of endothecium, tapetum, endosperm and embryo, squash preparations of tapetum, microspore mother cells, dyads, tetrads pollinia and massulae. Study of mitosis and meiosis and identification of various stages.

4) Study of different pollen using acetolysed and non acetolysed pollen, preparation of permanent slides for morphological study. (polarity, symmetry, shape, size, aperture, sporoderm stratification: minimum 15 slides to prepare).

5) Interpretation of electron micrographs (SEM, TEM) of pollen.

6) Short term exercises on pollen production, viability and their percentage of germination. Rate of growth of germ tube to be studied in a given period.

7) Viability of seed through germination, biochemical and excised embryo methods.

8) Cytology of pollen inhibition in self and interspecific incompatibility, application of some technique to overcome incompatibility.

9) Experiments on intra-ovarian pollination.

10) Experiments on plant tissue culture. Technique-washing.Sterilization, preparation of media, storage of media, inoculation, callus initiation, proliferation.

11) Responses of calli to stress condition viz. temp, (low, high), moisture, salinity.

12) Induction of androgenesis through anther culture.

13) Physiology of embryo development, using electropheratic and histochemical methods embryo culture.

14) Somatic embryogenesis

15) Protoplast culture.

Semester III

3T3 - Core Elective I :(Mycology and Plant Pathology - I)

Objectives:

- **Understanding structure, reproduction of bacteria, viruses, fungi and mycorrhiza.**
- **Understanding & Application of knowledge human diseases caused by various fungi**
- **Understanding fungal metabolite production and its uses.**

Outcomes: After completion of the course, the student will be able to

- **Learning the structure, life cycles, economic importances etc of bacteria, virus, fungi and apply this knowledge in identification of organisms.**
- **Analysis of diseases based on symptoms, and apply knowledge for identification of disease**
- **Understanding and application of knowledge of fungal metabolites, their uses for human welfare**

Module I:General Microbiology

Bacteria- Morphology, size, shape, structure, Characters of Eubacteria, Actinomycetes, Archaebacteria, Bacterial nutrition, reproduction.

Viruses- General Characteristics, structure, classification (LHI System), replication (lytic cycle & lysogeny)

Rikettsia- General Characters.

Fungal diversity in different ecosystems, effect of environment on fungal growth and behaviour.

Module II: Mycorrhiza

1. Kinds of mycorrhizae. Ectotrophic and endotrophic mycocrhizae, their morphology and anatomy.V A-mycorrhiza.Mycorrhiza in plant growth promotion, mycorrhiza in plant disease control.

2. Rhizoshere and phyllosphere -General concept and importance.

3. Medical Mycology-Dermatophytic fungi -Knowledge of common dermatophytes and human diseases caused by them viz. *Tinea pedis, Tinea capitis, Tinea barbae. Tinea, corporis* and *Tinea manuum*; Aspergillosis, fungi allergic to human beings.

Module III: Production of Metabolites by Fungi

A) Industrial Fungal Metabolites:

i) Antibiotics -Penicillin, Cephalosporin, Griseofulvin, Industrial production of Penicillin

ii) Enzymes -. Amylase, proteases, Lipases, Pectinases, Cellular and xylanases.

iii) Organic acids -Critic acid, Gluconic acid, lactic acid, kojic acid, Itaconic acid.

B) Non Industrial Fungal Metaboilites:

i) Phytoalexins, ii) Mycotoxins

Module IV: Fungi as welfare to human beings

i) Fungi in food processing: soybean products, cheese, fermented milk, other fermented foods.

ii) Fungal metabolites – General account of production and application: Primary metabolites (vitamins, proteins), Secondary metabolites (antibiotics, pigments, alkaloids)

iv) Fungi as food -edible mushrooms, methods oftheir cultivation

v) Concept of biodeterioration and Biodegradation

a) Biodeterioration of non-cellulosic materials (leather, plastics, hydrocarbons, pesticides)

b) Biodeterioration of cellulosic materials.

c) Role of microorganisms in Biodegradation of organic wastes. Factors affecting the process of Biodegradation.

Suggested readings

1. Agrios, G.N. (1980) Plant Pathology, academic Press, INC, New York.

2. Ainsworth, G.C. and A.S.Sussman (eds). The Fungi, An advance Treatise Vol.I, II, III & IV Academic Press, New York.

3. Alexopoulos, C.J. (1962). Introductory Mycology John Wiley Eastern Pvt.Ltd.

4. Alexopoulos, C.J. and Mims C.W. (1979). Introductory Mycology 3rd Edition, John Wiley and Sons, Inc. Wiley, New York.

5. Alexopoulos, C.J., Mims and Black well (1996) 4th ed. John Wiley and Sons, Inc. Wiley, New York

6. Aneja, K.R. (1993) Experimental in Microbiology, Plant Pathology & Tissue Culture, Wiswa Prakashan, New Delhi.

7. Bessey, E.A. (1950) Morphology and Taxonomy of Fungi. The Blakiston co. Philadelphia.

8. Bilgrami, K.S. and H.C.Dube (1985) A text Book of Modern Plant Pathology, Vikas Publication House, New Delhi.

9. Barnett, J.H. (1968) Fundamentals of Mycology. The English Language Book Society and Edward Arnold Publication, Limited.

10. Dube, R.C. and D.K.Maheshwari (1999) A.Text Book of microbiology, S.Chand & Co. Ltd.

11. Dube, R.C. and D.K.Maheshwari (2000) Practical Microbiology -S.Chand & Co. Ltd.

12. Gupta, V.K. and M.K.Behl (1994) Indian Plant Viruses and Mycoplasma Kalyani Publishers, 1/1, Rejinder Nagar, Ludhiana.

13. Jha, D.K. (1993) A Text Book of Seed Pathology, Vikas Publication House.

14. Mehrotra, R.S. (1989) Plant Pathology, Tata McGraw Hill.

15. Mehrotra, R.S. and K.R.Aneja (1998) An Introduction to Mycology, New Age Intermidiate Press.

16. Pelzer, M.J. , Jr.Cahn, E.C.S. and N.R.Krieg (1993) Microbiology, Tata McGraw Hill.

17. Preece and Dickeson. Ecology of leaf surface microorganism Academic Press, New York.

18. Rangaswamy, G. and A.Mahadevan (1999) Diseases of Crop Plant in India, Prentice Hall of India.

19. Raychoudhari, S.P. and Nariani, T.K. (1977) Virus and Mycoplasma Diseases of Plant in India, Oxford and IBH Publication Co.

20. Schlegel, H.G. (1996) General Microbiology, 7th Edition, Cambridge University Press.

21. Snowdon, A.L. (1991) A colour Atlas of Post harvest diseases & disorders of fruits & vegetables Vol.I & II Wolfe Scientific, London.

22. Sunder Rajan, S. (2001) Tools and Techniques of Microbiology, Anmol Publ.New Delhi.

23. Thind, T.S. (1998) Diseases of field crops and their management, National Agricultural Technology, Information Centre, Ludhiana.

24. Vaidya, J.G. (1995) Biology of the fungi, Satyajeet Prakashan, Pune.

25. Walker, J.G. (1952) Diseases of Vegetables Crops. McGraw Hill, New York.

26. Walker, J.C. (1968) Plant Pathology, McGraw Hill, New York.

27. Eggins, H.O.W. and Allsop (1975) The Filamentous Fungi Vol. I Industrial Mycology (Biodetoriation and Biodegradation by Fungi) Eds. J.E. Smith and D.R. Berry Edward Arnold, London.

28. Emmons, C. W., C. H. Bin ford, J.P. Utz and Know Chung (1977) Medical Mycology, Lea and Febigo, Philadelphia.

29. Holliday, P. Fungus disease of tropical plants (1980), Cambridge University Press, Cambridge.

On line Journals available on UGC -VSAT

Practicals

1. Principles & working of tools, equipments and other requirements in the Mycology & Plant Pathology laboratory.

2. Micrometry and measurement of organisms.

3. Sterilization Processes viz. moist heat, dry heat, chemical and radiation.

4. Drawing of Camera Lucida diagrams and knowledge of computer based photomicrography and image processing

5. Preparation of different cultural media for cultivation of Fungi and Bacteria.

6. Monitoring and analysis of Aeromycoflora.

7. Isolation & identification of Phyllosphere mycoflora.

8. Demonstrate antifungal activities of different antibiotics and leaf, flower and root extract.

9. Study of toxicity of fungi in relation to seed germination, and seedling abnormality.

10. Cultivation of Mushrooms.

11. Demonstration on biodegradation of organic waste.

12. Isolation of Soil fungi by soil plate (War cup) and serial dilution (Walksman) method.

13. Isolation and identification of Rizosphere mycoflora.

14. Isolation of external and internal seed borne mycoflora by blotter and Agar Plate method. Cereals, pulses, oil seeds, fruit seeds.

15. Demonstration of Koch's Postulate.

16. Calculation of spore count using haemocytometer.

17. Qualitative estimation of enzymes – cellulases, amylases.

18. Estimation of sugars, proteins and aminoacids in fungal mycelium and culture filtrate.

19. Study of mycorrhiza (VAM)

20. Monographic study of locally available plant diseases caused by fungi (atleast 10).

21. Study of locally available crop plant diseases caused by Bacteria (Five)

22. Study of locally available plant diseases caused by viruses & Phytoplasma (Five)

23. Demonstration of morphological & physiological changes in disease plants.

24. Preparation and presentation of herbarium of pathological specimens available in the region (Atleast 15)

25. Field visit to different localities Visit to Agriculture University, Plant Pathological research centers

Semester III

3T3 - Core Elective I:(Palynology - I)

Objectives:

- **Know the history, palynological centres in India**
- **Understanding the structure of pollen & pistil and their importance.**
- **Understanding pollination, floral adaptations to diff. Pollinators, applications of pollen biology.**
- **Knowledge on different types of honeys, uses of honey in medicine, cosmetics etc.**

Outcomes:

After successful completion of the course the students will be able to

- **Understand the diff. aspects of pollen, pistil and pollination**

Applying knowledge with reference to agriculture, horticulture, medicine

Module I

General aspects of Palynology: -Historical background, Definition, basic concepts, scope,inter-relationship with other branches of Botany, Applications, Indian work on Palynology,Palynological centres in India.

Microsporogenesis : Stamen initiation, anther differentiation- anther initiation, anther wall,Tapetum, structure and functions, its role in pollen development, Functions of callose wall,pollen/microspore and wall development, production and deposition of sporopollenin.

Pistil : Structure and function of stigma and style, stigma receptivity and its importance.

Module II

Pollination Biology -Origin of pollination biology/anthecology, Spore and pollen dispersal inlower plants and gymnosperms, Pollination in angiosperms- types of pollination, floral adaptation to different pollinators(mode, style) flowers pollinated biotically (Hymenoptera, Diptera, Coleoptera, Lepidoptera,birds, bats) and abiotically (wind, water), pollination-plant interactions, special devices associated with pollinator attraction - pollen, nectar,Elaiophores, resin glands, osmophores, floral scent and perfume flowers.

Palaeopalynology: - Palynomorphs, their preservation in diverse lithic types, techniquesinvolved in the recovery and concentration of spores and pollen from clays, shales, coals andlignites. Maceration techniques, Application of Palynology in relation to oil and coal exploration. Role of spores and pollen in stratigraphy, index spores.

Module III

Phylogeny of Pollen and spores, Systematic palynology-monocotyledoneae anddicotyledoneae, evolutionary trends among pollen grains based on palynotaxonomical works, Palynology of spores / pollen- Algae, Fungi, Bryophytes, Pteridophytes and pollen types ofGymnosperms.

Pollen morphology of Angiosperms.: Introduction- Pollen units, polarity, symmetry, Shape, size, Apertures size, shape of thepollen grain, sporoderm stratification, Apertures-NPC System of classification, Apertural types, Exine ornamentation, LO analysis, evolutionary trends in exine structure, trends of evolution in apertural pattern, Techniques for the preparation of pollen slides, Light and scanning election microscopic studies of pollen, significance of SEM and TEM studies.

Module IV

Melittopalynology- Pollen analysis of honey-methods, qualitative and quantitative, social organization of honey bees, foraging behavior, geographical and floral origin of honey, its chemical analysis, adulteration of honeys, physical characteristics of honey, deterioration of honey, heavy metal contamination in honey, honey as environmental monitors, unifloral and multifloral honey, Applied Palynology with special reference to Agriculture and Horticulture - Bees as pollinators, role of apiaries in crop production. Use of honey in medicine, cosmetics, confectionary and other applications, Pollen loads, analysis, Bee pollen, chemical composition, utility, and its role in curing various human ailments.

Siggested Readings

1. Afzelius, B.M. 1956 Electron-microscope investigation into exine stratification*GranaPalynologica* (N.S.) 1:2,
2. Agashe S. N. – Paleobotany (1997) – Plants of the past their evolution paleoenvironment and applications inexploration of Fossil.
3. Agashe S. N. – Palynology and its Applications – Oxford and IBH Publishing Co.Pvt. Ltd. New Delhi.
4. Alexander M.P. (1969). Differential staining of aborted and non-aborted pollen *StainTechnol* 44:117-122.
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List of practicals:

Section A. Basic aspects / Pollen Morphology

1. To study structure of stamen
2. Study of permanent slides of microsporogenesis
3. Field study on different pollination mechanism
4. To study structure of pistil
5. Preparation of glycerin jelly
6. Preparation of pollen- Acetolysis technique
7. Preparation of pollen – Wodehouse technique.
8. Study of pollen types using acetolysed and non-acetolysed pollen. Pollen
9. morphology polarity, symmetry, shape, size, sporoderm stratification aperture NPC(To study the pollen types from at least 30 different species, Angiosperms preparation of permanent slides.)
10. Preparation and palynological description in technical language (at least 10 speciesof Angiosperms).

11. Interpretation of selected electron micrographs (SEM, TEM) of pollen.

12. Preparation, description and identification of spores of Algae, Fungi, Bryophytes,Pteridophytes and pollen types of Gymnosperms.

Section B. Aeropalynology/Melittopalynology/Palaeopalynology (Atleast two expts.)

13. Use of pollen traps to study local air-spora.

14. Analysis of aerospora slides.

15. Preparation of reference slides by different techniques, culture method (culture of fungi/Algae)

16. Preparation of slides honey samples

17. Analysis of honey samples for qualitative and quantitative study of pollen contents.

18. Estimation of pollen load from bee hive or bees/ pollinator

19. Analysis of coal samples for microfossils with special reference to pollen and spores.

20. Preparation of allergenic extract of pollen.

Section C Pollen Physiology/ecology/biochemistry/ecology. (Atleast three expts)

21. To study pollen production of the given flowers.

22. To study pollen viability of the given flowers.

23. To study percentage of pollen germination & rate of pollen tube growth.

24. To study different techniques of pollen storage

25. Effect of temperature and relative humidity on viability of stored pollen

26. Effect on Boron and Calcium on pollen germination and tube growth.

27. Semi-vivo technique to study pollen germination and pollen tube growth.

28. Multiple staining for localizing pollen tubes in the pistil

29. To study pollen germination and pollen tube growth in the pistil by employing aniline-blue fluorescence method

30. Cytochemical localization of esterase on stigma surfaces

31. Cytochemical analysis of pollen and pollen tube for various metabolites like proteins, amino acids, carbohydrates, starch, ascorbic acid, DNA, RNA, lipids,lignin, pectin, cellulose, etc (at least five metabolites)

32. Study of pollen contents by paper chromatography/TLC.

33. Colorimetric estimation of proteins/carbohydrates of pollen grains

34. To separate pollen proteins by SDS-PAGE electrophoresis

35. Enzyme bioassay in pollen grains.

Semester III

3T3 - Core Elective I:(Plant Physiology - I)

Objectives:

- **Understanding Plant growth and Development.**
- **Understanding the function of different growth regulators.**
- **Understanding seed physiology**
- **Understanding stress physiology**

Outcomes:

After successful completion of the course the students will be able to

- **Understand the aspects of plant growth and development**

Understand the aspects of seed physiology and stress physiology

Module:-I

Plant Growth and Development: - Growth, Differentiation and development. Control of growth and development, genetic control of development, hormonalControl of development. Pattern of growth and development, Plant growth Kinetics- Growth through time, Plant organs- How they grow? Morphogenesis.

Nitrogen: Importance of nitrogen for growth and development,nitrogen cycle, biological nitrogen fixation, symbiotic nitrogen fixation in legumes

Module-II

Growth Regulators (Plant Hormones): -Biosynthesis, Storage, breakdown and transport, physiological effects and movement of action., ABA, ethylene And nontraditional growth hormones, Jasmonate, Brassinosteriods, oligosachharins, polyamines, salisalate, nitric oxide, commercial application of plant growth regulators,

A brief idea about role of plant growth retardants: - a) CCC b) maleic hydrazide c) Trizoles d) TIBA

Module-III

Seed physiology:-

Structure of monocot and dicot seed

Latent life -Seed dormancy: Importance and types of dormancy, overcoming seeddormancy, bud dormancy. Factors responsible for dormancy, mechanism of dormancy, methods of breaking the seed dormancy.

Germination of seed: types of germination, chemical Changes duringgermination, mobilization of reserve Food during germination, hormonalControl seed Germination

Post Harvest Physiology: Ripening of fruit and its regulation, metabolismof leafy vegetables during storage.

Seed development: Biochemical changes during development of seeds.

Module-IV

Stress physiology: Response of plants to biotic(pathogen and insect) and abioticStress (water, temperature and salt)

a) Biotic Stress: - mechanism of resistance to biotic stress (HR, SAR) and tolerance to abiotic stress

b) Abiotic Stress:-

Water stress: - causes of water stress, drought effect On physiological processesin plants,various mechanism of drought resistance in plants.

Flooding stress: - nature of water logging stress. Effect of flooding onphysiological processes in plants. Mechanism of water logging tolerance

Salt stress :- definition of saline soil, physiological responses ofplants to salinitystress, halophytes and glycophytes mechanism of salinity tolerance in higherplants, genetic engineering for salt tolerance.

Thermal stresses: - Effect of high and low temperatures on plant metabolism,mechanism of high and low temperatures tolerance, cold hardening, role of HSP.

Oxidative stress: - Generation of reactive oxygen species, effect ofROS onmetabolism, ROX detoxification mechanisms in plants.

Suggested Readings (For theory):

Asana, R.D. and Sarin M.N. (1968): Crop Physiology in India IARI Publ.

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Kozlowski, T. T. (1984): Flooding and Plant Growth. 11. Levitt, J. (1969, 1980): Responses of Plants to Environmental Stress.

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Moore, T.C. 1989. Biochemistry and Physiology of Plant Hormones (2nded). Springer- Verlag, New York, USA.

Mansfield, C.A. (1976): Effect of air pollutant on plants.

Marschner, H. W. (1986): Mineral nutrition of Higher Plants.

McLaren, J.S. (1985): Chemical manipulation of crop growth and Development.

Mehrotra, R.S. (1980): Plant Pathology.

Mahadevan ,A and Sridhar R.(1986) Methods in Physiological plant Pathology, Sivakami Publications, Madras

Nobel, P.S.1999. Physicochemical and Environmental Plant Physiology (2nd ed). Academic Press, Diego, USA.

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Thomas,B. and Vince-Prue,D.1997: Photoperiodism in Plants (2nd ed).Academic Press, San Diego, USA.

Upeke, L. K. (1982): Tropical tree crops.

Westhoff, P.1998: Molecular Plant Development: From gene to plant. Oxford University Press, Oxford, UK.

Zuley G.L., (1998). Biochemistry, Wm.C .Brown Publishers USA.

Journals

- Annual reviews of Plant Physiology and Molecular Biology.
- Indian Journal of Plant Physiology.
- Journal of Experimental Botany.

Suggested Laboratory Exercises

1. Estimation of phenols from given plant material.
2. Estimation of proline from plant tissues under different environmental and physiologicalconditions.
3. Study the effects of red and infrared radiation on seed germination as affected.
4. Determination of gibberellic acid by half seed (cereal) method.
5. Demonstration of effects of auxin on abscission.
6. Demonstration of effects of cytokinin on senescence.
7. Demonstration of effects of abscission acid on stomatal regulation.
8. Preparation of cytoplasmic and chloroplastic LPC.
9. Estimation of Vitamin 'C' from suitable plant material.
10. Estimation of alkaloids from medicinal plants.
11. Study of changes in starch / protein content during seed development.
12. Study of lipid accumulation during development of oil seeds.
13. Study of effect of PEG induced water stress on seed germination.
14. Study the effect of ZnSO4 (800ppm) solution on (paddy) seed germination
15. study the physical and chemical methods for breaking the seed dormancy .

Suggested Readings (for laboratory exercises):

Bajracharya, D. 1999. Experiments in Plant Physiology: A Laboratory Manual. Narosa Publishing House, New Delhi.

Cooper, T.G. 1977. Tools in Biochemistry.John Wiley, New York, USA.

Copeland, R.A. 1996. Enzymes: A Practical Introduction to Structure, Mechanism and Data Analysis. VCH Publishers, New York.

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Wilson, K. and Goulding, K.H.(Eds), 1986. A Biologists Guide to Principles and Techniques of Practical Biochemistry. Edward Arnold, London,UK.

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Sadasivam and Manikum: Biochemical Methos , New Age International (p) Limited Publishers 4835/24, Ansari Road, Daryaganj, New Delhi- 110002

Semester III

3T4 - Foundation Course I: General Botany

(Student shall opt for this paper from any other subject other than his/her main subject for post graduation)

Objectives:

- **Understanding the morphology and histology of plant, taxonomy of plants**
- **Understanding concept of biodiversity and ecotourism, vision on ecotourism.**
- **Knowledge on local plant resources etc.**
- **Understanding on ecosystems, food chain and biodegradation of waste, pollution**

Outcomes:

After successful completion of the course the students will be able to

- **Learn different aspects of morphology, history, taxonomy biodiversity, biodegradation, pollution and ecotourism.**
- **Learn to apply knowledge of ecotourism development.**

Module I: Morphology and Taxonomy

Morphology of- Root, stem, leaf, flower and fruit.

Histology- Cell types and tissue systems in plant, specialized cells

Taxonomy- Classification system of Bentham & Hooker; General characters of- Fabaceae, Solanaceae, Verbanaceae, Liliaceae, Poaceae, Plant identification techniques.

Module II: Biodiversity & Ecotourism

Concept of biodiversity; Types (Species, genetic, ecosystem diversity); present status in India; Values of biodiversity; Mega-biodiversity centres; CBD- General account.

Aesthetic beauty of wild beautiful plants and their value in nature for Ecotourism point of view in various forests.

Module III: Plant resource utilization

Botany and uses of plants as a source of- fire wood, timber, Non-Wood forest products, cereals, pulses, oilseeds, spices, condiments, narcotics, beverages, fodder, forage, medicine and essential oil (any three of each type).

Module IV: Ecology & Biodegradation of waste

Introduction, concept of ecosystem, types of ecosystems, food chain and food web.

Pollution: Sources, consequences control of soil, air and water pollution. Carbon credit.

Various methods of bio-degradation of waste materials.

Suggested readings

Dash MC 1993.Fundamentals of Ecology. WB Saunders can Co., Philadelphia.

Devis, P.H. and Heywood, V. H. 1973.Principles of angiosperms taxonomy. Robert E. Kreiger Pub. Co. Newyork.

Heywood, V. H. and Moore, D. M. 1984. Current concepts in Plant Taxonomy. Academic Press, London.

Heywood, V. H. and Moore, D. M. 1984. Current concepts in Plant Taxonomy. Academic Press, London.

Jones, S. B., Jr.and Luchsinger, A. E. 1986. Plant Systematics (gd edition). McGraw -Hill Book Co., New York.

Khalid H and Nawaz K 2014.Introductory plant taxonomy. Kalyani Publ., New Delhi.

Kochhar PL 1986. Plant Ecology. Ratan Prakashan, Agra.

Kochhar SL 1998. Economic Botany in tropics 2e. Macmillan India Ltd., New Delhi.

Kumar HD 1994. Modern concepts of ecology. Vikas Publi. House Pvt. Ltd., New Delhi.

Sharma OP 1996 Hill's Economic Botany. TMH Publ. Co. Ltd., New Delhi.

Woodland, D. W. 1991. Contemporary Plant Syatematics, Pentice Hall, New Jersery.

Semester III

3T4 – Core : Aesthetic Botany

Objectives:

- **Knowledge on floristic regions of the world and India, endemism, hotspots etc.**
- **Understanding the scope, components of the garden and features of the garden**
- **Knowledge on scope of floriculture, methods of propagation and its importance in designs**
- **Understanding the scope of landscape, elements of landscape, importance of polyhouses, designing of lawns and cactus garden.**

Outcomes:

After successful completion of the course the students will be able to

- **Learn phytogeographical regions of India, world, scope of gardening, landscaping.**
- **Learn designing of lawns and cactus, ornamental gardens.**

Module I – Phytogeography

Climate and Vegetation of the world

Floristic regions of the world. Phytogeographical regions of India; Endemism; Concept of hotspots, hot spots of the world. Forest types of India

Module II – Gardening

Garden Design: Scope and objectives of gardening; Style of gardens (Formal, Informal); Types of gardens (English, Mughal and Japanese)

Components of garden; Planning of outdoor gardens- Small, Residential, Larger Home Garden, Roof Garden, Terrace Garden, Industrial garden, Housing complex, Indoor gardening

Garden Features and Ornamentation: Water, Garden pool, Stream, Waterfall, Fountain, Rocks, Roads, Walks, Pavements and Steps, Walls fences and Gates, Hedges, Edges, Arches, Statues, Towers.

Module III– Floriculture

Nursery production and management: Scope, Site, Soil, Environment, Layout, Manure, Fertilizers, Maintenance, Garden tools, Culture and Garden calendar, Types, Nursery beds, Pest & Disease management.

Propagation of ornamental plants by seeds, bulbs, layering, cuttings, grafting, budding & tissue culture.

Plant disorders including nutrition, pests and diseases, and chimaeras

Ornamental ferns and their propagation; herbaceous perennials, Annuals & Biennials: Important Genera and Species, their importance in garden designs.

Module IV – Landscaping

Landscape Design: Definition, objectives and scope, Landscape elements of construction and designing of Residential, Commercial, Bungalow, Public area, Hotel, Educational Institute and religious places Palms and Cycas: Characteristics, propagation, culture, pest and disease, importance and uses, genera and species of palms and Cycads. Bamboo and conifers: Genera, species and varieties

Lawns & Grasses: Planting methods, maintenance, pest management

Ornamental succulents, Cacti

Polyhouse technology: Scope and objectives of floriculture.

References

Randhawa GS and Mukhopadhyay A. 2004.Floriculture in India.Allied Publishers Pvt. Limited.

Swarup Vishnu. 2003. Garden Flowers. National Book Trust

Hartmann HT, Kester DE, Davies FT and Geneve RL. 2002. Plant Propagation – Principles and Practices. Prentice Hall India Ltd.

Royal Horticultural Society's Encyclopedia of Gardening.

Semester IV

4T1 - Core : Cell and Molecular Biology-II

Objectives:

- **Knowledge on structure and functions of ribosomes, mechanism of transcription and translation in pro- and eukaryotes.**
- **Understanding the gene structure and regulation of gene expression**
- **Knowledge on genome organization and recombination mechanisms**
- **Understanding the mechanism of cell cycle, apoptosis, techniques in cell biology**

Outcomes:

After successful completion of the course the students will be able to

- **Learn structure and functions of ribosomes, mechanism of transcription and translation.**
- **Learn gene structure and regulation of gene expression**
- **Learn mechanism of cell cycle, apoptosis, application of cell biology techniques.**

Module I:

Ribosomes: Structure and function

Transcription: Transcription in prokaryotic and eukaryotic cells, plant promoters, transcription factors, types of RNA and their function, RNA splicing, mRNA transport

Translation:In prokaryotic and eukaryotic cells, structural levels of proteins, post-translational modification; structure and role of rRNA and tRNA.

Module II:

Protein sorting: Protein glycosylation; vesicles involved in protein transport; protein targeting to plastids, mitochondria, peroxisomes, nucleus, vacuoles; modification during transport.

Gene structure: Chemical nature of gene; Fine structure of gene: Classical and modern concept of gene, Cis-trans test; fine structure analysis in eukaryotes; introns and their significance, RNA splicing

Regulation of gene expression:Prokaryotes- Positive and negative control, inducible and repressible operons, lac operon, trp operon, attenutation, riboswitch; Eukaryotes- Regulation at DNA, transcription, translation and post translational level, Epigenetic regulation

Module III:

Genome organization in prokaryotes and eukaryotic organelles: Phage genome, genetic recombination in phage and mapping phage genes; mapping of bacterial genes through transformation, conjugation and transduction; genome of mitochondria and chloroplast.

Genetic recombination and genetic mapping: Recombination; independent assortment and crossing over; molecular mechanism of recombination; role of RecA and RecBCD enzymes; homologous, non-homologous and site-specific recombination; chromosome mapping- linkage

group, genetic markers, types of maps, construction of molecular maps, correlation of genetic and physical maps; Somatic cell genetics -an alternative approach to gene mapping.

Module IV:

Cell cycle and apoptosis: Control mechanismsof bacterial and eukaryotic cell cycle, check point control, presence of regulators of cell cycle, G1 – S progression, G2 – M progression, role of cyclins and cyclin dependent kinases; retinoblastoma and E2F proteins; cytokinesis and cell plate formation; Apoptosis and its pathway.

Signal transduction:Overview, receptors and G-proteins, phospholipid signaling, role of cyclic nucleotides, calcium-calmodulin cascades, diversity in protein kinases and phosphatases, specific signaling mechanisms e.g. two-component sensor-regulator system in bacteria and plants, sucrose sensing mechanism

Techniques in cell biology: Electrophoresis, immunotechniques(Western blotting and ELISA), FISH, GISH, confocal microscopy

Suggested readings

Alberts, B., Bray, D., Lewis, J., Raff, M., Roberts, K. and Watson, J.D. 1999.

Molecular Biology of Cell, Garland Publishing, Inc., New York.

Buchanan, B.B., Gruissem, W. and Jones, R. L. 2000 Biochemistry and Molecular Biology of Plants. American Soc. Of Plant Physiologists, Maryland, USA.

De Robertis, E.D.P. and De Robertis, E.M.F. Cell and Molecular Biology 8th Ed. B. I. Waverly Pvt. Ltd., New Delhi.

Jones R, Ougham H, Thomas H, Waaland S 2013 The Molecular life of plants. Wiley-Blackwell, USA

Karp, G. 1999 Cells and Molecular Biology; Concepts and Experiments. John Wiley & Sons, Inc., USA.

Khush, G.s. 1973 Cytogenetics of Aneuploids, Academic Press, New York, London Kleinsmith, L.J. and Kish, V.M. 1995 Principles of Cell and Molecular Biology (2 nd Edi.) Harper Collins Coll. Publisher, New York, USA.

Lewin, B. 2000 Gene VII Oxford Univ. press, New York.

Lodish, H., Berk, A. Zipursky, S. L. Matsudaira, P., Baltimore, D. and Darnell, J. 2000 Molecular Cell Biology Edi.W.H. Freeman and Co., New York, USA.

Malacinski, G. M. and Freifelder, D. 1998 Essentials of Molecular Biology (3rd Edi.)Jones and Bartiet Pub. Inc., London.

Russel, P. J. 1998 Genetics (5th Edi.) The Banjamin/ Cummings Publishing Com. Inc., USA

Sunstad, D. P. and Simmons, M. J. 2000 Principles of Genetics (2nd Edi.) John Wiley & Sons Inc., USA.

Tamarin, R. H. 2001 Principles of Genetics 7th Edi.The McGraw-Hill Companies.

Wolf, S.L. 1993. Molecular and Cellular Biology, Wadsworth Publishing Co., California, USA.

References: Online journals available on UGC V-SAT programme

Practicals

1. Isolation of nuclei and identification of histones by SDS-PAGE.
2. Isolation of chloroplast and demonstration of two subunits of RUBISCO by SDS-PAGE
3. To perform the restriction digestion of the DNA and analyse the digest over agarose gel.
4. To study *in vitro* transcription.
5. To study *in vitro* translation.
6. To study conjugation in bacterial cells.
7. To detect the presence of specific antigen by ELISA
8. Isolation of RNA and quantification by spectrophotometric method.
9. To map the genes on the basis of given cross-over data.
10. Separation of amino acids by paper electrophoresis, TLC method.
11. Separation of carbohydrates by paper electrophoresis, TLC method.

Semester IV

4T2 - Core: Plant Biotechnology and Plant Breeding

Objectives:

- **Understanding the principles and techniques of gene cloning, types of vectors**
- **Knowledge on recombinant DNA technology & its tools, microbial genetic manipulations.**
- **Understanding the basic concepts of tissue culture and knowledge on transgenics.**
- **Practical knowledge and analysis skills in usage of various bioinformatic tools.**

Outcomes:

After successful completion of the course the students will be able to

- **Learn gene cloning, recombinant DNA technology etc.**
- **Learn ttissue culture methods.**
- **Learn and apply bioinformatic tools for analysis of bioinformation data.**

Module I

a. Recombinant DNA technology: Gene cloning- Principles and technique; vectors- types (cloning & expression; plasmid & viral) and their properties; construction of DNA libraries (gDNA and cDNA); splicing of insert into the vector; screening of DNA libraries and introduction of the recombinant DNA into the host cells.

b. Genetic engineering of plants: Aims, strategies for development of transgenics (with suitable examples); Agrobacterium-the natural genetic engineer; T-DNA and transposon mediated gene tagging.

Module II

a. Microbial genetic manipulation: Bacterial transformation, selection of recombinants and transformants, genetic improvement of industrial microbes and nitrogen fixers, fermentation technology.

b. Genomics and proteomics: Molecular markers for introgression of useful traits; high throughput sequencing; functional genomics; Protein profiling and its significance.

c. DNA synthesis; DNA sequencing; basic polymerase chain reaction and applications of PCR; DNA fingerprinting

Module III

Plant tissue culture: Basic concepts; Principles and scope; tissue culture media; callus induction and cell suspension; aspects of morphogenesis; haploid and triploid production; production of somatic embryos; applications of plant tissue culture; protoplast isolation and culture; production of cybrids

Transgenic production: Methods to introduce gene in plants; selection of transformed plants/explants; salient achievements in crop biotechnology.

Module IV

Bioinformatics: Introduction, History, Definition and applications of bioinformatics; Database: Sequences (nucleotide and amino acid); nomenclature- IUPAC symbols, nomenclature of DNA & protein sequences, directionality of sequences, types of sequences used in bioinformatics; Definitions, types and classification of databases- Primary Databases, Secondary databases, Literature database and Taxonomy database.

Plant breeding: Methods of breeding sexually (self and cross pollinated) and vegetatively propagated crops; heterosis and inbreeding depression and their genetic basis; use of male sterility in hybrid production.

Suggested readings

Baxevanis, A. D., Davison, D. B.; Page, R. D. M.; Petsko, G. A.; Stein, L. D. and Stormo, G. D. 2008 Current Protocols in Bioinformatics, John-Wiley and Sons Publications, New York.

Baxevanis, A. D. and Ouellate, B. F. F. 2009 Bioinformatics: A Practical Guide to the analysis of genes and proteins. John-Wiley and Sons Publications, New York.

Brown, T. A. 1999. Genomes, John Wiley &Sons(Asia) Pvt. Ltd., Singapore.

Callow, J. A., Ford-Lloyed, B. V. and Newbury, H. J. 1997. Biotechnology and Plant Genetic Resources: Conservation and Use, CAB International, Oxon UK.

Chrispeeels, M. J. and Sadava, D. E. 1994, Plants, Genes and Agriculture.Jones & Barlett Publishers, Boston, USA.

Dubey, R. C. 2014 Advanced Biotechnology. S. Chand & Co. Pvt. Ltd., New Delhi.

Glazer, A. N. and Nikaido, H. 1995.Microbial Biotechnology. W. H. Freeman & Company, New York, USA.

Gustafson, R. J. 2000. Genomes.Kluwer Academic Plenum Publishers, New York, USA.

Henry, R. J. 1997. Practical Applications of Plant Molecular Biology.Chapman & Hall, London, UK.

Jain, S. M., Sopory, S. K. and Veilleux, R.E. 1996. In vitro Haploid Production in Higher Plants, Vols. 1-5, Fundamental Aspects and Methods. Kluwer Academic Publishers, Dordrecht, The Netherlands.

Jolles, O. and Jornvall, H. (eds) 2000. Proteomics in Functional Genomics.Birkhauser Verlag, Basel, Switzerland.

Kartha, K. K. 1985. Cryopreservation of Plant Cells and Organs.CRC Press, Boca Raton, Florida USA.

Kingsman, S. M. Genetic Engineering : An Introduction to Gene Analysis and Exploitation in Eukaryotes, Blackwell Scientific Publications, Oxford, 1998

Mount W. 2004 Bioinformatics and sequence genome analysis 2nd Edi. CBS Pub. New Delhi

Old, R. W. and Primrose, S. B. 1989.Principles of Genome Analysis.Blackwell Scientific Publications. Oxford, UK.

Primrose, S. B.1995. Principles of Genome Analysis.Blackwell Scientific Ltd., Oxford, UK.

Raghavan, V. 1997.Molecular Biology of Flowering Plants. Cambridge University Press, New York, USA.

Practicals

1. To study the growth characteristics of *E. coli* using plating and turbidimetric methods.

2. To isolate the plasmid from *E. coli* and quantify it with suitable method.

3. To perform restriction digestion of the given plasmid DNA and to estimate of the size of various DNA fragments.

4. To Clone the given DNA fragment in a plasmid vector.

5. To prepare competent cells from the given bacterial culture.

6. To transform the competent bacterial cells with the given vector and perform blue-whit selection.

7. To prepare the media for plant tissue culture.

8. To surface sterilize the given seeds/explant for tissue cultural manipulation.

9. To isolate protoplast and determine its viability.

10. To fuse the protoplast for production somatic hybrid.

11. To workout the DNA sequence from the given autoradiogram and identify the gene using online tools.

12. To search literature database of different organisms.

13. To search the genes in the Genebank.

14. To use the various tools to retrieve information available from NCBI

15. To locate gene(s) on chromosomes for a given disease/disorder.

Suggested Readings(for laboratory exrcises)

Baxevanis, A. D. and Ouellate, B. F. F. 2009 Bioinformatics: A Practical Guide to the analysis of genes and proteins. John-Wiley and Sons Publications, New York.

Glover, D. M. and Hames, B. D.(Eds) 1995. DNA Cloning 1: A Practical Approach: Core Techniques, 2nd edition PAS, IRL Press at Oxford University Press, Oxford.

Hackett, P. B. Fuchs, J. A. and Messing, J. W. 1988. An Introduction to Recombinant DNA Techniques.Basic Experiments in Gene Manipulation. The Benjamin/cummings Publishing Co., Inc. Menlo Park, California.

Maniatis et al. Molecular cloning Vol.I, II and III.Cold-Spring Harbor Lab Press.

Shaw, C. H. (Ed.) 1988, Plant Molecular Biology : A Practical Approach. IRl Press, Oxford.

References: Online journals available on UGC V-SAT programme.

Semester IV

4T3 -Core Elective II:(Molecular Biology and Plant Biotechnology - II)

Objectives:

- **Understanding the methods of gene transfer.**
- **Know the applications of transformation, transgenics, molecular farming.**
- **Knowledge on some methods of tissue culture.**
- **Practical knowledge and analysis skills in usage of various DNA fingerprinting techniques.**
- **Knowledge on pollution cleaner Biotechnology.**

After successful completion of the course the students will be able to

- **Learn gene transfer methods, transgenics, molecular farming etc.**
- **Learn tissue culture methods.**
- **Learn and apply DNA finger printing techniques for analysis of molecular markers.**

Module I:

Transgenic plants: Cloning vectors for higher plants; Methods for gene transfer, *Agrobacterium tumefaciens*mediated gene transfer-Basis of tumour formation, features of Ti and Ri plasmids, mechanisms of DNA transfer, role of virulence genes;Direct DNA transfer- particle bombardment, electroporation, microinjection, macroinjection, liposomes, electrophoretic; pollen tube method; pollen transformation; PEG method; transformation of monocots; transgene stability and gene silencing; chloroplast transformation.

Module II:

a. Applications of transformation: Herbicide resistance; insect resistance; Bt genes, disease resistance; Nutritional quality; biopesticides and biofertilizers; hazards and safety regulations for transgenic plants.

b. Transgenics and molecular farming: Production of secondary metabolites; industrial enzymes; biodegradable plastics (PHB and any other); edible vaccines; antibody production and other important drugs.

Module III:

Plant tissue culture: History, Culture types- Callus culture, organ culture, suspension culture for production of secondary metabolites, protoplast culture, fusion and somatic hybrids, Somatic embryogenesis, production of haploid plants, somaclonal variations, organogenesis (direct and indirect).

Module IV:

a. DNA fingerprinting and marker assisted breeding:RFLP maps; linkage analysis; RAPD markers; STS; SSR (microsatellites); ISSR; SCAR (sequence characterized amplified regions); SSCP (single strand conformational polymorphism); AFLP; QTL: map based cloning; molecular marker assisted selection

b. Cleaner Biotechnology: Pollution control through genetically modified organisms; types of pollutants, bioremediation and phytoremediation; Production of bioethanol, biodiesel and biohydrogen.

Suggested readings

Alberts, Bruce; Johnson, Alexander; Lewis, Julian; Raff, Martin; Roberts, Keith; Walter, Bhojwani SS and Rajdhan MK 1996 Plant tissue culture: Theory and Practice. Elsevier Sci. Publ., New York

Peter 2002 Molecular Biology of the Cell, New York and London: Garland Science.

Callow, J. A., Ford-Lloyed, B. V. and Newbury, H. J. 1997. Biotechnology and Plant Genetic Resources: Conservation and Use, CAB International, Oxon UK.

Charlwood, B. Y. and Rhodes, M.V. 1999 Secondary products from plant tissue culture, Clarendon Press. Oxford.

Chrispeeels, M. J. and Sadava, D. E. 1994, Plants, Genes and Agriculture.Jones & Barlett Publishers, Boston, USA.

Collins HA and Edwards S 1998 Plant cell culture. BIOS Sci. Publ., Oxford UK

Dicosmo F and Misawa, M. 1996 Plant Cell culture: Secondary metabolism towards industrial application, CRC press, Boca Raton, NewYork.

Glazer, A. N. and Nikaido, H. 1995.Microbial Biotechnology. W. H. Freeman & Company, New York, USA.

Gustafson, R. J. 2000. Genomes.Kluwer Academic Plenum Publishers, New York, USA.

Henry, R. J. 1997. Practical Applications of Plant Molecular Biology.Chapman & Hall, London, UK.

Jain SM, Sopory SK and Veilleux RE 1996 In vitro haploid production in higher plants. Vols. 1-5. Kluwer Acad. Publ., The Netherlands

Kurz, W.G.W 1989 Primary and Secondary metabolism of plant and Cell cultures, Springer Verlag, Berlin.

Old, R. W. and Primrose, S. B. 1989.Principles of Genome Analysis.Blackwell Scientific Publications. Oxford, UK.

Primrose, S. B. 1995.Principles of Genome Analysis. Blackwell Scientific Ltd., Oxford ,UK.

Raghavan, V. 1997.Molecular Biology of Flowering Plants. Cambridge University Press, New York, USA.

Shantharam, S. and Montgomery, J. F. 1999.Biotechnology, Biosafety, and Biodiversity. Oxford & IBH Publication Co., Pvt., Ltd., New Delhi.

Semester IV

4T3 - Core Elective II:(Reproductive Biology of Angiosperms - II)

Objectives:

- **Understanding of mechanism of fertilization. Formation of endosperm, nutritive part of the seeds.**
- **Understanding of development of embryo, variation in types of embryo formation,**
- **Understanding of use of biotechnology in solving plants reproductive problems and metabolite production and its uses.**

Outcomes: After completion of the course, the student will be able to

- **Learning of problems in fertilization and fruit froduction.**
- **Analysis of type of reproduction, production of seedless fruits and role of insects in the fruit formation/pollination**
- **Understanding and application of knowledge of role of biotechnology in the reproduction and their uses for human welfare.**

Module I:

Fertilization: Cellular nature of sperm, the sperm cytoskeleton, the male germ unit, isolation and characterization of sperm, growth of the pollen tube through the style, passage of sperm into the embryo sac, fussion of nuclei, double fertilization, triple fussion, unusual features. In-vitro approaches to the study of fertilization-Intra-ovarian pollination, test tube fertilization, in-vitro fertilization, placental pollination, Gynogenesis.

Endosperm: types of endosperms, ruminate endosperm, cytological status. endosperm haustoria, chemical composition of endosperm, food reserve in endosperm, role of endosperm in embryo development, endosperm mutants.

Module II:

Embryogenesis: Zygote and its ultra-structure, Johanssen's system of embryo development, symmetry and polarity, rest period in zygote embryonic formulae, embryonomic law. Suspensor-Ultra structure of suspensor cells, cytology of suspensor cell, physiology and biochemistry of suspensor; Nutrition of embryo-nutrient supply of the zygote, embryo-endosperm relation.

Polyembryony: Defination, causes, classification, induction of polyembryony, practical importance of polyembryony.

Module III:

Apomixis: Defination, causes, classification, -Diplospory, Apospory, pseudogamy, autogamous development of endosperm, causes of apomixes, significance.

Parthenocarpy:Defination, causes, practical importance

Mellitopalynology: Pollen analysis of honey, Role of apiary in crop production.

Biotechnology: Concept and scope of biotechnology; Cell structure, cellular totipotency

a) Anther and pollen culture,

b) Ovule and nucellus culture

c) Endosperm culture and its practical applications

Module IV:

d) Embryo culture: Techniques, nutritional aspects of embryo culture morphological and physiological considerations, culture of mature embryo and proembryo.

e) Somatic embryogenesis: historical background, embryogenesis from callus, direct embryogenesis-recurrent embryogenesis; cytology of somatic embryogenesis, nutritional factors, hormonal factors.

f) Protoplast culture and somatic hybridization-isolation of protoplast, culture methods, fussion of protoplast, selection of fussion products, consequences of fussion, production of Cybrids and hybrids.

g) Biotransformation and production of useful compounds through cell culture, factor affecting yield, biotransformation, bioreactors, perspective.

Semester IV

4T3 - Core Elective II:(Mycology and Plant Pathology -II)

Objectives:

- **Know the history, milestones in phytopathology of India**
- **Knowledge on host-parasite relationship, defence mechanism in host.**
- **Practical knowledge on disease control measures in various crops**
- **Knowledge on bacterial, viral, mycorhizal and nematode diseases, symptoms and their importance.**

After successful completion of the course the students will be able to

- **Knowledge on the history, milestones in phytopathology of India**
- **Learn host-parasite relationships, various diseases and control methods.**

Module I:

History:Milestones in phytopathology with particular reference to India. Major epidemics and their social impacts. Historical developments of chemicals, cultural and biological protectionmeasures.

Altered metabolism of plants under biotic and abiotic stresses.

Koch's Postulates

Epidemiology and forcasting of plant diseases

Indian Institutes and their research activities in Mycology and Plant Pathology

Module II: Principles of Plant pathology

i. Principles of plant pathology-Importance, nature, classification and general symptoms of plant diseases.

ii. Pathogenecity of microorganisms and pathogenesis.

iii. Host parasite relationship and Interaction; Signal transduction.

iv. Defence mechanism in host plants against pathogens -morphological or structural defence mechanism;Biochemical defence mechanisms - role of phenolic compounds, enzymes and toxins,

v. Principles and methods of plant disease control -cultural methods, chemical methods, Biological control,transgenic approach for plant disease control, integrated pest management (IPM), Biopesticides.

Module III:

A Detailed study of the Diseases of the following crops caused by fungal pathogens with effective control measures.

Diseases of Cereals: Seedling blight of cereals, Smut of wheat, Foot rot of wheat, Covered smut of Barley, False smut of rice, Downey mildew of jowar, Green ear disease of Bajra, Ergot of Bajra, Downey mildew of maize.

Diseases of Vegetable crops with special reference to the important diseases of thefollowing: Chilli, Brinjal, Tomato, Onion, Bhindi.

General knowledge of post harvest diseases of fruits and vegetables and their control.

Diseases of Oil Seed Crops viz. *Linum*, *Seasamum*, Groundnut, Mustard and Sunflower

Diseases of Fruit Trees-With special reference to important diseases of the following Citrus, Apple, Mango, Banana and Grapes.

Module-IV:

Bacterial diseases of plants - Bacterial blight of rice, Tundu disease of wheat, Angular leaf spot of cotton, stalk rot of maize, Fire blight of Apple, Bacterial soft rot of fruits and Vegetables.

Viral Diseases of Plant: Bunchy top of Banana, Leaf curl of Papaya, Yellow vein mosaic of Bhindi. Mosaic of Cucurbits, Viral diseases of Tobacco, Potato and Tomato.

Mycoplasma/Phytoplama (PPLO) Diseases of Plants: Citrus greening, Rice yellow dwarf: Little leaf of Brinjal, Sandal Spike.

Nematode Diseases of Plants: General knowledge of plant parasitic nematodes and important nematode diseases viz.Root knot of Vegetables, Ear cockle of wheat. .

Suggested readings

1. Agrios, G.N. (1980) Plant Pathology, academic Press, INC, New York.

2. Ainsworth, G.C. and A.S.Sussman (eds). The Fungi, An advance Treatise Vol.I, II, III & IV Academic Press, New York.

3. Alexopoulos, C.J. (1962). Introductory Mycology John Wiley Eastern Pvt.Ltd.

4. Alexopoulos, C.J. and Mims C.W. (1979). Introductory Mycology 3rd Edition, John Wiley and Sons, Inc. Wiley, New York.

5. Alexopoulos, C.J., Mims and Black well (1996) 4th ed. John Wiley and Sons, Inc. Wiley, New York

6. Aneja, K.R. (1993) Experimental in Microbiology, Plant Pathology & Tissue Culture, Wiswa Prakashan, New Delhi.

7. Bessey, E.A. (1950) Morphology and Taxonomy of Fungi. The Blakiston co. Philadelphia.

8. Bilgrami, K.S. and H.C.Dube (1985) A text Book of Modern Plant Pathology, Vikas Publication House, New Delhi.

9. Barnett, J.H. (1968) Fundamentals of Mycology. The English Language Book Society and Edward Arnold Publication, Limited.

10. Dube, R.C. and D.K.Maheshwari (1999) A.Text Book of microbiology, S.Chand & Co. Ltd.

11. Dube, R.C. and D.K.Maheshwari (2000) Practical Microbiology -S.Chand & Co. Ltd.

12. Gupta, V.K. and M.K.Behl (1994) Indian Plant Viruses and Mycoplasma Kalyani Publishers, 1/1, Rejinder Nagar, Ludhiana.

13. Jha, D.K. (1993) A Text Book of Seed Pathology, Vikas Publication House.

14. Mehrotra, R.S. (1989) Plant Pathology, Tata McGraw Hill.

15. Mehrotra, R.S. and K.R.Aneja (1998) An Introduction to Mycology, New Age Intermidiate Press.

16. Pelzer, M.J. , Jr.Cahn, E.C.S. and N.R.Krieg (1993) Microbiology, Tata McGraw Hill.

17. Preece and Dickeson. Ecology of leaf surface microorganism Academic Press, New York.

18. Rangaswamy, G. and A.Mahadevan (1999) Diseases of Crop Plant in India, Prentice Hall of India.

19. Raychoudhari, S.P. and Nariani, T.K. (1977) Virus and Mycoplasma Diseases of Plant in India, Oxford and IBH Publication Co.

20. Schlegel, H.G. (1996) General Microbiology, 7th Edition, Cambridge University Press.

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On line Journals available on UGC -VSAT

Semester IV

4T3 - Core Elective II:(Palynology - II)

Objectives:

- **Knowledge on pollen physiology and biochemistry**
- **Understanding the pollen biotechnology, genetics and forensic palynology.**
- **Knowledge on aerobiology history and various methods applied for collection and data analysis.**
- **Knowledge on pollen allergy, causes, symptoms, prevention and cure.**

Outcomes:

After successful completion of the course the students will be able to

- **Understand the diff. aspects of pollen physiology, biochemistry, genetics, biotechnology and forensic palynology.**
- **Applying knowledge on pollen allergies, identification of allergents, cure etc.**

Module I: Pollen physiology and biochemistry-

Pollen production, Pollenviability, tests for pollen viability, Pollen germination of pollen in *vivo* and in *vitro*, germination requirements, Role of boron and calcium in pollen germination, Factors affecting pollen germination. Chemical composition of pollen wall and pollen contents (amino acids, proteins, carbohydrates, lipids, vitamins, pectin, DNA, RNA, ascorbic acid, flavones, pigments etc.). Fine structure inside the tube, pollen culture movements of nuclei-and formation of calloseplug, promotion and inhibition of pollen tube, elongation, pollen enzymes and isozymes.

Module II: Pollen biotechnology and genetics, forensic palynology

Pollen storage-Factors affecting viability in storage, freeze-drying of pollen, storage of pollen in organic solvents, causes of decreased viability in storage and pollen germination.

Pollen-pistil interaction- significance, self incompatibility (regulation of fertilization) Pollen biotechnology & crop production- Anther / pollen culture, production of haploids

Genetics of pollen: Genetic segregation of pollen, pollen sterility- genic and cytoplasmic male sterility, factors involved in male sterility. Male sterility through recombinant DNAtechnology.

Forensic palynology- Introduction, methodology, role in criminology, examples

Module III:

Aerobiology-Introduction, Historical background, applications of Aeropalynology, Aeromycology,Aerophycology. Importance in medical field, importance of aero mycological

studies in various types of crop infection by spores, disease forecasting, aerobiological work in India and abroad.

Intramural and extramural studies, different devices to collect spores, pollen grains such askite, balloons, trap air strips and slides, volumetric samplers, culturing techniques, analysis ofdata and their processing, seasonal changes of air-spora, Indoor environments, Outdoor airspora, characteristics, identification

Module IV:

Airborne allergens- Introduction, allergens and their types, Impact of airborne materials onhuman system, Lung as particulate sampler, Source, causes, symptoms of Pollen allergy, fungal spore allergy, dust mite allergy, algal allergy other allergies, pollinosis, nasobroncheal allergy, Prevention and cure, Human immunoglobulins- types, and significance in diagnosis of allergy, diagnosing allergic diseases, Testing and treatment standardization, pollen calendar and daily census of airborne pollen, Correlation between aerobiological, clinical and meteorological data.

Recommended reading

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Chowdhary, J.B. and T.M. Varghese. 1968. Pollen sterility in crop plants-A review Palyn. Bull.IV (2).

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Semester IV

4T3 - Core Elective II:(Plant Physiology - II)

Objectives:

- **Understanding the role of secondary metabolites in plants.**
- **Understanding various industrial applicable concepts and nanobiotechnology**
- **Understanding neuro and electro physiology**
- **Understanding the signal transduction in plant cells.**

Outcomes:

After successful completion of the course the students will be able to

- **Understand the importance of secondary metabolites and their medicinal importance**
- **Understand the applicability of learnt concepts at industrial level.**
- **Understand the pathways and proteins involved for different signaling response at cellular level.**

Module-I

Secondary metabolites :-Introductionand classification, Secondary metabolitesand ecological functions in plants , secondary metabolites defend plants against herbivoresand pathogens

a. Alkaloids:- alkaloid biosynthesis, Biotechnological application of alkaloidsBiosynthesis, plant defense against pathogens

b. Terpenoids:- terpenoids and herbivory, steroids and sterols, polyterpens,prenyltrasferase and terpene synthase reactions, modifications of terpeniod skeletons toward transgenic production

c. Phenolic compounds:- medicinal properties of phenolic compounds, types- simple phenolics, coumarins, lignin, flavonoids, tannins

d. Glycosides:-saponins, cardiac glycosides, cyanogenics glycoside,glucosinolates

Module-II

Leaf protein: - Green crop fractionation (GCF), Leaf Protein Concentrate (LPC), Chloroplastic LPC, Cytoplasmic LPC, Deproteinised Leaf Juice (DPJ), Uses of DPJ.Importance of leaf protein

Industrial fermentation:-importance of fermentation, type of fermentation, alcoholic fermentation, enzyme production , antibiotic production

Biodiesel production:- introduction and historical account of biodiesel,methods of preparation biodiesel from vegetable oil, biochemical properties of biodiesel Importance of biodiesel.

Module-III

Plant Neuro/electro physiology:- introduction and historical account of plantelectrophysiology, Factor affecting electrical potential, electrodes and methods usedfor Measuring the Electrical potential energy of plants and fruits

S**ignal Perception and Transduction**:-Introduction, overview of signal transduction pathway, receptors, specific examples of plant receptors, signal transduction in Prokaryotes, signal transduction in eukaryotes, G-proteins and phospholipids signaling, cyclic nucleotides, secondary messengers (Calcium, calcium-calmodulin complexes, Protein kinases particular pathways of signal transduction Associated with plant growth regulators

Module-IV

Vitamins:- water and fat- soluble vitamins, biochemical function of thiamine, riboflavin, nicotinic acid, pantothenic acid, pyridoxin, biotin, folic acid, vitamin B12, ascorbic acid, vitamin A and vitamin D

Antioxidants:-what are antioxidants, types of antioxidants, role of antioxidants in medicine and in disease control, cure and prevention, antioxidant rich foods

Nanobiotechnology:-Application of nano-biotechnology in medicine and food, synthetic and natural bionanomaterials. Implications of nanoscience and nanotechnology on society.

Issues- biosensors and their applications, biological nanostructures.Applications of bionanoscience to materials research.

4T4 - Foundation Course II: Applied Botany
(Student shall opt for this paper from any other subject other than his/her main subject for post graduation)

Objectives:

- **Know the concept and types of entreneurship, types of start-ups**
- **Understanding the production of various plant products**
- **Understanding green herbal and cultural techniques**
- **Knowledge on different types of garden, floriculture, silviculture developments, post-harvent techniques.**

Outcomes:

After successful completion of the course the students will be able to

- **Learn the production of plant bio-products**
- **Applying knowledge with reference to green herbal techniques, culture technique and cultivation of garden, silviculture,post-harvesting techniques etc.**

Module I: Entrepreneurship in Botany

Concept, definition, structure and theories of entrepreneurship; Types of start-ups; Types of entrepreneurship, Entrepreneurship of NTFP (collection/Production, value addition, marketing strategies), Biodiesel/bio-ethanol plant production, *Trichoderma* production for control of soil borne fungi, honey production., Plant enzyme production

Module II: Green herbal techniques

Phytochemistry: Classification of secondary metabolites accumulated by the plants; extraction of phytochemicals

Plant based products: Techniques for extraction/preparation of various dyes, cosmetics, perfumes (essential oils), sweeteners (*Stewia* etc.), herbal medicine, nutraceuticals.

Fibre production: Coir, Jute, banana, cotton, silk cotton etc.

Cultivation of common medicinal herbs: *Aloe vera, Curcuma longa, Zingier officinalis, Withania somnifera, Chlorophytum borivilianum.*

Module III: Gardening, silviculture and Post harvesting techniques

Gardening: History, types of gardens, landscape gardening, major gardens of the world.

Floriculture: General introduction, nursery management, methods of propagation (Bonsai, cutting, grafting, budding) poly house and green house, commercial floriculture.

Silviculture: Introduction, Agro-forestry, avenue trees, ornamental shrubs and trees cultivation.

Kitchen gardening: Spinach, tomato, brinjal, coriander, drumstick, lady's finger, chilly, curry leaf, methi and other spices etc.

Post harvest techniques: Vegetables, fruits, ornamentals, neutraceuticals,

Module IV: Culture techniques

Sterilization techniques for various types of cultures

Technique of- Mushroom culture, *Spirulina* cultivation, compost, vermi-composting, bio-fertilizer production, hydroponics, plant tissue culture, techniques to increase shelf-life of ornamental plants.

Suggested readings

Burch JG 1086. Entrepreneurship.Wiley, USA.

Des R. 2013 Floriculture at glance. Kalyani Publ., New Delhi.

Desai V 1994.Forest management in India- Issues and Problems. Himalaya Publ. House, New Delhi.

Grewal HS and Singh P 2014.Landscape designing and ornamental plants. Kalyani Publ., New Delhi.

Gupta CB and Srinivasan NP 2001.Entrepreneurship in India. S. Chand and Sons, New Delhi.

Hartman HT, Kester DE, Davies FT(Jr) and Geneve RL 2002. Plant Propagatino- Priniciples and Practices 6e. Prentice-Hall India, New Delhi.

Holt DH 1998. Entrepreneurship- New venture creation.Prentice-Hall of India, New Delhi.

Kas J. 1989. Entrepreneurship: Creativity and Organization. Prentice Hall Englewood Cliffs, New Jersey.

Kochhar SL 1998. Economic Botany in tropics 2e. Macmillan India Ltd., New Delhi.

Nandan H 2011.Fundamentals of Entrepreneurship 2e. PHI Learning Pvt. Ltd., New Delhi.

Randhwa GS and Mukhopadhyay A 1986.Floriculture in India.Allied Publ., New Delhi.

Sabnis SD and Daniel M 1990.A phytochemical approach to economic botany. Kalyani Publ., New Delhi.

Sagwal SS 2010.A textbook of silviculture. Kalyani Publ., New Delhi.

Sharma OP 1996 Hill's Economic Botany. TMH Publ. Co. Ltd., New Delhi.

Singh B. 2012. Horticulture at glance. Kalyani Publ., New Delhi.

Singh BD 2013.Plant Biotechnology. Kalyani Publ., New Delhi.

Swaminathan MS and Kochhar SL 2003.Groves of Beauty and Plenty- An atlas of major flowering trees in India. Macmillan India Ltd. New Delhi.

M.Sc. Biochemistry
Semester I
Paper 1 (Code: 1T1)
Protein Biochemistry

Unit I: Proteins and Mass Spectrometry

Overview of protein structure, protein folding, Ramchandran plot, domains and modules, binding sites within proteins, protein sequencing.

Basics of Mass Spectrometry, Ionization mechanisms- protonation, deprotonation, cationization, transfer of charged molecules to gas phase, electron ejection, electron capture, Mass analyzers-TOF, Ion trap, Quadrupole, Ionization methods-Electron Impact (EI), Chemical Ionization (CI), Fast Atom Bombardment (FAB), Field Description (FD), Electron Spray Ionization (ESI), Matrix Assisted Laser Desorption Ionization (MALDI), Protein Identification using MS.

Unit II: Protein biosynthesis

Eukaryotic translation machinery, structure and assembly of the ribosome, initiation, elongation and termination of translation. Various factors involved in initiation, elongation and termination of translation. Formation of aminoacyltransfer RNA complex. Regulation of translation at genetic level.

Unit III: Protein sorting and degradation

Intracellular protein sorting, movement of proteins between cellular compartments: gated, transmembrane and vesicular transport. Protein transport and translocation to nucleus, mitochondria, chloroplast, peroxisomes, endoplasmic reticular system. Protein degradation.

Unit IV: Protein Engineering

Design and construction of novel proteins and enzymes, Conformation of proteins in general and enzymes in particular, Effect of amino acids on structure of proteins, Energy status of a protein molecule, Structure function relations of enzymes, Physical methods such as x-ray crystallography for determination of protein structure, Site directed mutagenesis for specific protein function, Basic concepts for design of a new protein/enzyme molecule, Specific examples of enzyme engineering, -Dihydrofolate reductase and Subtilisin.

Suggested References:

1. Modern Protein Chemistry: Practical Aspects Published: September 12, 2001 by CRC Press - 272 Pages Edited By: Gary C. Howard
2. Biochemistry. 5th edition. Berg JM, Tymoczko JL, Stryer L. New York: W H Freeman; 2002
3. Proteins: Structures and Molecular Properties: Thomas E. Creighton Publisher: W. H. Freeman 1992 Edition: Second Edition
4. Protein Engineering Protocols (Methods in Molecular Biology) Kristian Müller (Editor), Publisher: Humana Press; Softcover reprint of hardcover 1st ed. 2007 edition (November 10, 2010)
5. Protein Degradation Series, 4 Volume Set (v. 1) R. John Mayer (Editor), Publisher: Wiley-VCH; 1 edition (March 4, 2008)
6. Structural Aspects of Protein Synthesis Anders Liljashttp://www.amazon.com/Structural-Aspects-Protein-Synthesis-Anders/dp/981238863X/ref=sr_1_1?s=books&ie=UTF8&qid=1323503546&sr=1-1 - # (Author) Publisher: World Scientific Pub Co Inc; 1 edition (November 2004)
7. Protein Targeting, Transport, and Translocation Ross Dalbey (Editor), Publisher: Academic Press; 1 edition (May 13, 2002)
8. Principles of Physical Biochemistry- Kensl.E. van Holde, W. Curtis Johnson, P. Shing Ho, Pearson Prentice Hall, 2nd Edition.
9. Crystallography made crystal clear, 1993. G. Rhodes. Academic Press.
10. Principles and Techniques of Biochemistry and Molecular Biology, 6th Edition, Wilson Keith and Walker John (2005), Cambridge University Press, New York.
11. A textbook of biophysics, R. N. Roy, New Central Publication, 1st edition.

M.Sc. Biochemistry
Semester I
Paper 2 (Code: 1T2)
Advanced Enzymology

Unit I: Kinetics and Regulation of enzyme activity

Review of unisubstrate enzyme kinetics, multisubstrate enzyme kinetics, Co-operativity phenomenon, Hill and Scatchard plots, protein-ligand binding and its measurement, detailed mechanism of catalysis of serine protease, carbonic anhydrase, and PEP kinase, Metalloenzymes

Unit II: Allosteric enzymes and multienzyme systems

Allosteric enzymes, sigmoidal kinetics and its physiological significance, symmetric and sequential modes of action and their significance, immobilized enzymes and their industrial applications, study of multienzyme complexes with respect to occurrence, isolation and their properties and polygenic nature eg. pyruvate dehydrogenase and fatty acid synthase.

Unit III: Enzyme regulation

General mechanisms of enzyme regulation: Feedback inhibition and feed forward stimulation, repression and induction of enzymes, reversible and irreversible covalent modifications of enzymes, flexibility and conformational mobility of enzymes, convergent and divergent evolution of enzymes.

Unit IV: Bioenergetics and oxidative phosphorylation

Energy transformation, laws of thermodynamics, Gibbs energy, free energy change, redox potentials, phosphate potential, ion electrochemical potential, proton electrochemical potential, membrane potential, Chemi-osmotic theory, mitochondrial respiratory chain, order and organization of carrier proton gradients, Characterization of Iron- Sulphur proteins and Cytochromes, Q cycle, Respiratory controls and oxidative phosphorylation, ATP synthase complex.

Suggested References:

1. Enzymes: Biochemistry, Biotechnology and Clinical Chemistry-Trevor Palmer
2. Principles of Biochemistry- Lehninger, David L. Nelson and Michael M. Cox
3. Enzymes- Malcolm Dixon and Edwin Webb
4. Harper's Biochemistry- Harper
5. Biochemistry- Western and Todd
6. Cell and Molecular Biology-Gerald Karp
7. Fundamentals of Biochemistry-Donald Voet, Judith G. Voet and Charlotte W. Bratt

M.Sc. Biochemistry
Semester I
Paper 3 (Code: 1T3)
Biochemical Research Techniques

Unit I: Research Methodology

1. Introduction to research methodology: History and definition of research, role of theory, hypothesis, sampling, variables, randomness, selection of problem, purpose of research and research reporting
2. Experimental research: Early experimentation, experimental groups, control groups, variables, method of controlling variables, designing and validation of experiments
3. Methods and tools in research: Research tools and its reliability and validity, quantitative and qualitative studies, observation, inquiry forms, Q methodology, data collection, limitations and sources of error
4. Types of data Analysis: Descriptive data analysis, Inferential data analysis, Computer data analysis

Unit II: Biostatistics

Principles and practice of statistical methods in biological research, samples and populations, Basic statistics-average, statistics of dispersion, coefficient of variation, confidence limits, Probability distribution, normal, binomial and Poisson distribution. Mean variants, standard deviations and standard error, correlation and regression, test of statistical significance, and analysis of variance and covariance .

Unit III: Data Retrieval, Scientific Writing and Presentation

1. Information Search & Data Retrieval, Tools for Web Search , Data Retrieval Tools, Data Mining of Biological Databases.

2. Report Writing, Significance of report writing, different steps in report writing, types of report, layout of research paper.

3. Mechanics and precautions of writing research reports for scientific journals, popular magazines, seminars/symposia/ conferences/workshops, poster session.

4. Presentation– Oral & Written Presentations in classrooms, scientific meets & public audience. Defence of research thesis.

Unit IV: Computers

Introduction of computer networks- Topologies and designs; Basics of computer operating systems- windows and Linux; Introduction to Markup language-Hyper Text Markup Language (HTML) and Extensive Markup Language (XML); Spreadsheets and Presentation software.

Systems Biology-An introduction

Introduction to Metagenomics.

Suggested References:

1. Fundamentals of Biostatistics, Bernard A. Rosner, Thomson-Brooks/Cole, 2006
2. Research methodology in social, behavioural and life sciences: Designs, models and methods, Herman J Ader and Gideon Mellenbergh (Ed), SAGE Publications
6. Principles of Genome analysis and genomics, Primrose SB, Twyman RM, Blackwell Science (2002).
7. Biostatistics-A foundation for Health Science, Daniel WW, John Wiley (1983).
8. Statistical Methods, Medhi J, Willey Eastern Limited, (1992).

M.Sc. Biochemistry
Semester I
Paper 4 (Code: 1T4)
Plant Biochemistry

Unit I: Plant Cell and Photosynthesis

Structure of plant cell. Structure of plant cell membrane and cell wall.

Structure of chloroplast system. Photosynthetic pigments and their functions, Photo system I & II. Photosynthetic electron transport and photophosphorylation.

Calvin cycle(C3 plants), Hatch slack pathway (C4 plants), Crassulacean acid metabolism.

Unit II: Plant hormones and Tissue culture

Plant hormones: Biosynthesis, structure and biochemical mode of action of auxins, gibberellins, cytokinins, abscisic acid and ethylene. Other plant growth regulators

Plant tissue culture: Plant cell organs and culture, Somaclonal variation, protoplast isolation, fusion and culture of protoplasts, Application of plant tissue culture

Unit III: Plant respiration and Metabolism

Plant respiration: Carbohydrate, lipid and Protein metabolism. Cyanide sensitive and insensitive respiration.

Nitrogen metabolism: Development and structure of root nodules, Role of nod factors in nodule development. Structure of plant nitrogenase system, Symbiotic nitrogen fixation and and its regulation. Formation and assimilation of ammonia

Sulphur metabolism: Sulphate activation, Reduction of active sulphate, Oxidation of inorganic sulphur, incorporation of sulphur into amino acids.

Unit IV: Biochemistry of plant growth & stress physiology:

Biochemistry of seed and bud dormancy, Biochemistry of seed germination, factors affecting seed germination.

Structure and function of Phytochrome and Cryptochrome; Photoperiodism and Vernalization, Hormonal regulation of flowering.

Responses of plant to biotic (pathogens and insects) and abiotic (water, temperature and salt) stresses; Mechanism of resistance to biotic stress and tolerance to abiotic stress

Suggested References:

1. Plant physiology -Taiz & Ziger
2. Biochemistry and molecular Biology of plant-Buchanan
3. Plant physiology -M. Devlin
4. Plant pathology- George N. Agriose
5. Plant breeding- B.D. Singh
6. Germination of seed- A.M .Mayer & A. Mayber
7. Introduction of Plant Physiology -William Hopkins
8. Introduction to plant - Godwin & merser
9. Plant physiology - Mohit Warma

M.Sc. Biochemistry
Semester I
Practical 1 (Code: 1P1)
Protein Biochemistry and Enzymology

1. Estimation of protein by UV Spectrophotometer by E_{280}/E_{260} method
2. Estimation of Riboflavin by Arnold's fluorimetric method
3. Estimation of Thiamine by thiochrome method
4. Separation of proteins by PAGE
5. Seperation of proteins by SDS gel electrophoresis
6. Western Blotting
7. Purification of proteins by isoelectric precipitation
8. Molecular weight determination
9. Fractionation of cells by differential centrifugation
10. Assay of marker enzymes
11. To study the essentiality of co-enzymes in enzyme catalyzed reaction
12. Fractionation of human plasma proteins by precipitation
13. Assay of acid and alkaline phosphatase
14. Effect of environmental factors such as pH, temperature and inhibitors on alkaline phosphatase.
15. Measurement of initial velocity
16. To study kinetics of enzyme using Lineweaver-Burk, Eadie-Hofstee and Hanes Plots

M.Sc. Biochemistry
Semester I Practical 2
(Code: 1P2)
Biochemical Research Techniques and Plant Biochemistry

1. Absorption of water by live & dead seeds.
2. Changes in carbohydrate, protein content during germination.
3. Induction of proteinases, amylases, and lipase during germination.
4. Induction of vitamin C synthesis during germination.
5. Isolation and characterization of trypsin inhibitor.
6. Assay of peroxidase, catalase, phenol oxidase, ascorbic acid oxidase.
7. Isolation of plant DNA & RNA.
8. Estimation of carotene, ascorbic acid, phenols and tannins in fruits and vegetables.
9. Development of callus culture from meristems and leaves.

M.Sc. Biochemistry
Semester I
Seminar 1 (Code: 1S1)
Seminar

M.Sc. Biochemistry
Semester II Paper 5
(Code: 2T1)
Immunology

Unit I: The Immune system, Immunoglobulins and TCR

History of Immunology, Innate Immunity: effector mechanisms involved; PAMPs, PRRs, Phagocytosis, Lysis, blocking, extra cellular killing etc . Biochemistry and biology of TLRs, Inflamatory processes, inflamamasomes interrelationship between innate and adaptive immunity.

Immunoglobulins and TCR

Immunochemistry: Antigen antibody reaction, its kinetics and thermodynamics; Structure, functions of immunoglobulins; Ig genes and their expression, Generation of Ab diversity. BCR, TCR, Organization and re-arrangement of TCR genes, TCR diversity.

Unit II:

Anatomy of Immune system

Immunological cells, tissues and organs. Maturation, activation and differentiation of B and T cells. MHC genes and their polymorphism, Structure and function of MHC molecules. Clonal selection theory Cell surface molecules : Ig super family, integrins , selectins , chemokine receptors and other accessory molecules, Cytokines and chemokines

Unit III:

Immune response by T and B lymphocytes

Cellular and molecular mechanisms of Ab production, humoral and cell mediated immunity, Antigen processing and presentation, T and B cell interaction. Super antigens.

Unit IV:

Immunological Techniques

Immunochemical techniques including immunodiffusion, RIA, EIA, agglutination, immunoflorescence, immunoelectron microscopy, immunoelectrophoresis. HLA typing, leukocyte migration inhibition technique, delayed hypersensitivity technique, cytotoxicity assay. Monoclonal Ab's, hybridoma and other technologies, Abzymes.

Suggested References:

1. Cellular and Molecular Immunology- 5th Edition, Abul K. Abbas, Andrew Litchman
2. Immunology-5th Edition, Richard A Goldsby, Thomas J. Kindt, Barbara A Osborne, Janis Kuby

Immunology- 6th Edition, Ivan Roitt, Jonathan Brostoff, David Male

M.Sc. Biochemistry

Semester II Paper 6

(Code: 2T2)

Clinical Biochemistry

Unit I: Automation in clinical biochemistry, gastric and blood disorders

Automation in Clinical Biochemistry- Instrumental concept, Selection of Instrument, Quality assurance, Control of pre-analytical and analytical variables, External and internal quality control measurements.

Gastric disorders: Disorders of gastric function, method of evaluation, pancreatic diseases, Steatorrhoea, Malabsorption syndrome test for their evaluation.

Blood Disorder: Review of mechanism of coagulation and fibrinolysis, abnormalities in blood coagulation, variation of plasma proteins, abnormalities of blood formation, anemia, haemoglobinopathies, clinical significance of fecal and urine analysis.

Unit II: Endocrinology I

Insulin and glucagon: Various types of hyperglycemia, Diabetes mellitus Ketonemia ,ketonuria , Experimental diabetes , Hypoglycemia, Polyurea, Glucose tolerance test.

Thyroid: Iodine metabolism, Hypo and Hyper thyroidism, B.M.R.and other test for evaluation of thyroid function.

Parathyroid: Calcium and phosphorus metabolism. Abnormalities of Parathyroid function and methods of evaluation.

Unit III: Endocrinology II

Adrenal: Addison's disease and pheochromocytoma, Disorders of steroid metabolism, Test for evaluation of adrenal functions.

Pituitary: Pituitary hormones, Clinical syndromes and their evaluation.

Unit IV: Liver disorders

Liver disorders: Jaundice, fatty liver and liver function tests. Renal function test

Cerebrospinal fluid: Composition in health and disease. Lipid profile in health and disease.

Elements of Clinical Enzymology: Isoenzymes in health and disease.

Clinical significance of GOT, GPT, Creatine kinase, LDH etc.

Biochemical diagnosis of disease by enzymatic evaluation.

Suggested References:

1. Clinical Biochemistry – Metabolic and Clinical aspects. By-William J. Marshall & Stephen K. Angert.
2. Harper's Biochemistry - 27th Ed.Text book of Medical Physiology - By Guyton.
3. Text book of Physiology -By Burn & levy.
4. Biochemistry –By L .Stryer (Freeman & Co.NY.)
5. Biochemistry with clinical correlation- By Thomas Devli.
6. The Metabolic Basis of Inherited Disease 5th Ed.-By John Stanbury.
7. Teitz Fundamentals of Clinical Chemistry –By C.A.Burtis & Ashwood .
8. Biochemistry - By Lehninger.
9. Lehninger's Biochemistry –By Nelson & Cox.
10. Biochemistry –By Stanford.
11. Basic Medical Biochemistry: A Clinical approach- By Smith.
12. Principles of Internal Medicines- By Harrison.T. R.
13. Practical Biochemistry Principles & Techniques- By Wilson & Walker.
14. Practical Biochemistry –By David Plummer.

M.Sc. Biochemistry

Semester II Paper 7

(Code: 2T3)

Cell Biochemistry

Unit I: Cell cycle and regulation

Review of cell cycle, divisional control, regulatory proteins, cyclin/cdk complexes, positive and negative regulation, inhibitory molecules, restriction points, regulation of DNA synthesis, regulation of degradation, check points, cell cycle arrest, role of cyclically activated protein kinases, transcriptional regulation.

Unit II: Cell communication I

General principles of cell communication, extra cellular signals and their receptors, autocrine signaling and role of gap junctions, types of cell receptors, relay of signal and intracellular signal proteins, regulated proteolysis dependent signaling pathways (Notch, Wnt, hedgehog, NFKB)

Unit III: Cell communication II

Informational transactions in eukaryotic cells- cyclic AMP facet, Study of G-proteins, signaling through G-protein linked cell surface receptors, signaling through enzyme linked cell surface receptors, Calcium messenger system, signaling via GMP.

Unit IV: Cancer

Causes and types of cancer, viral carcinogenesis, tumor suppressors, oncogenes and signal transduction, growth and spread of cancer, molecular basis of cancer therapy, molecular markers.

Programmed cell death and its regulation in normal physiology, regulation and execution of mammalian apoptosis, cytokine signaling and role of apoptosis in tumor genesis.

Suggested References:

1. Molecular Biology of the Cell: Alberts 5th Edition 2007 NCBI Publication
2. Principles of Biochemistry: Lehninger WH Freeman
3. Biochemistry of Signal Transduction and Regulation - Gerhard Krauss Wiley VCH 3rd Revised Edition
4. Molecular Cell Biology: Lodish 6th Edition, WH Freeman & Company
5. The Cell: Cooper 2nd Edition ASM Press
6. Gene IX: Benjamin Lewin Published by Pearson Prentice Hall
7. Cell and Molecular Biology: Gerald Karp
8. Molecular Biology: Robert Weaver 1st Edition, WCB McGraw-Hill
9. Molecular Biology of the Gene: Watson 6th Edition, Pearson Publication
10. Gene Regulation: A Eukaryotic Perspective: David Latchman 5 illustrated , Taylor & Francis, 2005
11. The Cell- G. M. Cooper

M.Sc. Biochemistry
Semester II
Paper 8 (Code: 2T4)
Molecular Biology

Unit I: Eukaryotic and Prokaryotic chromosomes

Chromatin structure: Histones, DNA, nucleosome morphology and higher level organization; Functional states of chromatin and alterations in chromatin organization. **Chromosome organization**: Metaphase chromosomes: centromere and kinetochore, telomere and its maintenance; Holocentric chromosomes; Heterochromatin and euchromatin, position effect variegation; Chromosomal domains (matrix, loop domains) and their functional significance.

Organization of nuclear and organellar genomes; C-value paradox, Repetitive DNA-satellite DNAs and interspersed repeated DNAs, Transposable elements, LINES, SINES, Alu family and their application in genome mapping

Concept of a gene: Conventional and modern views. Fine structure of gene, split genes, pseudogenes, non-
coding genes, overlapping genes and multi-gene families.

Unit II: Replication and Recombination

Replication: Review of replication in bacteria, plasmid and viruses, Models of DNA replication. DNA replication in eukaryotes. Eukaryotic DNA polymerases and their roles, origin of replication, Autonomously Replicating Segments (ARS) in yeast, elongation, lagging strand synthesis, and termination.

Recombination: DNA recombination: Homologous, site specific and transposition, Homologous recombination: Holliday Model, Messelsson -Radding Model, Rec BCD pathway. Site specific recombination: Lambda phage ingration, and excision rearrengement,of immunoglobulin genes. Transposition: Prokaryotic transposition, Insertion sequence,s, and mere complex transposons (eg Tn3), conservative and replicative transposition. Eukaryotic transposable elements: yeast and Drosophila transposons, retroviruses, and retrovirus like elements.

Unit III: Transcription

Review of prokaryotic transcription, transcription in eukaryotes: Eukaryotic RNA polymerases and their subunit structure, Class I, II and III promoters, Upstream elements, enhancers and silencers, General transcription factors, Class I, II, III genes and their functions elongation factors, TBP structure and its role in transcription, mediators. Structure of transcription activators, zinc fingers, homeodomains, helix loop helix, bZIP, beta barrels. **Unit IV: Viruses**

General properties of viruses (size, shape, composition of viral capsid, spikes, envelope and nucleic acids).

Viral classification in brief, Baltimore classification. Structure and composition of DNA viruses (Herpes virus & Adenovirus) and RNA viruses (HIV).

Tumor viruses (HBV, HTLV, HPV) structure and mechanism of oncogenesis.

Structure and life cycle of Lambda and M13 bacteriophages.

Laboratory diagnosis of viral diseases.

Mechanism of action of **Antiviral drugs** (Acyclovir, Foscarnet, Nevirapine, Saquinavir, Oseltamivir).

Suggested References:

1. Molecular Biology of Gene: Watson.
2. .Cell & Molecular Biology: Devlin.
3. Biochemistry: Voet & Voet.
4. Molecular biology-Lodish, Baltimore.
5. Genetics 1and 2-C.B.Power.
6. Molecular biochemistry –Robert Weaver.
7. Virology by Luria
8. Understanding Viruses-Teri Shors, Jones and Bartlett Publishers, Massachusetts, edition 2009.

1. Gene 7: Benjamin Lewin
2. Biochemistry: Lehninger, Nelson & Cox
3. Molecular Biology: David Frifelder
4. Genetics-Russell.
5. Molecular biology-Watson
6. Microbiology by Davis

M.Sc. Biochemistry

Semester II

Practical 3 (Code: 2P1)

Clinical Biochemistry and Immunology

1. Determination of serum and urine Creatinine by Jaff's method.
2. Determination of serum Bilirubin by Malloy & Evllyn method.
3. Determination of serum Chloride by Schales & Schales method.
4. Estimation of blood urea by Nesslerisation method.
5. Estimation of Serum amylase (E.C.3.2.1.1).
6. Estimation of Serum Cholesterol by Single Step Method (Libermann & Burchard).
7. Determination of Serum Uric Acid by Henry Caraway's method.
8. Determination of Icteric Index, SGOT, SGPT and alkaline phosphatase activity
9. Routine Urine Analysis.
10. Quantitative Estimation of T3, T4 and TSH
11. To determine Urinary VMA (3-methoxy 4 –Hydroxyl Vanillin Mandellic Acid).
12. Glucose Tolerance Test.

M.Sc. Biochemistry

Semester II Practical 4

(Code: 2P2) Cell and Molecular Biology

1. Use of Simple, Compound and Phase Contrast Microscopes
2. Isolation, culture and cell counting of lymphocytes
3. Adherent cell line: Trypsinization, cell count, subculturing
4. MTT assay
5. Isolation of DNA from Bacteria and Blood
6. Assessment of purity of DNA by 260/280 ratio
7. Isolation of plasmid DNA: Mini Prep, Midi Prep and Maxi Prep.
8. Restriction digestion of DNA
9. Ligation of DNA
10. Separation of DNA fragments by Electrophoresis.
11. Southern Blotting & Northern Blotting

M.Sc. Biochemistry

Semester II Seminar

2 (Code: 2S1) Seminar

M.Sc. Biochemistry
Semester III
Paper 9 (Code: 3T1)
Advanced Molecular Biology

Unit I: Regulation of eukaryotic gene expression at transcriptional level

Overview of transcription by RNA Polymerases I, II, and III
Anatomy of a protein-coding gene
Basal transcription by RNA polymerase II: Subunits of Pol II; general transcription factors;
Activators, How the initiation complex is assembled, How initiation occurs.
Speeding up the process: Enhancers, TAF's and how they work
Regulated transcription: transcription factors: Zinc-fingers (Sp1; the first such factor identified)
Leucine zippers, Basic helix loop helix, Homeodomains, DNA binding domains, Activating domains
RNA Elongation: HIV TAT/TAR
RNA polymerase III and regulation of 5S rRNA

Unit II: Regulation of eukaryotic gene expression at post translational, translational and post-translational levels

Regulation at tpst-transcriptional level: Effect of cap and polyadenylation on splicing, trans and alternative splicing, RNA editing, mRNA stability and transport.
Regulation at Translational level: Global regulation through eIF2 and eIF4E/eIF4E-BP. Specific regulation through 5' UTRs using RNA structure e.g. ODC. Specific regulation through 5' UTR/protein interactions e.g. ferritin in eukaryotes and ribosomal proteins in prokaryotes. Specific regulation through 3' UTRs e.g. 15-LOX
Regulation at post-translational level: Control of the level of active proteins, regulation of proteolysis

Unit III: Regulatory RNAs

Historical background, RNA interference as regulatory mechanism in eukaryotes Slicer and dicer, synthesis and function of RNAi molecules in plants, chromatin remodeling in human disease and diagnosis.

Unit IV: Epigenetics

Background, chromosomal inheritance taking fission yeast as an example, DNA methyltransferases, DNA methylation maintenance, histone modification and regulation of chromatin structure, bivalent histones, DNA demethylation, histone demethylation.

Suggested References:

1. Molecular Biology of the Cell: Alberts 5th Edition 2007 NCBI Publication
2. Principles of Biochemistry: Lehninger WH Freeman
3. Biochemistry of Signal Transduction and Regulation - Gerhard Krauss Wiley VCH 3rd Revised Edition
4. Molecular Cell Biology: Lodish 6th Edition, WH Freeman & Company
5. The cell: Cooper 2nd Edition ASM Press
6. Genes IX: Benjamin Lewin Published by Pearson Prentice Hall
7. Cell and Molecular Biology: Gerald Karp
8. Molecular Biology: Robert Weaver 1st Edition, WCB McGraw-Hill
9. Molecular Biology of the Gene: Watson 6th Edition, Pearson Publication
10. Gene Regulation: A Eukaryotic Perspective: David Latchman 5 illustrated , Taylor & Francis, 2005

M.Sc. Biochemistry
Semester III
Paper 10 (Code: 3T2)
Biotechnology

Unit I: rDNA technology

Genomic and cDNA libraries, DNA manipulation enzymes, isolation of specific genes.

Gene cloning: REs, vectors-plasmids, cosmids phage vectors, M13 phage vectors, phagemids expression vectors with strong promoters, inducible, vectors produce fusion proteins and their isolation, Eucaryotic expression system, shuttle vectors, YAC, BAC insertion of DNA and its ligation to carrier DNA, introduction of DNA in cells, gene synthesis, gene libraries.

Application of recombinant DNA technology in medicine, agriculture industry and environmental sciences.

Unit II: Gene control systems in bacteria and bacteriophage lambda:

Mechanism of induction and repression, constitutive expression various control mechanisms, positive

regulation, negative regulation, attenuation, operon hypothesis with special reference to mal/gal, ara and histidine operons, Regulatory mechanisms in bacteriophage lambda.

Regulation of gene expression at various levels (transcription, post transcriptional and translational)

DNA-protein interactions: Lambda family of repressor, trp repressor.

Unit III: Biochemical engineering: Biochemical Engineering: Bioreactors and related equipment and instrumentation, types of bioreactor (Batch, semi batch, CSTF, recycle etc), reactor analysis, reactor design, reactor for recombination proteins.

Fermentation technology: Fermentation technology, microbial culture reaction, genetic modification, use of mutants, recombinant DNA technology and application in fermentation technology, microbial growth kinetics, sterilization, fermentation process kinetics, analysis of rate pattern and kinetic groups, fermentation process types, control of environmental variables, recovery of fermentation products, isolation and purification and use of immobilization techniques.

Unit IV: Bioinformatics and Drug Designing

Introduction to Bioinformatics: Applications of Bioinformatics, Bioinformatics resources

Biological Databases: Overview to Biological Databases, Nucleotide Databases (GenBank, DDBJ, ENA), Protein sequence databases (Uniprot, Swiss prot, Prosite , Pfam, Prodom), Protein structure databases (PDB, SCOP, CATH)

Sequence analysis: Sequence similarity search, BLAST, FASTA, CLUSTAL

Genomics: Introduction to Genomics, Comparative Genomic Databases, Objective of Genome Comparisons, Genome Alignments

Proteomics: Overview of Proteomics, Experimental Techniques, Bioinformatics Approaches, Protein-Protein

Interaction, Databases and software

Softwares for Drug Designing. Structure Based Drug Designing, Ligand Based Drug Designing.. Virtual Screening. Homology Modeling and Chimera Generation

Suggested References:

1. Molecular Biology of the Cell: Alberts 5th Edition 2007 NCBI Publication
2. Principles of Biochemistry: Lehninger WH Freeman
3. Biochemistry of Signal Transduction and Regulation - Gerhard Krauss Wiley VCH 3rd Revised Edition
4. Molecular Cell Biology: Lodish 6th Edition, WH Freeman & Company. 5. The cell: Cooper 2nd Edition ASM Press
5. Genes **IX**: Benjamin Lewin Published by Pearson Prentice Hall. 6. Cell and Molecular Biology: Gerald Karp
6. Molecular Biology: Robert Weaver 1st Edition, WCB McGraw-Hill
7. Molecular Biology of the Gene: Watson 6th Edition, Pearson Publication
8. Gene Regulation: A Eukaryotic Perspective: David Latchman 5 illustrated , Taylor & Francis, 2005
9. Molecular Biotechnology: Principles and Applications of Recombinant DNA technology
10. Principles of gene manipulation and genomics S. B. Primrose, Richard M. Twyman Publisher: Wiley-Blackwell; 7 edition (February 17, 2006)
11. Principles of Fermentation Technology, P. F. Stanbury (Author), S. Hall (Author), A. Whitaker (Author) Publisher: Butterworth-Heinemann; 2 edition (February 19, 1999)
12. Bioinformatics: A practical guide to the analysis of genes and proteins. Baxevanis A.D and Ovellette B.F.F., Wiley-Interscience, (2002).
13. Molecular and Biotechnology. A comprehensive desk reference, R.A. Meyes (Ed.) VCH Publishers Inc. (1995)
14. 3. Textbook of Biotechnology Das H.K., Wiley Dreamtech India Pvt Ltd, (2004).

M.Sc. Biochemistry
Semester III
Core Elective 1
Paper 11 (Code: 3T3A) Biochemical &
Environmental Toxicology

Unit I: General principles of Toxicology

Definition, Different facets of toxicology and their interrelationships, Classification of toxic agents. Desired and undesired effects.

Various factors affecting toxicity: vehicles, formulation factors, biological half life, volume and concentration, dose, dosage forms, routes of administration / entry, genetic status etc.

Principles of selective toxicity: comparative morphology, comparative biochemistry, comparative cytology.

Toxicity assessment: acute, subchronic, chronic exposure, determination of ED50 and LD50 values, tests for mutagenecity, carcinogenicity, genotoxicity, Ames test.

Unit II: Disposition of Toxicants

Factors affecting disposition of toxicants: absorption, distribution, biotransformation, elimination.

Absorption through gastro-intestinal tract, lungs, skin.

Distribution: storage in tissues, blood-brain barrier, passage across placenta, redistribution.

Biotransformation, Phase I and II reactions, metabolic interrelationship, antidotal therapy.

Excretion: urinary, fecal, exhalation, other routes.

Toxicokinetics: classic and physiologic.

Unit III: A) Non –organ directed toxicity

Chemical carcinogenesis: definition, mechanism.

Genetic toxicology: definition, health impacts and mechanism of induction of genetic alterations.

Developmental toxicology: definition, principles, mechanism and pathogenesis of developmental toxicity.

B) Environmental Toxicology

Air pollution: definition, air pollutants, health effects and risk assessment of air pollution.

Introduction to Ecotoxicology

Unit IV: Target organ toxicity

Skin: skin as a barrier, dermatitis, acne, urticaria

Toxic responses of the blood: blood as a target organ, toxicology of erythron, leukon and platelets.

Toxic responses of the liver: physiology and pathophysiology, factors in liver injury, mechanism of liver injury.

Toxic responses of the respiratory system: lungs structure and functions, pulmonotoxic agents, pathogenesis of chemical induced damage, acute and chronic responses of lungs to injury.

Suggested References:

1. Casarette and Doull's Toxicology by Klaassen CD
2. Biochemical Toxicology of Environmental Agents by Bruine D.
3. Detoxification mechanisms by Williams RT
4. Selective Toxicity by Albert A.
5. Developmental Toxicology by Hood RD.

M.Sc. Biochemistry
Semester III
Core Elective 1
Paper 11 (Code: 3T3B)
Nutritional Biochemistry

Unit I: Basic Concepts:

Basic Concept: Energy content of foods. Measurements of energy expenditure: Direct & Indirect calorimetry. Definition of BMR and SDA and factors affecting these. Thermogenic effects of foods. Energy requirements of man and woman and factors affecting energy requirements.

Role of dietary fibers in nutrition.

Unit II: Nutritional Disorders:

Protein Energy Malnutrition (PEM): Aetiology, Clinical features, Metabolic disorders and Management of Marasmus and Kwashiorkor diseases. Hypo and hyper thyroidism,

Disorders of Mineral Metabolism: Hypercalecemia, Hypocalcaemia, Normocalcemia, Hyperphosphatemia.

Unit III: Starvation and Antinutrients:

Starvation: Techniques for studying starvation, protein metabolim in prolonged fasting, protein sparing treatments during fasting. Concept of high protein, low calorific weight reduction diets.

Antinutrients: Naturally occurring food borne toxicants, protease inhibitors, hemagglutins, hepatotoxins, allergens, oxalates, toxins from mushrooms, animal food stuffs and sea foods.

Unit IV: Clinical Nutrition and Food Allergies:

Clinical Nutrition: Role of diet and nutrition in the prevention and treatment of diseases: dental caries, Fluorosis, Atherosclerosis & Rheumatic disorders .Inherited metabolic Disorders: Phenylketonuria, Maple Syrup disease & Hemocystinuria.

Food Allergies: Definition, role of antigen, host and environment, types of hypersensitivities, diagnosis and treatment of allergy.

Suggested Reading:

1. **Basics of clinical nutrition:** author- y.k. joshi**,** jaypee publication
2. **Nutrition for the community:** Gully baba publishing house

Essentials of human nutrition: author-jim mann & stewart truswell; oxford university press

3. **Introduction to human nutrition**
   edited by- professor michael gibney (ucd institute of food and health), professor susan lanham-new (university of surrey) professor aedin Cassidy, (university of east anglia) , professor hester vorster (north-west university, south africa) http://www.nutritionsociety.org/publications/textbooks/introduction-to-human-nutrition#sthash.tdyscawh.dpuf
4. **Nutrition and metabolism**
   edited by- professor susan lanham-new (university of surrey), professor ian macdonald (university of nottingham) professor helen roche, (unviersity college dublin) - http://www.nutritionsociety.org/publications/textbooks/nutrition-and-metabolism#sthash.iusrjtiu.dpuf

M.Sc. Biochemistry
Semester III
Core Subject centric 1
Paper 12 (Code: 3T4)
Bioresearch Techniques I

Unit I: Flow cytometry

Principles of flow cytometry, Instrument overview, principle of fluorescence, sample preparation, data analysis and applications of flow cytometry. Overview, Fludics, Generation of Scatter and fluorescence (Optical bench, optical filters, signal detection, Treshold), Data Analysis, (Data Collection and Display, gating, data analysis for subsetting applications, Data analysis for their applications) Sorting, Lasers, and Alignment (Working of lasers and laser alignment)

Unit II: Animal cell culture techniques

Animal cell Culture: Cell culture (adherent and suspension), basic equipment, cell culture media-Components, sterility, buffering capacity, growth requirements, supplementation of serum antibiotic and antimycotic agents, preparation of medium, advantages and limitations of Primary cell culture clonal cell lines, basic technique a of animal cell, subcultuing disaggregation, method for quantitation of cells in culture, counting chamber, counters, cell viability determination, cytotoxicity assay and its applications, cell apoptosis assay and its applications, 3 D cultures.

Unit III: DNA techniques

Isolation, Sequencing, Restriction Nucleases, Gel Electrophoresis, DNA probes Nucleic acid hybridization: Southern blotting, DNA fingerprinting and DNA typing, DNA Library,
DNA sequencing: Sanger and Maxam Gilbert,
Restriction Mapping, DNase foot printing, DMS foot printing, knockouts
PCR: RFLP, RAPD, AFLP, SNP

Unit IV: RNA techniques

Isolation, Hybridization, Northern Blotting, in vitro labelling with radioisotopes and chemical markers,
Mapping and quantifying transcripts: S1assay, primer extension, run off transcription
Transcription rate measurement in vivo: Nuclear run on transcription, reporter gene N transcription. si RNA technology/ gene silencing techniques, its applications, microarrays, ribozyme technology.

Suggested References:

1. Molecular Biology of The Cell: Alberts 5th Edition 2007 NCBI Publication
2. Principles of Biochemistry: Lehninger. WH Freeman
3. Biochemistry of Signal Transduction and Regulation- Gerhard KraussWiley VCH 3rd Revised Edition
4. Molecular Cell Biology: Lodish 6th Edition, WH Freeman & Company
5. The cell: Cooper 2nd Edition ASM Press
6. Gene IX: Benjamin Lewin, Published by Pearson Prentice Hall
7. Cell and Molecular Biology: Gerald Karp
8. Molecular Biology: Robert Weaver 1st Edition, WCBNMcGraw--- Hill
9. Molecular Biology of the Gene: Watson 6th Edition, Pearson Publication
10. Gene Regulation: A Eukaryotic Perspective: David Latchman 5 illustrated, Taylor & Francis, 2005.

M.Sc. Biochemistry
Semester III
Practical 5 (Code: 3P1)
Biotechnology and Molecular Biology

1) Fermentation
    i) Isolation of microorganisms from soil demonstrating synthesis capability of desired product, Gram staining (Desired property to be decided by the instructor), and screening
    ii) Optimization of the lab scale production of the desired product: Effect of temperature, pH, substrate concentration
    iii) Growth curve: Estimation of cell number, substrate utilization and/or product formation.
2) Polymerase Chain Reaction
    i) PCR amplification from genomic DNA
    ii) Nested PCR
    iii) Random Amplification of Polymorphic DNA (RAPD)
3) Restriction Fragment Length Polymorphism (RFLP)

M.Sc. Biochemistry
Semester III Practical 6
(Code: 3P2A)
Biochemical & Environmental Toxicology

1. Qualitative detection of various toxicants in biological samples:
   Phenothiazine derivatives, Organochlorine compounds (Fujiwara test), Phenol, Methanol, Arsenic (As), Antimony (Sb), Selenium (Se), Mercury (Hg), Bismuth (Bi), Fluoride (F), Boron (Bo), Gutzeit test for Antimony (Sb) and Arsenic (As), Spot test for metal toxicants.
2. Quantitative determination of Salicylate, Paracetamol (acetaminophen), Sulphonamide in biological samples.
3. Enzyme assay in toxic conditions:
   GOT (AST), GPT (ALT), Acid phosphatase, Alkaline phosphatase, Acetyl cholinesterase etc.
4. Construction of dose-response curves.
5. Determination of LD50 value of a toxicant.
6. Induction of hepatotoxicity / diabetes / skin lesions / teratogenesis.
7. Assay of biomarkers of environmental pollution / toxicity.

M.Sc. Biochemistry
Semester III
Practical 6 (Code: 3P2B)

1. Determination of Calcium in food samples.
2. Determination of Inorganic Phosphorous in food samples.
3. Determination of Iron in food samples.
4. Determination of beta carotene in carrots by column chromatography
5. Determination of Ascorbic Acid in food
6. Estimation of Amylase activity
7. Determination of Total Lipids By Sulphophospho vanillin Method

M.Sc. Biochemistry

Semester III Seminar
3 (Code: 3S1) Seminar

M.Sc. Biochemistry
Semester IV Paper 13
(Code : 4T1)
Advanced Clinical Biochemistry

Unit I: Aging and Neurological Disorders

Current view and theories of aging, auto immune connection and HLA association, processes of aging and biochemical alteration, DNA damage, protein oxidation and axonal transport in aging, nutritional intervention as anti-aging therapy.

Alzheimer's disease: Causes, symptoms, diagnosis, pathogenesis, genetics, APP, ApoE, PS2, tau protein, risk factors and therapeutic approaches.

Progeria. Parkinson's disease: Causes, symptoms, diagnosis, pathogenesis, genetics and therapeutic approaches

Unit II: Obesity

Theories, lipid metabolism, adipose tissue anomalies.

Genetic basis of familial obesity, effects of neuropeptides and leptin in nutrient partitioning.

Obesity related derangements in metabolic regulation. Therapeutic approaches

Unit III: Molecular and Metabolic Diseases

Human gene map, genetic diversity, polymorphism, genetic linkage, chromosomal disorder. Monogenetic Disorders: Autosomal dominant, autosomal recessive, X-linked, Multifactorial disorders, Genetic heterogeneity. Allelic heterogeneity, Pathogenesis of genetic disease, Galactosemia, Hemophilia, Sickle cell anemia, Muscular dystrophy, Hypercholesterolemia, Gout, Turner's syndrome.

Unit IV: Reproductive Biochemistry

Overview of reproductive system and reproduction, biochemistry of reproductive disorders (male & female), Influence of various factors in reproduction with special reference to role of prostaglandins and gonadotrophins. Mechanism and methods of birth control and possible biochemical consequences thereof. Biochemical marker's in infertility disorders. Techniques involved in assisted reproductive technology (ART). Culture media and cell culture techniques in ART programme.

Suggested References:

1. Clinical Biochemistry – Metabolic and Clinical aspects By-William J. Marshall & Stephen K. Angert.
2. Harper's Biochemistry - 27th Ed.
3. Text book of Medical Physiology - By Guyton.
4. Text book of Physiology -By Burn & levy.
5. Biochemistry –By L .Stryer (Freeman & Co.NY.)
6. Biochemistry with clinical correlation- By Thomas Devli.
7. The Metabolic Basis of Inherited Disease 5th Ed.-By John Stanbury.
8. Teitz Fundamentals of Clinical Chemistry –By C.A.Burtis & Ashwood .
9. Biochemistry - By Lehninger.
10. Lehninger's Biochemistry –By Nelson & Cox.
11. Biochemistry –By Stanford.
12. Basic Medical Biochemistry: A Clinical approach- By Smith.
13. Principles of Internal Medicines- By Harrison.T. R.

14. Practical Biochemistry Principles & Techniques- By Wilson & Walker.
15. Practical Biochemistry –By David Plummer.

M.Sc. Biochemistry
Semester IV Paper 14
(Code: 4T2) Advanced Immunology

Unit I: Introductory Immunobiology

Complement system: Alternative and Classical pathway of complement activation

Immune networks: Homeostasis in the immune system-termination of normal immune responses, network hypothesis

In vivo immunity to viruses, bacteria, fungi, protozoa, worms etc

Unit II: Immunological tolerance and Autoimmunity

Immunologic tolerance, T lymphocyte tolerance- central and peripheral, Apoptosis in Lymphocytes- pathways and biochemical mechanisms, effector mechanisms, Tolerance induced regulatory T cells, B lymphocyte tolerance- Central and Peripheral, Homeostasis in the immune, pathogenesis and therapeutic approaches to autoimmunity.

Unit III: Tumor and Transplantation Immunology, Hypersensitivity

General features of tumor immunity, tumor antigens, Immune response to tumor and evasion, Immunotherapy, Types of hypersensitivity, Effector mechanisms of immunologic tissue injury and disease.

Unit IV: Immunodeficiency and Vaccinology

MHC and disease susceptibility, immune deficiency disorders, Active immunization (immune prophylaxis), passive immunization, adjuvants, modern approaches to vaccine development, role of vaccines in the prevention of disease.

Suggested References:

1. Cellular and Molecular Immunology- 5th Edition, Abul K. Abbas, Andrew Litchman
2. Immunology-5th Edition, Richard A Goldsby, Thomas J. Kindt, Barbara A Osborne, Janis Kuby
3. Immunology- 6th Edition, Ivan Roitt, Jonathan Brostoff, David Male

M.Sc. Biochemistry
Semester IV
Paper 15 (Code: 4T3A)
Clinical Research

Unit I: Pre-Clinical Research:

Animal studies, acute & chronic toxicity of drugs; regulations for number & types of animals, protocols for animal experimentation. Biochemical & histopathological studies of animals after drug administration. Mechanism & cause of death. Routine toxicity studies & special toxicity studies; carcinogenicity, mutagenicity & teratogenicity to be given special emphasis.

Unit II: Phases of Clinical Research

Phases of clinical research, number of volunteers in phase I & types of patients in phase II to IV. Importance of these investigations. Post marketing surveillance (PMS) & pharmacovigilence in case of clinical investigations after marketing authorization. Importance of ethical committee, protocol design, documentation in clinical trials. Bio Availability and Bio Equivalence studies Pharmacokinetics, Pharmacodynamics, Genomic studies

Unit III: Good lab practices

Good Clinical Practices, Good Manufacturing Practices and Good Laboratory Practices Principles of ICH-GCP, History GCP, declaration of Helsinki, Belmont report, Nuremberg code, Tuskgee trial. Schedules Y and its amendments, ICMR Guidelines Composition, functions & operations of IRB/IEC ethics of clinical trials Health Authorities- CDSCO, US-FDA, EMEA and other

Unit IV: Roles and Responsibilities of different stake holders in Clinical Research- Sponsor, CRO, SMO, Ethics Committee, Investigator, CRA, CRC, Patients and other, Departments in Clinical Research- Operations, Business Development, Regulatory, Pharmacovigilance, Data Management, Centralized Monitoring, Quality, Finance. Important documents in Clinical Research and importance of documentation in Clinical Research. Stages in clinical trial-Feasibilities, PSSV, SIV, SMV and Close-out visits, Audits and Inspections

Suggested reading:

1. Clinical Research Coordinator Handbook Norris, Deborrah Plexus Publications 2004/06/01
2. Clinical Research Methodology and Evidence-Based Medicine Babu, Ajit N Anshan 2008/05/30
3. Conducting Clinical Research Judy Stone Biblio Distribution 2006
4. Essentials of clinical research Stephen P Glasser (Edt) Springer Verlag 2008

M.Sc. Biochemistry
Semester IV
Paper 15 (Code: 4T3B)
Applied Nutritional Biochemistry

Unit I: Clinical nutrition

Role of a dietician: role and responsibilities of a dietician, nutrition counseling, professional ethics and obligations.

Diet therapy-Rationale for diet therapy (normal diet, modifications of the diet to the light diet, soft

diet, full liquid diet, clear liquid, tube feeding); Routes for diet therapy-enteral and parental; use of biochemical parameters in the planning of diets, use of computers in the planning of diets.

Unit II: Nutritional Counselling and Dietetics

Nutritive value of different food groups and changes due to cooking in various food groups.

Storage of foods, food quality and factors affecting food quality. Control of food quality. Use of additives, Classification and applications.

Unit III: Community Nutrition

Opportunities in community Nutrition, Assessing Community Resources, assessing target population, program planning, Assessing community's nutritional resources, Food insecurity, food assistance programs, world hunger and food insecurity. Principles of nutrition education and policy making, national nutrition agenda.

Unit IV: Applied Nutrition and Public Health

Concept of Health, Nutrition and Public Health Nutrition, Demographic trends in India and the significance of certain indices of Health and Nutrition situation of a community IMR, MMR, TFR, Birth rate, Death rate, Life expectancy etc.) Major nutritional problems in developing countries. Dietary surveys-methods, ways of interpretations and analysis, recommendations based on survey findings. Assessment of nutritional status: biochemical and anthropometry.

Suggested Reading:

1. Clinical nutrition

Edited by- Professor Merinos Elias (university of 24Southampton) Professor olla Ljungqvist (Karolinska institute & Orebro university hospital) dr 24out ham 24out amp (university of 24Southampton professor Susan Latham-new (University of Surrey)

2. Public health nutrition

Edited by- Professor Michael Gibney (Ucd institute of food and health) professor Barrie Margetts (university of Southampton) Dr john Kearney (Dublin institute of technology)

Professor Lenore Arab. (University of California Los Angeles)

3. Staying healthy with nutrition. authors- Elson m. Hass, Buck Levin

American dietetic association complete food and nutrition guide: Roberta Larson Duyff

M.Sc. Biochemistry
Semester IV
Core Subject centric 2
Paper 16 (Code: 4T4)
Bioresearch Techniques II

UNIT I

Biochemical methods I - Co-immunoprecipitation, BiFC bimolecular fluorescence complementation, affinity electrophoresis, Pull down assays, label transfer, yeast two hybrid screens, phage display

UNIT II

Biochemical methods II- *In-vivo* crosslinking of protein complexes using photo-reactive amino acid analogs, Tandem affinity purification (TAP), Chemical cross-linking, SPINE (Strepprotein interaction experiment)' Quantitative immunoprecipitation combined with knock-down (QUICK), Proximity ligation assay (PLA) *in situ.*

UNIT III

Biophysical and theoretical methods I:

Bio-Layer Interferometry
Dual polarisation interferometry (DPI)
Static light scattering (SLS)
Dynamic light scattering (DLS)
Surface plasmon resonance

UNIT IV

Biophysical and theoretical methods II:

Fluorescence polarization/anisotropy
Fluorescence correlation spectroscopy
FRET, BRET
2D-FT NMR spectroscopy
Protein–protein docking
Isothermal Titration Calorimetry (ITC)
Isothermal Titration Calorimetry (ITC)

Suggested References:

1. Molecular Biology of The Cell: Alberts 5th Edition 2007 NCBI Publication
2. Principles of Biochemistry: Lehninger WH Freeman
3. Biochemistry of Signal Transduction and Regulation--- Gerhard Krauss
Wiley VCH 3rd Revised Edition
4. Molecular Cell Biology: Lodish 6th Edition, WH Freeman & Company
5. The cell: Cooper 2nd Edition ASM Press
6. Gene IX: Benjamin Lewin
Published by Pearson Prentice Hall
7. Cell and Molecular Biology: Gerald Karp
8. Molecular Biology: Robert Weaver 1st Edition, WCBNMcGraw--- Hill
9. Molecular Biology of the Gene: Watson 6th Edition, Pearson Publication
10. Gene Regulation: A Eukaryotic Perspective: David Latchman 5 illustrated, Taylor & Francis, 2005

M.Sc. Biochemistry
Semester IV
Practical 7 (Code: 4P1A)
Advanced Clinical Biochemistry & Immunology and Clinical Research

1. Demonstration of dialysis using blood filtrate (Protein Separation)
2. Immunology
    a. Quantitative Estimation of Antibody
    b. Precipitation Techniques : Double Immunodiffusion, Single (Radial) Immunodiffusion
3. Electrophoretic Techniques :Immuno-electrophoresis,Rocket Immunoelectrophoresis, Immuno-diffusion
4. To assay cathepsin D, ATPase (Na/K/Ca/Mg), Lipid peroxidase enzymes
5. Assay of Acetylcholine esterase activity in rat brain
6. Assay of monoamine oxidase.
7. Fractionation of tissues and assay of proteins
8. Assay of ornithine amino transferase
9. Glutathione Estimation
10. Organ / tissue morphology / histopathology
11. Assay of toxicant biotransformation enzyme-cytochrome P450.
12. Test for teratogenecity / carcinogenecity / Ames test.
13.

M.Sc. Biochemistry
Semester IV
Practical 7 (Code: 4P1B)
Applied Nutritional Biochemistry

1. Determination of total carbohydrate, Lipid and protein content in food
2. Determination of vitamin A, B, C, D. and E content in food
3. Concept of balanced diet and determination of calorific value of food.
4. Determination of antinutritional factors such as Trypsin inhibitor in food
5. Determination of mineral content of food such as sulphur, content in food.
6. Determination of essential amino acids such as methionine, tryptophan content in food
7. Determination of calcium, potassium, zinc, copper content in food.
8. Determination of fiber content and protein digestibility ratio of food
9. Determination of Triglycerides
10. Proximate Analysis of Food Samples.

M.Sc. Biochemistry
Semester IV
Practical 8 (Code: 4P2)
Research Project

M.Sc. Biochemistry

Semester IV Seminar
4 (Code: 4S1) Seminar

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY

DIRECTION NO. 43 OF 2016

DIRECTION GOVERNING THE EXAMINATION LEADING TO THE DEGREE OF MASTER OF COMPUTER MANAGEMENT (MCM)
Choice Based Credit System (CBCS)

WHEREAS the Maharashtra Universities Act No. XXXV of 1994 has come into force with effect from 22nd July,1994.

AND

WHEREAS the amendment to the said Act came to be effected from 2016-2017.

AND

WHEREAS the Faculty of Commerce at its meeting held on 14.2.2012 have decided to update and upgrade the existing syllabus for the award of the degree of Master of Computer Management commensurate with the curricula existing in the various Universities in India and with a view to include the latest trends in the commerce stream as well as to design it to suit to the needs of the industries and corporate houses as provided under Section 38(a) of the Act.

AND

WHEREAS the Coordinator of the Faculty of Commerce concurred with the recommendations of the Special Task Committee in Computer Application in the Faculty of Commerce .

AND

WHEREAS the Special Task Committee in Computer Application in its meetings held on 24.2.2016 updated the existing syllabi and recommended some modifications in the scheme of examination for postgraduate courses,

AND

WHEREAS the Coordinator, Faculty of Commerce has consented to the changes in the syllabus and the scheme of examination for the award of Master of Computer Management Degree,

AND

WHEREAS the Vice-Chancellor, Nagpur University, Nagpur approved the recommendations so made by the Special Task Committee in the Faculty of Commerce duly concurred by the Coordinator, Faculty of Commerce as required under Section 38 (a) of the Act .

AND

WHEREAS it is expedient to provide and Ordinance for the purpose of prescribing examinations leading to the degree of Master of Computer Management in the Faculty of Commerce and phasic repeal of Ordinance No. 21 of 1994 governing the existing course of Master of Computer Management.

AND

WHEREAS As per the Advice of the Vice Chancellor, Coordinator, Faculty of Commerce & Coordinator, Special Task Committee (Computer Application) in the meeting held on 4.1.2016 constituted sub-committee for syllabus restructuring of MCM with Semester pattern.

The Sub-committee submitted the Semester Draft Syllabus of MCM in meeting held on 24.2.2016.

Now, therefore, I, Dr. S. P. Kane, Vice-Chancellor, Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur in exercise of the powers vested in me under Section 14(8) of the Maharashtra University Act of 1994 do hereby issue the following direction:

This direction shall be called "DIRECTION REGARDING EXAMINATIONS LEADING TOTHE MASTER OF COMPUTER MANAGEMENT Choice Based Credit System (CBCS) IN THE FACULTY OF COMMERCE, RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR".

1. There shall be FOUR examinations leading to the degree of Master of Computer Management namely:

   Part-I

   (1) The Master of Computer Management (MCM) Semester - I Examination,

   (2) The Master of Computer Management (MCM) Semester - II Examination,

   Part-II

   (3) The Master of Computer Management (MCM) Semester - III Examination,

   (4) The Master of Computer Management (MCM) Semester - IV Examination,

2. The duration of the Degree Course under this shall be of two academic years. The MCM Semester - I Examination at the end of the first Semester and MCM Semester - II Examination at the end of the Second Semester in First Year and MCM Semester - III Examination at the end of the Semester - III and MCM Semester - IV Examination at the end of Semester - IV in Second Year.

3. The Examinations Specified in above paragraph (i.e., Paragraph – 2) above shall be held twice a year (Winter + Summer) at such places and on such dates as may be fixed by the University.

4. The details of the procedure for admission as well as eligibility for examination of:

(A) An applicant of the **MCMSemester – I** Examination shall have :

(i) Obtained a Bachelor degree of this University or an equivalent Bachelor Degree of any statutory University in any faculty.

(ii) Prosecuted a regular course of study for not less than one Semester in any recognized institution or college affiliated to the R. T. M. Nagpur University where the course will be conducted.

(B) An applicant of the **MCMSemester - II** Examination shall have :

Appeared MCM Semester – I Examination of this University

(C) An Applicant of MCM Semester - III Examination shall have passed MCM Semester - I and appeared in Semester - II Examination.

OR

Passed PGDCCA/Post B.Sc. Diploma in Computer Science & Application of Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur.

(D) An applicant of MCM Semester - IV Examination shall have passed MCM Semester - I, Semester - II or equivalent Diploma and appeared in Semester - III Examination.

Admission to Semester	**Candidate should have passed in following examinations**	**Candidate should have competed the term and filled examination form**
Semester - I	Degree Examination	-
Semester - II	-	Semester – I
Semester - III	PGDCCA /PGDCS/ Semester-I	(Not applicable for PGDCCA/ PGDCS) Semester-II
Semester - IV	Semester-I & II	Semester - III

5. Without prejudice to the other provisions of Ordinance No. 6 relating to the Examinations in General, the provisions of Paragraphs 5, 7, 8, 10, 26 and 31 of the said Ordinance shall apply to every collegiate candidate.

6. The fees for the examination shall be as prescribed by the Management Council from time to time and whenever any change is made in the fees prescribed for any particular examination that shall be notified through a notification for information of the examinees concerned.

With the issuance of this Direction, The Direction No 24 of 2012 (Credit based Semester Pattern) shall stand repealed.

Sd/-

Nagpur
Date :21.6.2016

Dr. S. P. Kane
Vice-Chancellor

7. **Teaching and Examination Scheme**

Master of Computer Management (MCM)

(A) MCM Part-I

Semester – I

Course Code	Subjects	Paper	Teaching Scheme per weeks (hr)	End Sem Examination	Min Marks	Internal Assessment	Min Marks	Credits
Theory								
1CMT1	Fundamental of Information Technology	I	4	80	40	20	10	4
1CMT2	Programming in C & OOPs Concept	II	4	80	40	20	10	4
1CMT3	Introduction to Operating Systems	III	4	80	40	20	10	4
1CMT4	Computerized Accounting (Tally ERP 9)	IV	4	80	40	20	10	4
Practical								
1CMP5	**Practical-I :**Programming in C & Operating Systems	P-I	8	100	50	Nil	Nil	4
1CMP6	**Practical-II :**Tally (ERP 9)& MS-Office	P-II	8	100	50	Nil	Nil	4
	Total		32	520				24

Notes:

1. Duration of one Theory/Practical period is 1 hour.
2. The candidate has to pass theory papers and practical paper separately.
3. One credit is equivalent to one hour of Teaching or two hours of Practical Work per week.
4. Each semester will consist of 15 – 18 weeks of Academic Work equivalent to 90 actual teaching days.
5. The odd semester may be scheduled from July to December and even semester from January to June.

(B) MCM Part-I

Semester – II

Course Code	Subjects	Paper	Teaching Scheme per weeks (hr)	End Sem Examination	Min Marks	Internal Assessment	Min Marks	Credits
Theory								
2CMT1	Management Information Systems	I	4	80	40	20	10	4
2CMT2	Core Java	II	4	80	40	20	10	4
2CMT3	Quantity Techniques & Operation Research	III	4	80	40	20	10	4
2CMT4	E-Commerce and Web Designing	IV	4	80	40	20	10	4
Practical								
2CMP5	**Practical-I :**Core Java	P-I	8	100	50	Nil	Nil	4
2CMP6	**Practical-II :** HTML, JavaScript	P-II	8	100	50	Nil	Nil	4
	Total		32	520				24

Notes:

1. Duration of one theory/practical period is 1 hour.
2. The candidate has to pass theory papers and practical paper separately.
3. One credit is equivalent to one hour of teaching or two hours of practical Work per week.
4. Each semester will consist of 15 – 18 weeks of academic Work equivalent to 90 actual teaching days.
5. The odd semester may be scheduled from July to December and even semester from January to June.

(C) MCM Part-II

Semester – III

Course Code	Subjects	Paper	Teaching Scheme per weeks (hr)	End Sem Examination	Min Marks	Internal Assessment	Min Marks	Credits
Theory								
3CMT1	Advance Database Management System	I	4	80	40	20	10	4
3CMT2	Principles & Techniques of Management	II	4	80	40	20	10	4
3CMT3	**Electives :** (i) PHP & MySQL (ii) VB.Net (iii) C#.Net	III	4	80	40	20	10	4
3CMT4	**Compulsory Foundation** (i) Research Methodology	IV	4	80	40	20	10	4
Practical								
3CMP5	**Practical- I :**SQL & PL/SQL	P-I	8	100	50	Nil	Nil	4
3CMP6	**Practical-II :**Electives	P-II	8	100	50	Nil	Nil	4
	Total		32	520				24

Notes:

1. Duration of one theory/practical period is 1 hour.
2. The candidate has to pass theory papers and practical paper separately.
3. One credit is equivalent to one hour of teaching or two hours of practical work per week.
4. Each semester will consist of 15 – 18 weeks of academic work equivalent to 90 actual teaching days.
5. The odd semester may be scheduled from July to December and even semester from January to June.

(D) MCM Part-II

Semester – IV

Course Code	Subjects	Paper	Teaching Scheme per weeks (hr)	End Sem Examination	Min Marks	Internal Assessment	Min Marks	Credits
Theory								
4CMT1	ASP.Net	I	4	80	40	20	10	4
4CMT2	**Electives:** (i) Advance Java (ii) Android Programming (iii) Python	II	4	80	40	20	10	4
4CMT3	**Elective Foundation:** (i) Big Data &Hadoop (ii) Software Engineering (iii)Strategic Management	III	4	80	40	20	10	4
Practical								
4CMP4	**Practical-I:**ASP.Net	P-I	8	100	50	Nil	Nil	4
4CMP5	**Practical-II:**Electives	P-II	8	100	50	Nil	Nil	4
Project								
4CMP6	PROJECT	Project	8	100	50	-------	------	4
	Total		36	540				24

Notes:

1. Duration of one theory/practical period is 1 hour.
2. The candidate has to pass theory papers and practical paper separately.
3. One credit is equivalent to one hour of teaching or two hours of practical work per week.
4. Each semester will consist of 15 – 18 weeks of academic work equivalent to 90 actual teaching days.
5. The odd semester may be scheduled from July to December and even semester from January to June.

8. In order to pass the examination, an examinee shall obtain not less than 50 % marks in each of the theory papers and each of the practical and the project and Internal Assessment (Sessional) separately.

(A) An examinee who is unsuccessful in the examination shall be eligible for admission to the subsequent examinations on payment of a fresh fee prescribed for the examination together with the conditions of the ordinance in force from time to time.

9. (A) The scope of the subjects and pattern of examination shall be as indicated insyllabi.

(B) The Medium of instructions and examinations shall be in ENGLISH only.

10. Applicant for MCM Examination prosecuting regular course of study shall not bepermitted to join any other course in this or any other University.

11. **ASSESSMENT**

- The final total assessment of the candidates is made in terms of an internal assessment (Sessional) and an external assessment for each course.
- For each paper, 20 marks will be based on internal assessment and 80 marks for semester end examination (external assessment), unless otherwise stated.
- The division of the 20 marks allotted to internal assessment of theory papers should based on class test, attendance, project assignments, seminar, power point presentation, fieldwork, group discussions or any other innovative practice / activity as determined by the teacher in respective subject and moderated by Head of the Institute/Principal.
- There shall be no separate / extra allotment of workload to the concerned teacher. He/ She shall conduct the internal assessment activity during the regular teaching days / periods as a part of regular teaching activity.
- At the beginning of each semester, every teacher shall inform his / her students unambiguously the method he / she propose to adopt and the scheme of marking for internal assessment with the prior permission of HOD / principal.

- An unsuccessful examinee at any internal shall be eligible for reexamination on payment of fresh examination fee prescribed by the University as per the respective directions.
- The internal marks will be communicated to the University at the end of each semester, but before the semester end examinations. These marks will be considered for the declaration of the results.
- The record of internal marks, evaluation & result should be maintained for a period of one year by respective institute/college for verification by competent authority.
- The maximum and minimum marks which each subject carries in MCM Semester - I, Semester - II, Semester - III and Semester - IV Examination are as indicated in Paragraph 7. A, B, C and D respectively.
- A copy of Project work shall be submitted to college prior to commencement of Semester - IV Examination for Evaluation by Internal and External Examiner appointed as per University rules.
- Candidate shall submit his/her declaration that the Project is a result of his/her own work and the same has not been previously submitted to any examination of this University or any other University.
- The Practical Examination of each Semester will be conducted by Internal and External Examiner appointed as per University rules.
- The old course students shall be absorbed as per the absorption scheme mentioned in Appendix D.
- If an examinee failed to pass the MCM Degree within five successive years from the date of his/her first admission to particular programme he/she shall be declared as **"Not Fit for the Course" (NFC)** and he/she will not be allowed to appear further for any examination of the course.

STANDARD OF PASSING

- Every candidate must secure 50% marks in each head of passing.
- The passing marks for external examination will thus be 40 out of 80 and for internal examination, 10 out of 20 and aggregate marks taking both together will be 50 marks.
- There shall be no internal marks in Practical and Project Examination.

11. (A) There shall be no classification of examinees successful at the MCM Semester-I, Semester – II, Semester - III and Semester-IV Examinations whereas SGPA will be notified.

*** Conversion of Marks to Grades and Calculations of SGPA (Grade Point Average) and CGPA (Cumulative Grade Point Average):** In the Credit and Grade Point System, the assessment of individual Courses in the concerned examinations will be on the basis of marks only, but the marks shall later be converted into Grades by some mechanism wherein the overall performance of the Learners can be reflected after considering the Credit Points for any given course. However, the overall evaluation shall be designated in terms of Grade. There are some abbreviations used here that need understanding of each and every parameter involved in grade computation and the evaluation mechanism. The abbreviations and formulae used are as follows:-

Abbreviations and Formulae Used

G: Grade

GP: Grade Points

C: Credits

CP: Credit Points

CG: Credits X Grades (Product of credits & Grades)

SGPA = ΣCG: Sum of Product of Credits & Grades points / ΣC: Sum of Credits points

SGPA: Semester Grade Point Average shall be calculated for individual semesters. (It is also designated as GPA)

CGPA: Cumulative Grade Point Average shall be calculated for the entire Programme by considering all the semesters taken together.

After calculating the SGPA for an individual semester and the CGPA for entire programme, the value can be matched with the grade in the Grade Point table as per the ten (10) Points Grading System and expressed as a single designated GRADE such as O, A+, A, B+, B, etc.

Marks	Grade	Grade Points
85 and above	O (Outstanding)	10
75 - 84	A+ (Distinction)	9
71 - 74	A (Very Good)	8
61 - 70	B+ (Good)	7
55 - 60	B(Above Average)	6
50 - 54	C (Average)	5
40 - 49	P (Pass)	4

00 - 39	F (Fail)	0
	AB (Absent)	0

A student obtaining Grade F shall be considered failed and will be required to reappear in the examination.

(B) Division at the MCMSemester - IV Examination shall be declared based on the aggregate marks at the MCMSemester - I, Semester – II, Semester - III and Semester - IV Examination taken together and the CGPA will be calculated and notified.

(C) Successful examinees at the MCM Semester - IV Examination shall be awarded division based on CGPA as follows:

CGPA Range	**Final Grade**	**Equivalent Class/ Division**
9.01 to 10.00	O	First Division (Outstanding)
8.01 to 9.00	A+ (Distinction)	First Division(Distinction)
7.01 to 8.00	A(Very Good)	First Division (Very Good)
6.01 to 7.00	B+(Good)	First Division (Good)
5.55 to 6.00	B(Above Average)	Second Division (Above Average)
5.00 to 5.54	C(Average)	Second Division (Average)
4.00 to 4.99	P (Pass)	Pass
0	F (Fail)	Fail
0	AB(Absent)	Absent

12. Successful examinees in the MCMSemester Examination shall be awarded Distinction in each subject in which examinees obtain 75% or more marks in that subject at the respective Examination.

13. Unsuccessful examinees at the above examinations can be readmitted to the same examination on payment of a fresh fee and such other fees as may be prescribed by university.

14. Provisions of ordinance No 3 of 2007, relating to the award of grace marks for passing an examination, securing higher division / class and for securing distinction in subject(s) shall be applicable.

15. Notwithstanding anything to the contrary in this Direction, no person shall be admitted to an examination under this Ordinance, if he/ she has already passed the same examination or an equivalent examination of any other University.
16. Examinees successful at MCMSemester - I, Semester - II, Semester-III and Semester-IV Examination shall on payment of the prescribed fees receive a Degree in the prescribed form signed by the Vice-Chancellor.
17. This Scheme shall come into force from the academic session 2016-17.
18. The Provisions of Ordinance No. 21 of 1994 governing the existing course for Master of Computer Management stands repealed physically on implementation of this Direction.

APPENDIX –A

QUESTION PAPER PATTERN

First / Second / Third / Fourth Semester Master of Computer Management (MCM) Examination
Choice Based Credit System (CBCS)

Subject Name
Paper - I

Time: 3 Hours **Total Marks: 80**

N. B. - a) Draw well labeled diagram wherever necessary.
b) All questions are compulsory.

Part - A

N. B. – 1. Each question carries two marks.
2. Answers should not more than five lines.

1. } Unit - I
2. } Unit - I

8 x 2 = 16

3. } Unit - II
4. } Unit - II
5. } Unit - III
6. } Unit - III
7. } Unit - IV
8. } Unit - IV

Part - B

N. B. – 1. Each question carries three marks.
2. Answers should not more than ten lines.

1. } Unit - I
2. } Unit - I

8 x 3 = 24

3. } Unit - II
4. } Unit - II
5. } Unit - III
6. } Unit - III
7. } Unit - IV
8. } Unit - IV

Part - C

N. B. – 1. Each question carries five marks.

2. Answers should not more than 400 words for 5 marks questions and 600 words for 10 Marks questions respectively.

1. **Either**

(A) 5

(B) 5

Unit - I

OR

(C) 10

2. **Either**

(A) 5

(B) 5

Unit - II

OR

(C) 10

3. **Either**

(A) 5

(B) 5

Unit - III

OR

(C) 10

4. **Either**

(A) 5

(B) 5

Unit - IV

OR

(C) 10

APPENDIX –B

(A) Project and Classification of Marks on Project

Towards the end of the second year of study, a student will be examined in the course "Project Work".

a. Project Work may be done individually or in groups (Maximum 3 students) in case of bigger projects. However if project is done in groups, each student must be given a responsibility for a distinct module and care should be taken to monitor the progress of individual student.
b. The Project Work should be done using the tools covered in Master of Computer Management.
c. The Project Work should be of such a nature that it could prove useful or be relevant from the commercial / management angle.
d. The project work will carry 100 marks.
e. Project Work can be carried out in the Institute or outside with prior permission of the Institute.
f. The external viva-voce examination for Project Work would be held as per the Examination Time Table of the second year of study, by a panel of one external and one Internal Examiner.

Types of Project

As majority of the students are expected to work out a project in some industry/research and development laboratories/educational institutions/software export companies, it is suggested that the project is to be chosen which should have some direct relevance in day-today activities of the candidates in his/her institution. The Applications Areas of project - Financial/Marketing/Database Management System/ Relational Database Management System/E-Commerce /Internet/ Manufacturing/ web Designing / Scientific / ERP etc.

Project Proposal (Synopsis)

The project proposal should be prepared in consultation with the guide. The project guide must be a person having minimum Qualification MCM/ M.Sc. (Computer Science + Information

Technology)/ M.Sc. (Mathematics /Electronics/Statistics/Physics + Post B.Sc. Diploma in Computer Science& Application)/MCA. The project proposal should clearly state the objectives and environment of the proposed project to be undertaken. It should have full details in the following form:

Format of Synopsis for Desktop Application

1. Title of the Project.
2. Objectives of the Project.
3. Project Category (DBMS/RDBMS/OOPSetc.).
4. Tools/Platform and Languages to be used.
5. Complete Structure of the System:
    i. Numbers of Modules and its Description.
    ii. Modular Chart / System Chart.
    iii. Data Structures or Tables.
    iv. Process Logic of each Module.
    v. Types of Report Generation.
6. References.

Note: Synopsis should not be more than 3-4 pages.

Format of Synopsis for Web Application

1. Title of the Project.
2. Objectives of the Project.
3. Project Category (DBMS/RDBMS/OOPSetc.).
4. Tools/Platform and Languages to be used.
5. Complete Structure of the System:
    i. Number of pages and links their short description.
    ii. Use / Information of Pages.
    iii. Feedback Form (if any).
6. References.

Note: Synopsis should not be more than 3-4 pages.

Project Report Formulation

Front Page.

College Certificate Page.

Declaration Page.

Acknowledgment Page.

Project Profile.

Index or Content Page.

i. *Contents ——————————.

Appendices

i. List Figures, Tables& Charts.

ii. Approved copy of Synopsis.

Glossary

*** Contents.**

i. Introduction.

ii. Objectives.

iii. Preliminary System Analysis.

- Preliminary Investigation.
- Present System in Use.
- Flaws in Present System.
- Need of New System.
- Feasibility Study.
- Project Category.

iv. Software Engineering Paradigm Applied

- Modules
- System / Modular Chart.

v. Software & Hardware Requirement Specification.

vi. Detailed System Analysis.

- Data Flow Diagram.
- Numbers of Modules and Process Logic.
- Data Structures and Tables.
- Entity-Relationship Diagram.

vii. System Design.

- Form Design.
- Source Code.
- Input screen & Output Screen.

viii. Testing &Validation Checks.

ix. System Security Measures.

x. Implementation, Evaluation and Maintenance.

xi. Future Scope of the project.

xii. Suggestion & Conclusion

xiii. Bibliography& References.

Note :-

i. A Student is expected to complete the Assignments based on Syllabus of Practical subjects and submit the same in the form of a files (assignment Record) at the end of Academic Session for the evaluation purpose.

ii. A student should submit internal assessment of each theory paper prescribed by the subject teacher.

iii. A Student is expected to deliver a seminar on any course curricular subject / latest trends in IT relevant subject per semester for internal assessment.

Classification Of Marks on Project :-

Report & Documentation	40
Viva voce (External)	40
Viva voce (Internal)	20
Total Marks	**100**

The marks of Project shall be notified as a whole out of 100 in Foil/C-Foil.

(B)Practical and Classification of Marks on Practical

1. Practical exam shall be of 4 hours duration.
2. The Practical Record of every student shall carry a certificate as shown below, dulysigned by the teacher-in-charge and the Head of the Department.
3. If the student fails to submit his / her certified Practical Record duly signed by theTeacher-In-Charge and the Head of the Department, he / she shall not be allowed toappear for the Practical Examination and no Marks shall be allotted to the student.
4. After Viva-Voce and evaluation of practical records of a student by the Internal & External Examiner, both examiners should sign on the certificate of practical records.
5. The certificate template shall be as follows:

Name of the college / Institution
Name of the Department:

CERTIFICATE

This is to certify that Mr./Mrs./Ms. _____
of class MCM Part _____ Semester _____ has satisfactorily completedthe practical experimentsprescribed by RastrashantTukdojiMaharaj Nagpur University for the subject _____ during the academic year _____.

Signature
Practical In-charge Head of the Department

Signature
Head of the Department

Signature
Internal Examiner

Signature
External Examiner

Date: _____

Classification Of Practical Marks :-

		Marks
Practical – I		
1.	Writing a Program or Problem (Algorithm & Flowchart)	40
2.	Execute on a computer	
3.	Taking Hard Copy	
Practical – II		
1.	Writing a Program or Problem (Algorithm & Program)	20
Viva Voce		20
Practical Record		20
Total Marks		**100**

The marks of Practical shall be notified as a whole out of 100 in Foil/C-Foil.

APPENDIX –C

Absorption Scheme MCM

It is notified for general information of all concerned that the failure students of **MCM OldCourse (SemesterPattern)** shall be absorbed in the **New Course CBCS Pattern** introduced from the session 2016-2017 Examination with the following scheme.

1) The Failure students of **MCM – I (Semester – I & Semester - II) and MCM – II (Semester – III & Semester - IV)** as per Old Course (Semester Pattern) **appeared in Sum 2016** should clear their backlog papers of MCM – I (Semester – I & Semester - II) and MCM – II (Semester – III & Semester - IV) Old Course (Semester Pattern) **till Winter 2017**. If they fail to complete & pass till Winter 2017, then they will have to appear in parallel papers of New Course CBCS Pattern (Choice Based Credit System) as per absorption scheme indicated in Appendix - D.

2) The Failure students of **MCM – II (Semester – III)** as per Old Course (Semester Pattern) **appeared in Winter 2016** should clear their backlog papers of MCM – II (Semester - III) Old Course (Semester Pattern) **till Summer 2018**. If they fail to complete & pass till Summer 2018, then they will have to appear in parallel papers of New Course CBCS Pattern (Choice Based Credit System) as per absorption scheme indicated in Appendix - D.

3) The Failure students of **MCM – II (Semester – IV)** as per Old Course (Semester Pattern) **appeared in Summer 2017** should clear their backlog papers of MCM – II (Semester - IV) Old Course (Semester Pattern) **till Winter 2018**. If they fail to complete & pass till Winter 2018, then they will have to appear in parallel papers of New Course CBCS Pattern (Choice Based Credit System) as per absorption scheme indicated in Appendix - D.

APPENDIX –D

(A) MCM Part – I (Semester - I)

Old Course (Semester Pattern)➔New Course CBCS Pattern (Choice Based Credit System)

Sr. No	Old Course (Semester Pattern)	M. Marks	Sr. No	New Course CBCS Pattern (Choice Based Credit System)	Max Marks
Semester – I					
Theory			**Theory**		
I	Fundamental of Information Technology	80	1CMT1	Fundamental of Information Technology	80
II	Programming in C	80	1CMT2	Programming in C & OOPs Concept	80
III	Introduction to Operating Systems	80	1CMT3	Introduction to Operating Systems	80
IV	Computerized Accounting (Tally)	80	1CMT4	Computerized Accounting (Tally ERP 9)	80
Practical			**Practical**		
P - I	**Practical - I :** Programming in C & Operating Systems	100	1CMP5	**Practical - I :** Programming in C & Operating Systems	100
P - II	**Practical -II :** Tally & MS-Office	100	1CMP6	**Practical - II :** Tally (ERP 9) &Ms-Office	100

(B) MCM Part – I (Semester - II)

Old Course (Semester Pattern)➔New Course CBCS Pattern (Choice Based Credit System)

Sr. No	Old Course (Semester Pattern)	M. Marks	Sr. No	New Course CBCS Pattern (Choice Based Credit System)	Max Marks
Semester – II					
Theory			**Theory**		
I	Management Information Systems and Software Engineering	80	2CMT1	Management Information Systems	80
II	Visual Basic Programming	80	2CMT2	Core Java	80
III	Principles & Techniques of Management	80	2CMT3	Quantity Techniques & Operation Research	80
IV	E-Commerce and Web Designing	80	2CMT4	E-Commerce and Web Designing	80
Practical			**Practical**		
P - I	Practical-I : Visual Basic	100	2CMP5	**Practical-I :**Core Java	100
P - II	Practical-II : HTML, JavaScript	100	2CMP6	**Practical-II :** HTML, JavaScript	100

(C) MCM Part – II (Semester - III)

Old Course (Semester Pattern)➔New Course Pattern (Choice Based Credit System)

Sr. No	Old Course (Semester Pattern)	M. Marks	Sr. No	New Course Pattern (Choice Based Credit System)	Max Marks
Semester – III					
Theory			**Theory**		
I	Quantitative Techniques & OR	80	3CMT1	Advance Database Management System	80
II	Core Java	80	3CMT2	Principles & Techniques of Management	80
III	DBMS and oracle	80	3CMT3	**Electives :** (i) PHP & MySQL (ii) VB.Net (iii) C#.Net	80
IV	Research Methodology & Software Product & Project Management	80	3CMT4	**Compulsory Foundation** (i) Research Methodology	80
Practical			**Practical**		
P - I	Practical-I : Core Java	100	3CMP5	**Practical- I :**SQL & PL/SQL	100
P - II	Practical-II : Oracle	100	3CMP6	**Practical-II :**Electives	100

(D) MCM Part – II (Semester - IV)

Old Course (Semester Pattern)➔New Course Pattern (Choice Based Credit System)

Sr. No	Old Course (Semester Pattern)	M. Marks	Sr. No	New Course Pattern (Choice Based Credit System)	Max Marks
Semester – IV					
Theory			**Theory**		
I	Information Security & Cyber Laws	80	4CMT1	ASP.Net	80
II	PHP& My-SQL	80	4CMT2	**Electives:** (i) Advance Java (ii) Android Programming (iii) Python	80
III	Electives : (i) Advanced Java (ii) OOPS & C++ (iii) ASP.Net	80	4CMT3	**Elective Foundation:** (i) Big Data &Hadoop (ii) Software Engineering (iii)Strategic Management	80
Practical			**Practical**		
P - I	Practical-I : PHP& My-SQL	80	4CMP4	**Practical-I:**ASP.Net	100
P - II	Practical-II : Elective	100	4CMP5	**Practical-II:**Electives	100
Project			**Project**		
Proj	PROJECT	100	4CMP6	PROJECT	100

Rashtrasant Tukdoji Maharaj Nagpur University, Nagpur.

M. A. PSYCHOLOGY

CHOICE BASED CREDIT SYSTEM (CBCS)

SEMESTER PATTERN

RULES & REGULATIONS

R.T.M. Nagpur University regulations governing Post Graduate Programmes under Semester, Credit & Grade system. This System is offered to Psychology students appearing for post graduate programmes offered by the R.T.M. Nagpur University from the Academic Year 2016-2017.

These Regulations shall come into from the Academic Year 2016-2017.

1. **Papers** :-

There are five compulsory papers in each semester. Each semester includes four theory' paper and a separate one paper for "Practicum". Each Semester includes four theory paper of 100 marks each and one paper for 'Practicum' of 200 marks. In all Five papers are compulsory in each semester and student will earn total 600 marks in each semesters and grand total of the four semester would be 2400 marks.

In semester III first two paper are Core papers .Core paper I and core paper II .

Third paper is Elective –I that consists of two Core Electives: Core Elective -I-a or Core Elective -I-b) .(students should select any one)

The forth paper is consists of two papers. Foundation course-I or core III. .(students should select any one)

The fifth paper will be 'psychology practicum'

In semester IV first two papers are core papers –core paper-I and core paper II

The third paper is Core Elective –II that consists of two Electives, Core Elective -II- a or Core Elective- II- b. .(Students should select any one)

The forth paper is consists of two papers. Foundation course-II or core III (students should select any one)

The fifth paper will be 'psychology practicum'

2. Units:-

There are Four units in each theory paper. Minimum two questions will be set from each unit. Students will have to answer 'One' question from each unit. .(One questions from each unit with internal choice.)

3. Credits & Marks:-

Each semester will offer total 24 credits per week running for 15 weeks. The student will earn total 600 marks in each semester and grand total 0f all the four semesters will be 2400 marks.

4. Examination :-

Examination of all subjects of Post Graduate Programmes shall be conducted by the R.T.M. Nagpur University as per the scheme of Examination prescribed by the Board of Studies of a particular discipline / subject. Every student desirous for appearing at M.A. Psychology examination will have to complete practical work as per the directions of the concerned teachers and obtain completion certificate to that effect duly signed by Head of the department. The student who fails to produce completion certificate will not be eligible to appear for the related practical or theory examination.

1. The term end examination, however, shall be conducted by the RTM Nagpur University, Nagpur in the allotted centres.
2. Academic calendar showing dates of commencement and end of teaching, internal assessment tests & term end examination shall be duly notified before commencement of each semester every year by the University / Department / Affiliated Colleges.
3. One credit shall be given for every 25 marks, two credits for every 50 marks, four credits for 100 marks and six credits for 150 marks.
4. The proportion of internal and external marks for each theory / practical subjects shall be of 20:80 marks (Internal Examination weightage 20%, external examination weightage 80%).

5. Pattern of Question Paper

1. There will be four units in each paper

2. Question paper will consist of five questions.

3. First four questions will be from first four units.(One questions from each unit with internal choice.)

4. The fifth question will be compulsory consisting of short questions will be based on all four units.

5. Maximum marks in each theory paper will be 80

6. Each paper will be of 3 hours duration.

7. Practical Papers/ laboratory examination shall be of 200 marks for each semester and distribution of marks shall be 160 External and 40 internal.

8. Minimum passing marks in each theory, practical and internal assessment will be 40%.

Scheme of teaching and Examination under Credit Based Semester pattern for

M.A. Psychology

Semester I

S. N.	Paper SEM I	SUB Code	Teaching Scheme (Hrs/Wk)			Credits	Examination Scheme					
			Th	Pr	Total		Duration (Hrs/Wk)	Max Marks		Total Marks	Min Passing Marks [40%] (Combined passing)	
								External	Internal			
1	I	CP-1T1	4		4	4	4	80	20	100	40	
2	II	RMS-1T2	4		4	4	4	80	20	100	40	
3	III	PERI-1T3	4		4	4	4	80	20	100	40	
4	IV	ASP-1T4	4		4	4	4	80	20	100	40	
5	Pract	P-1P1		14	14	8	14	160	40	200	80	
TOTAL			**16**	**12**	**30**	**24**	**30**	**480**	**120**	**600**	**240**	

Subject Code: 1=Semester 1, T-1=Theory- 1, P1=Practical 1,

CP=Cognitive Psychology, RMS=Research Method & Statistics, PERI-I= Personality Theories I,

ASP= Advanced Social Psychology. P=practical

M.A. Psychology

Semester II

S. N.	Paper SEM II	SUB Code	Teaching Scheme (Hrs/Wk)			Credits	Examination Scheme					
			Th	Pr	Total		Duration (Hrs/Wk)	Max Marks		Total Marks	Min Passing Marks [40%] (Combined passing)	
								External	Internal			
1	I	**AGP-2**T1	4		4	4	4	80	20	100	40	
2	II	**RD**-2T2	4		4	4	4	80	20	100	40	
3	III	**PERII-2**T3	4		4	4	4	80	20	100	40	
4	IV	**ISB-2**T4	4		4	4	4	80	20	100	40	
5	Pract	**P-2**P1		14	12	8	14	160	40	200	80	
TOTAL			**16**	**14**	**30**	**24**	**30**	**480**	**120**	**600**	**240**	

Subject Code: 2=Semester 2, T-2=Theory- 1, P-1=Practical 1,

AGP=Advanced General Psychology, RD=Research Designs, PER-II= Personality Theories 2nd, ISB= Issues in Social Behaviour ,p=practical

M.A. Psychology – Semester III (Stream – A) Optional Specialization(Clinical Psychology)

S. N.	Paper SEM III-A	SUB Code	Teaching Scheme (Hrs/Wk)			Credits	Examination Scheme					
			Th	Pr	Total		Duration (Hrs/Wk)	Max Marks		Total Marks	Min Passing Marks [40%] (Combined passing)	
								External	Internal			
1	Core- I	**ABP A- 3T1**	4		4	4	4	80	20	100	40	
2	Core-II	**PD& PTH A-3T2**	4		4	4	4	80	20	100	40	
3	Ele-I-a or Ele-I-b	**HP A-3T3a or PAST A- 3T3b**	4		4	4	4	80	20	100	40	
4	F-coI* OR Core-III	**FCI(psy) A-3T4a OR PS-I A-3T4b**	4		4	4	4	80	20	100	40	
5	Pract	**P A-3P1**		14	14	8	14	160	40	200	80	
TOTAL			**16**	**14**	**30**	**24**	**30**	**480**	**120**	**600**	**240**	

Subject Code: A=CLINICAL PSYCHOLOGY, 3=Semester 3, T-1=Theory- 1, P-1=Practical 1,

ABP=Abnormal Psychology, PD&PTH=Psycho Diagnosis&Psycotherapy,

Ele- Elective HP= Health Psychology, PAS-Psychological Assessment & Specific Testing.,

FCI(PSY)-(FONDATION .* foundation paper from other discipline students):GENERAL PSYCHOLOGY, PS-I=POSITIVE PSYCHOLOGY –I(for psychology students)

M.A. Psychology - Semester III (Stream – B) Optional Specialization

(Organizational Psychology & Human Resource Management)

S.N.	Paper SEM III-B	SUB Code	Teaching Scheme (Hrs/Wk)			Credits	Examination Scheme					
			Th	Pr	Total		Duration (Hrs/Wk)	Max Marks		Total Marks	Min Passing Marks [40%] (Combined passing)	
								External	Internal			
1	Core- I	**HRM B- 3T1**	4		4	4	4	80	20	100	40	
2	Core-II	**OB B-3T2**	4		4	4	4	80	20	100	40	
3	Ele-I-a or Ele-I-b	**CB B-3T3a OR IND A- 3T3b**	4		4	4	4	80	20	100	40	
4	F-coI* OR Core-III	**FCI(psy) B-3T4a OR PS-I B-3T4b**	4		4	4	4	80	20	100	40	
5	Pract	**P B-3P1**		14	14	8	14	160	40	200	80	
TOTAL			**16**	**14**	**30**	**24**	**30**	**480**	**120**	**600**	**240**	

Subject Code: 3=Semester 3, T-1=Theory- 1, P-1=Practical 1

HRM=Management of Personnel and Human Resources, OB=Organizational Behaviour,

Ele- Elective CB= Consumer Behaviour IND= Industrial Psychology,

FCI(PSY)-(FONDATION .* foundation paper from other discipline students):GENERAL PSYCHOLOGY, PS-I=POSITIVE PSYCHOLOGY –I(for psychology students)

M.A. Psychology - Semester III (Stream – C)

Optional Specialization (Counselling Psychology)

S.N.	Paper SEM III-C	SUB Code	Teaching Scheme (Hrs/Wk)			Credits	Examination Scheme					
			Th	Pr	Total		Duration (Hrs/Wk)	Max Marks		Total Marks	Min Passing Marks [40%] (Combined passing)	
								External	Internal			
1	Core- I	**GCP C- 3T1**	4		4	4	4	80	20	100	40	
2	Core-II	**BCS C-3T2**	4		4	4	4	80	20	100	40	
3	Ele-I-a or Ele-I-b	**ECG C-3T3a OR ACG C- 3T3b**	4		4	4	4	80	20	100	40	
4	F-coI* OR Core-III	**FCI(psy) C-3T4a OR PS-I C-3T4b**	4		4	4	4	80	20	100	40	
5	Pract	**P C-3P1**		14	14	8	14	160	40	200	80	
TOTAL			**16**	**14**	**30**	**24**	**30**	**480**	**120**	**600**	**240**	

Subject Code: 3=Semester 3, T-1=Theory- 1, P-1=Practical 1,

GCP=Guidance and Counselling Psychology, BCS= Basic Counselling Skills,

Ele- Elective ECG=Educational Career Guidance, ACG= Assessment in Counselling & Guidance,

FCI(PSY)-(FONDATION .* foundation paper from other discipline students):GENERAL PSYCHOLOGY, PS-I=POSITIVE PSYCHOLOGY –I(for psychology students)

M.A. Psychology - Semester IV (Stream – A)

Optional Specialization (Clinical Psychology)

S.N.	Paper SEM IV-A	SUB Code	Teaching Scheme (Hrs/Wk)			Credits	Examination Scheme					
			Th	Pr	Total		Duration (Hrs/Wk)	Max Marks		Total Marks	Min Passing Marks [40%] (Combined passing)	
								External	Internal			
1	Core- I	**PP A- 4T1**	4		4	4	4	80	20	100	40	
2	Core-II	**TIS A-4T2**	4		4	4	4	80	20	100	40	
3	Ele-II-a or Ele-II-b	**CMM A-4T3a OR PT A- 4T3b**	4		4	4	4	80	20	100	40	
4	F-coII* OR Core-III	**FCII(psy)-A-4T4a OR PS-II A-4T4b**	4		4	4	4	80	20	100	40	
5	Pract	**P A-4P1**		14	14	8	14	160	40	200	80	
TOTAL			**16**	**14**	**30**	**24**	**30**	**480**	**120**	**600**	**240**	

Subject Code: 4=Semester 4, T-1=Theory- 1, P-1=Practical 1,

PP= Psychopathology, TIS= Therapeutic Intervention Strategies,

Ele- Elective CMM= Community Mental Health and Medical Psychology,PT- Psychological Testing,

FCII(PSY)-(FONDATION .* foundation paper from other discipline students):APPLIED PSYCHOLOGY, PS-II=POSITIVE PSYCHOLOGY –II(for psychology students)

M.A. Psychology - Semester IV (Stream – B) Optional Specialization

(Organizational Psychology & Human Resource Management)

S.N.	Paper SEM IV-B	SUB Code	Teaching Scheme (Hrs/Wk)			Credits	Examination Scheme					
			Th	Pr	Total		Duration (Hrs/Wk)	Max Marks		Total Marks	Min Passing Marks [40%] (Combined passing)	
								External	Internal			
1	Core- I	**OD B- 4T1**	4		4	4	4	80	20	100	40	
2	Core-II	**EC B-4T2**	4		4	4	4	80	20	100	40	
3	Ele-II-a or Ele-II-b	**LCO B-4T3a OR OCO B- 4T3b**	4		4	4	4	80	20	100	40	
4	F-coII* OR Core-III	**FCII(psy)-B-4T4a OR PS-II B-4T4b**	4		4	4	4	80	20	100	40	
5	Pract	**P B-4P1**		14	14	8	14	160	40	200	80	
TOTAL			**16**	**14**	**30**	**24**	**30**	**480**	**120**	**600**	**240**	

Subject Code: 4=Semester 4, B-Stream B, T-1=Theory- 1, P-1=Practical 1,

OD=Organizational Development, EC= Employee Counselling,

Ele- Elective LCO=Leadership and Communication in Organization, OCO= Organizational Culture and Organizational change,

FCII(PSY)-(FONDATION .* foundation paper from other discipline students):APPLIED PSYCHOLOGY, PS-II=POSITIVE PSYCHOLOGY –II(for psychology students)

M.A. Psychology - Semester IV (Stream – C) Optional Specialization

(Counselling Psychology)

S.N.	Paper SEM IV-C	SUB Code	Teaching Scheme (Hrs/Wk)			Credits	Examination Scheme					
			Th	Pr	Total		Duration (Hrs/Wk)	Max Marks		Total Marks	Min Passing Marks [40%] (Combined passing)	
								External	Internal			
1	Core- I	**PD C- 4T1**	4		4	4	4	80	20	100	40	
2	Core-II	**ISC C-4T2**	4		4	4	4	80	20	100	40	
3	Ele-II-a or Ele-II-b	**SAC C-4T3a OR PCG C- 4T3b**	4		4	4	4	80	20	100	40	
4	F-coII* OR Core-III	**FCII(psy)-C-4T4a OR PS-II C-4T4b**	4		4	4	4	80	20	100	40	
5	Pract	**P C-4P1**		14	14	8	14	160	40	200	80	
TOTAL			**16**	**14**	**30**	**24**	**30**	**480**	**120**	**600**	**240**	

Subject Code: 4=Semester 4, C-Stream C, T-1=Theory- 1, P-1=Practical 1,

PD=Psychological Disorders, ISC= Intervention Strategies in Counselling,

Ele- Elective SAC= Social Areas of Counselling. PCG=Psychological Testing in Counselling and Guidance

FCII(PSY)-(FONDATION .* foundation paper from other discipline students):APPLIED PSYCHOLOGY, PS-II=POSITIVE PSYCHOLOGY –II(for psychology students)

List of courses

M.A.Part-I –Semester-I

Core Course

Paper No.	**Title of the paper**
I	COGNITIVE PSYCHOLOGY
II	RESEARCH METHOD, STATISTICS & PSYCHOLOGICAL TESTING
III	PERSONALITY THEORIES- I
IV	ADVANCED SOCIAL PSYCHOLOGY
V	PSYCHOLOGY PRACTICUM

M.A.Part-I –Semester-II

Core Course

Paper No.	**Title of the paper**
I	ADVANCED GENERAL PSYCHOLOGY
II	RESEARCH DESIGNS
III	PERSONALITY THEORIES- II
IV	ISSUES IN SOCIAL BEHAVIOUR
V	PSYCHOLOGY PRACTICUM

M.A.Part-II –Semester-III

(Stream A) :Clinical psychology

Paper No.	Title of the paper
	Core paper
I	ABNORMAL PSYCHOLOGY
II	PSYCHODIAGNOSIS AND PSYCHOTHERAPY
	Elective Papers(select any one paper of the following two)
III(Elective I-a)	HEALTH PSYCHOLOGY OR
III(Elective I-b)	PSYCHOLOGICAL ASSESSMENT AND SPECIFIC TESTING
	Foundation Course(select any one paper of the following two)
IV	FOUNDATION COURSE-I(GENERAL PSYCHOLOGY) **(FONDATION .* foundation paper from other discipline students)** OR POSITIVE PSYCHOLOGY-I**(for psychology students)**
V	CLINICAL PSYCHOLOGY PRACTICUM

M.A.Part-II –Semester-III

(Stream B): Organizational Psychology and Human Resource Management

Paper No.	Title of the paper
	Core paper
I	MANAGEMENT OF PERSONNEL AND HUMAN RESOURCES
II	ORGANIZATIONAL BEHAVIOR
	Elective Papers(select any one paper of the following two)
III(Elective I-a)	CONSUMER BEHAVIOR OR
III(Elective I-b)	INDUSTRIAL PSYCHOLOGY
	Foundation Course(select any one paper of the following two)
IV	FOUNDATION COURSE-I(GENERAL PSYCHOLOGY) **(FONDATION .* foundation paper from other discipline students)** OR POSITIVE PSYCHOLOGY-I**(for psychology students)**
V	Organizational Psychology Practicum

M.A.Part-II –Semester-III

(Stream C-): Counselling Psychology

Paper No.	Title of the paper
	Core paper
I	GUIDANCE AND COUNSELLING PSYCHOLOGY
II	BASIC COUNSELLING SKILLS
	Elective Papers(select any one paper of the following two)
III(Elective I-a)	EDUCATIONAL & CAREER GUIDANCE
	OR
III(Elective I-b)	ASSESSMENT IN COUNSELLING AND GUIDANCE
	Foundation Course(select any one paper of the following two)
IV	FOUNDATION COURSE-I(GENERAL PSYCHOLOGY) **(FONDATION .* foundation paper from other discipline students)** OR POSITIVE PSYCHOLOGY-I**(for psychology students)**
V	COUNSELLING PSYCHOLOGY PRACTICUM

M.A.Part-II –Semester-IV

(Stream A) :Clinical psychology

Paper No.	Title of the paper
	Core paper
I	PSYCHOPATHOLOGY
II	THERAPEUTIC INTERVENTION STRATEGIES
	Elective Papers(select any one paper of the following two)
III(Elective- II-a)	COMMUNITY MENTAL HEALTH AND MEDICAL PSYCHOLOGY
	OR
III(Elective- II-b)	PSYCHOLOGICAL TESTING IN CLINICAL PSYCHOLOGY
	Foundation Course(select any one paper of the following two)
IV	FOUNDATION COURSE-II(APPLIED PSYCHOLOGY) **(FONDATION .* foundation paper from other discipline students)** OR POSITIVE PSYCHOLOGY-II**(for psychology students)**
V	CLINICAL PSYCHOLOGY PRACTICUM

M.A.Part-II –Semester-IV

(Stream B): Organizational Psychology and Human Resource Management

Paper No.	Title of the paper
	Core paper
I	ORGANIZATION DEVELOPMENT
II	EMPLOYEE COUNSELLING
	Elective Papers(select any one paper of the following two)
III(Elective II-a)	LEADERSHIP AND COMMUNICATION IN ORGANIZATIONS
	OR
III(Elective II-b)	ORGANIZATIONAL CULTURE, ORGANIZATIONAL LEARNING AND ORGANIZATIONAL CHANGE
	Foundation Course(select any one paper of the following two)
IV	FOUNDATION COURSE-II(APPLIED PSYCHOLOGY) **(FONDATION .* foundation paper from other discipline students)** OR POSITIVE PSYCHOLOGY-II**(for psychology students)**
V	ORGANIZATIONAL PSYCHOLOGY PRACTICUM

M.A.Part-II –Semester-IV

(Stream C): Counselling Psychology

Paper No.	Title of the paper
	Core paper
I	PSYCHOLOGICAL DISORDERS
II	INTERVENTION STRATEGIES IN COUNSELLING
	Elective Papers(select any one paper of the following two)
III(Elective II-a)	SPECIAL AREAS OF COUNSELLING
	OR
III(Elective II-b)	PSYCHOLOGICAL TESTING IN COUNSELLING AND GUIDANCE
	FOUNDATION COURSE(select any one paper of the following two)
IV	FOUNDATION COURSE-II(APPLIED PSYCHOLOGY) **(FONDATION .* foundation paper from other discipline students)** OR POSITIVE PSYCHOLOGY-II**(for psychology students)**
V	COUNSELLING PSYCHOLOGY PRACTICUM

M.A. Psychology

Semester I - Paper I

CODE – CP-1T1 **COGNITIVE PSYCHOLOGY**

UNIT- 1

Cognitive psychology: What is cognitive psychology? Origin and current status, Cognitive psychology and related fields

Characteristics of human information processing: feature analysis, hierarchical organization, parallel processing.

Representation and processing of knowledge: mental representation, mental procedures.

Cognitive neuroscience : brain lesion, brain imaging

UNIT –2

Cognitive phenomenon: Cognitive style, Cognitive structure, Cognitive consistency, Cognitive map

UNIT-3

Metacognition

Definition of metacognition: knowledge, monitoring and control.

Metamemory: judgement of learning, feeling of knowing. (Illusion of knowledge)

Tip of the tongue phenomenon, Metacomprehension, Application of metacognition

UNIT-4

Thinking and problem solving

Types of thinking: convergent and divergent thinking

Theories of thought process: association, gestalt, information processing.

Components of thinking: ideas, images, concepts

Functions of thinking: types of reasoning, problem solving

Decision making

Books Recommended

Bernstein, D.A., Penner, L.P., Clarke-Stewart, E.J. (2008). *Psychology* (8th Ed.). N.Y.: Houghton Miffin

Smith, E. E. & Kosslyn, S. M.. (2007) *Cognitive Psychology Mind and Brain*. Prentice – Hall of India Private Limited.

Matlin, M. W. (2006) *Cognition,* John Wiley & Sons, Inc. U.S.A.

Baddeley, A. (1986). *Working memory*. Oxford: Clarendon Press.

Baron, R.(2004) *Psychology.* New Delhi : Prentice – Hall of India.

Galloti,K.M.(2006*).Cognitive psychology In and Out of the Laboratory*. USA:Wadsworth/ Thomson Learning.

Matlin, M.W.(2003). *Cognition*. USA: John Wiley and sons.

Jahnke, IC.,Nowaczyk, R.H.(1998). *Cognition. New Jersey* : Prentice Hall.

Glass ,Lewis, A, Hylock,James,K.(1986). *Cognition*. McGraw Hill book company.

M.A. Psychology

Semester I - Paper - II

CODE- RMS-1T2 **RESEARCH METHOD, STATISTIC & PSYCHOLOGICAL TESTING**

UNIT 1

Scientific thinking and common sense thinking,

Problem: concept, criteria and sources;

Hypothesis: concept, criteria, types, sources and information; significance of problem and hypothesis in psychological research.

UNIT 2

Experimentation in Psychology

Purpose, Nature of variables; Techniques of experimental manipulation, Impact and control in experiment. Sources of bias, Ethical issues in Psychological research.

UNIT 3

Psychological Testing

Function and origins of psychological testing; Nature and the use of Psychological test; Social and ethical implications of testing.

Standardized Test

Its meaning, its psychometric properties; item analysis, validity and reliability; norms and interpretation of test scores.

UNIT 4

- Parametric and non parametric Methods

  , t- test, F -test, ANOVA, Sign test and U test.

- Correlation: [Product moment]; [Rank difference]; [Biserial, Phi]. Regression equation
- Types of sample, Standard score, percentile.

Books Recommended

Kerlinger, F.N.(1973*). Foundation of Behavioural Research* (2nd Ed.). N.Y.: Holt Rinehart & Wilson

Anastasi, A., Urbina, S. (2004).*Psychological Testing* (7th Ed.). India: Pearson Education Pvt. Ltd. (Indian Branch

Guilford, J.P. & Fruchter, B. (1978). *Fundamental Statistics in Psychology and Education* (6th Ed.). N.Y.: McGraw Hill

Mangal, S. K. (2007). *Statistics in Psychology and Education* (2nd Ed.). New Delhi: Prentice Hall of India.

King, B. M. & Minium, E.M. (2003). *Statistical Reasoning in Psychology and Education* (4th Ed.). U.S.A.: John Wiley & Sons

Aron, A., Aron, E.N. (1994). *Statistics for Psychology*. U.K.: Prentice Hall

Scott, W. A. & Wertheimer, M. (1962). *Introduction to Psychological Research*. N.Y.: John Wiley & Sons

M.A. Psychology

Semester I - Paper - III

CODE- PERI-1T3 **PERSONALITY THEORIES- I**

AIM: To help student gain clearer insight

1] in understanding human behaviour

2] in multiple determinants of personality.

And

3] To provide solid foundation for further study and evaluation of human behaviour.

Unit – 1

Personality Psychology

Introduction to the discipline. The concept of personality (meaning, definition, heterogeneity etc..) Theories of personality. Components of personality theory/ies. Criteria fror evaluating personality theories. Important issues in personality theories.

Unit – 2

The psychodynamic approach to personality

Sigmund Freud.

Carl Jung.

Alfred Adler

Unit 3

Ego psychology. Hartman, A. Freud, Erikson, Mahler

Unit – 4

Trait and Type Approach

Cattell's trait approach

Eysenck's Trait – Type approach

The Five Robust Factors – Super traits

Books Recommended

Ewen R. B. (1988) An ntroduction to theories of personality. 6rd edn. Lawrence Erlbaum Associates Inc. Mahwah New Jersey, London

Boeree, C. G. (2006) Personality Theories

[**http://www.ship.edu/%7Ecgboeree/perscontents.html**]

Hjelle, L. A. and Ziegler, D. J. (1992) Personality Theories. Basic assumptions, research and Applications, 3rd edn. McGraw-Hill Inc.International Edition.

Pervin, L. a Personality: Theory and Research, (1991) 6th edn, John Wiley & Sons, Inc. U.S.A.

Pervin, L (2003). The Science of Personality. 2nd edn. Oxford University Press. New York

Hall, C. s. & Linzey, G. (1991) Theories of Personality, 3rd edn.. John Wiley & Sons, Inc. U.S.A.

M.A. Psychology

Semester I - Paper - IV

CODE- ASP-1T4 **Advanced Social Psychology**

UNIT-1

Introduction to social psychology

Social psychology: definition, nature, scope and goals of social psychology.

Social psychology in the new millennium: cognitive perspective, multicultural perspective, biological and evolutionary perspective.

UNIT-2

Attitude and behaviour

Formation of attitudes

How attitude influences behaviour, attitude change

Persuasion: paths and elements of persuasion, resistance to persuasion, cognitive dissonance.

UNIT-3

Social psychology and sustainable future

Global crisis: sustainable life styles, creating incentives to conserve.

Psychology of materialism and wealth.

Creating sustainable future: adjusting adaptations and comparisons.

UNIT -4

Aggression

Aggression : theoretical perspectives, determinants of aggression and its causes.

The prevention and control of human aggression : punishment , catharsis, cognitive intervention and other techniques.

Books recommended

Myers, D.G. (2005). *Social psychology*. New Delhi; Tata McGraw- Hill.

Baron, R.A. ,Byrne, D. (2003*). Social Psychology*. New Delhi : Prentice – Hall of India.

Schneider, W.F., Gruman, J.A., Coutts, L.M. (2005). *Applied Social Psychology; Understanding and Addressing Practical Problem*s. Sage Pub. @ www.sagepublications.com

Tripathi, R.C. (1988). *Applied Social Psychology.* In J. Pandey. (Ed.) Pychology in India: The state-of-the art. (pp. 95 -157). New Delhi: Sage Pub.

M.A. Psychology

Semester I - Paper – V

CODE - P-1P1 **PSYCHOLOGY PRACTICUM (SEM I)**

a)This paper consists of five laboratory experiments* and one mini field – study**; related to attitudes/current psychological issues.

Each student shall complete five experiments during the 1st semester period. Each student shall submit journal containing reports of experiments and a report of mini field study.

*(*Experiments to be conducted will be decided by concerned teachers' committee.)*

*(**Topics/areas for field study will be decided by the student(s) in consultation with concerned teachers' committee.)*

b) calculating mean.std.dev,correlation with computer.

Internal Assessment	**Marks:40**
- **Performance during academic session**	- 20marks
- Experiment and mini field - study reports,	- 20 marks

External Practical examination	**MARKS:160**
- Experiment and report writing	- 50 marks
o field - study written report:	- 50 marks
- Viva voce	- 60 marks
	TOTAL MARKS:200

M.A. Psychology

Semester II - Paper I

CODE - AGP-2T1 **ADVANCED GENERAL PSYCHOLOGY**

UNIT –I

Intelligence and creativity
Development of intelligence
Biological bases of intelligence: nature & nurture
Theories of intelligence, diversity of mental abilities.
Contextual intelligence, Perceived intelligence, Artificial intelligence
Creativity: Meaning, problem
Creativity and intelligence relationship, Brain storming

UNIT-2

- Memory:
  Biological bases of memory, models of memory, information processing approach to memory
- Emotion and motivation
  Emotion: physiological bases of emotion, role of limbic system,
  Theories of emotion: evolutionary, neo-jamesian, cognitive.
  Motivation: process of motivation, theories of motivation.

UNIT-3

Altered States of consciousness: sleep, hypnosis, drug induced alteration, meditation
Forensic Psychology: Meaning, Nature, scope, applications
Lie detection, eye witness testimony, Psychological autopsy.

UNIT-4

Human development
Major theories of development: intellectual , moral, social, cognitive.
Adolescence: physical, cognitive, social and emotional development, anxiety and problems faced .Adulthood and aging: theories of aging. Death and bereavement..

Books Recommended

Matlin, M. W. (2006) *Cognition*, John Wiley & Sons, Inc. U.S.A.
Baddeley, A. (1986). *Working memory*. Oxford: Clarendon Press.
Baron, R.(2004) . *Psychology*. New Delhi : Prentice – Hall of India.
Jahnke, IC.,Nowaczyk, R.H.(1998). Cognition. New Jersey : Prentice Hall.
Bernstein, D.A., Penner, L.P., Clarke-Stewart, E.J. (2008). *Psychology* (8th Ed.). N.Y.: Houghton Miffin
Snyder, C. R., Lopez, S.J.(2007*).Positive Psychology; The Scientific and Practical Explorations of Human Strengths*.Sage publications@ www,sagepublication.com
Shafter, D.R., Kipp,K. (2007).*Developmental Psychology; Childhood & Adults*. Haryana: Thomson Wadsworth
Papalia,D.E.,Olds,S.W.(1994).*Human development*. New Delhi : Tata McGraw Hill

Papalia,D.E.,Olds,S.W, Feldman,R.D.(2004).*Human development* (9th Ed.). New Delhi : Tata McGraw Hill

M.A. Psychology

Semester II - Paper - II

CODE - RD-2T2 **RESEARCH DESIGNS**

UNIT 1

Nature of research and its process

Experimental research and field experiment

Between and within group designs (single factor)

UNIT 2

- Randomized block design, Factorial design [fixed model], Latin square design, ANCOVA.
- Quasi Experimental Designs

Non Equivalent control group designs; Time series designs, Pre –post test design

Case study, Longitudinal, Cross-sectional, Panel design, correlational research, survey research

UNIT 3

Qualitative research method

Program evaluation, , Discourse (content) analysis, Narrative method

UNIT 4

Analysis, meta- analysis, trend analysis, analysis of qualitative data

Interpretation, meaning, description vs. discussion, narrow vs. broad

Research report writing

Books Recommended

Banister, P., Burman, E., Parker, I., Taylor, M., & Tindall, C. (1994). *Qualitative Methods in Psychology: A Research Guide*. Philadelphia: Open University Press.

Broota, K.D. (1992). *Experimental Designs in Behavioural Research*. New Delhi: Wiley Eastern.

Camic, P.M., Rhodes, J.E., Yardley, S. (Eds.) (2003). *Qualitative Researches in Psychology*. Washington D.C.: APA

Glaser, B. G. & Strauss, A. L. (1973). *The discovery of grounded theory: Strategies for qualitative research.* Chicago : Aldine Pub.

Goodwin, C. J.(1995). *Research in Psychology Methods and Design*. New York: John Wiley & Sons.

Helode R.D.(2012) *Basic of research in behavioural science*. Psycoscan ,58,Laxmi nagar, wardha.

Kaplil, .H. K. (2007). *Research Methods (In Behavioural Science*)(13th Ed). Agra: H.P. Bhargava Book House

Shaughnessy, J.J. & Zechmeister E. B.(1997). *Research Methods in Psychology* (4th Ed.). N.Y.: McGraw Hill

Winer, B.J. (1971). *Statistical Principles in Experimental Design*. N.Y.: McGraw Hill

M.A. Psychology

Semester II - Paper - III

CODE – PERII-2T3 **PERSONALITY THEORIES - II**

Unit - I

Behavioural Approach, The behavioural view of the person

B. F. Skinner: radical Behaviourism.

Albert Bandura, Julian Rotter

Unit –2

- A Cognitive theory of personality

George Kelly. The psychology of personal constructs

Humanistic approach.

C. R. Rogers,Abraham Maslow

- Existential Approach

Rollo May, Vicktor Frankle

Unit 3

The Indian Approaches to personality

Guna theory – Srimadbhagvadgeeta

View points of Sri Aurobindo

Abhidhama – Gautam Buddha.

Unit –4

The psychology of women

A relational approach – Miller

The ideals of personality, the Mature person [Adler], Fully Functioning person [Rogers], Self-actualizer [Maslow], Sthitpradnya / Trigunateet (Srimadbhagwadgita), Arhat

Personality theories – new directions in the discipline

Books Recommended

Ewen R. B. (2003) An ntroduction to theories of personality. 3rd edn. Lawrence Erlbaum Associates Inc. Hillsdale, New Jersey, London

Hall, C. s. & Linzey, G. (1991) Theories of Personality, 3rd edn.. John Wiley & Sons, Inc. U.S.A.

Pervin, L. a Personality: Theory and Research, (1991) 6th edn, John Wiley & Sons, Inc. U.S.A.

Tilak B. G. (1986) Geeta Rahasysa or Karma Yoga Rahasya, B. s. Sukhtankar (Eng. Tra.) 6th ednGeeta printers, Pune, India

Sri Aurobindo, The synthesis of Yoga (1970 - 73) Sri Aurobindo Birth Centenary Library, Sri Aurobindo Ashram Press, Pondicherry, India

Pandey, J. (ed.) (2001) Personality and Health Psychology In Psychology in India Revisited. Developments in the discipline, sage Publication India Pvt ltd. New Delhi. India.

Nithiyanandan, V. (2008) Buddhist andwestern psychology comparative study. Global vision publishing house.

Pervin, L (2003). The Science of Personality. 2nd edn. Oxford University Press. New York

M.A. Psychology

Semester II - Paper - IV

CODE : ISB-2T4 **Issues In Social Behaviour**

UNIT- I

- Poverty, gender issues, unemployment and its psychosocial consequences , population issues, media culture, effects of televiewing, AIDS.
- Conflict
- Conflict: social dilemma , competition, perceived injustice, misperception.
- Conflict management and resolution of inter-group conflict.

UNIT- 2

Prejudice and discrimination. Development of prejudice : social, motivational and cognitive sources of prejudice.

Social learning, social categorisation, mechanism of prejudice: collective and individual

Consequences of prejudice. Combating prejudice: techniques for countering its effects.

UNIT- 3

Group dynamics : what is group? Group polarization, group think, decision making in group, minority influence on group decision.

UNIT –4

Pro-social behaviour

Pro-social behaviour : altruism and bystander effect

Altruism: definition, egotism motive, motivated altruism, cultivating altruism and its measurement

Empathy: definition, empathy- altruism hypothesis, genetic and neural foundations of empathy.

Gratitude and forgiveness : defining, cultivating ,measuring and neurobiological bases.

Societal implications of altruism.

Books recommended

Myers, D.G(2005). Social psychology. New Delhi; Tata McGraw- Hill.

Baron, R.A. ,Byrne, D (2003) social psychology. New Delhi : Prentice – Hall of India.

Schneider, W.F., Gruman, J.A., Coutts, L.M. (2005). *Applied Social Psychology; Understanding and Addressing Practical Problem*s. Sage Pub. @ www.sagepublications.com

Snyder, C. R., Lopez, S. J. (2006). *Positive Psychology; The Scientific and Practical Exploration of Human Strengths*. Sage Pub. @ www.sagepublications.com

Bunk, A.P., Van Vugt, M. (2007). *Applying Social Psychology; From Problems to Solutions.* Sage Pub. @ www.sagepublications.com

M.A. Psychology

Semester II - Paper - V

CODE - P-2P1 **PSYCHOLOGY PRACTICUM**

- This paper consists of Five Testing practical and one test evaluation*

- Each student shall complete Five Tests and one test evaluation during the II semester period. Each student shall submit journal containing reports of tests and a report of one test evaluation.

*(*Testing practical and test to be evaluated will be decided by the teachers committee)*

- *Preparing pi diagram, simple graphs with computer.*

Internal Assessment **Marks:40**

- **Performance during academic session** - 20 marks

- Testing and test evaluation reports, - 20 marks

External Practical examination **MARKS:160**

- Testing and report writing - 60 marks
  - Evaluation of test written report: - 40 marks

- Viva voce - 60 marks

TOTAL MARKS:200

Semester – III (Stream-A)

Core Paper - I

Code: ABP A- 3T1 **ABNORMAL PSYCHOLOGY**

Objectives:
To provide an in-depth understanding of abnormal psychology.
To provide background knowledge regarding psychopathology, etiology and symptomatology of various psychological disorders.

UNIT 1

- Abnormal behavior: Its meaning, historical background, meaning of prevalence, incidence and risk factors.

Causes of abnormal behavior; biological, psycho-social, socio-cultural & neuro-psychological factors

- THEOREITICAL PERSPECTIVE ON MALADAPTIVE BEHAVIOUR

Biological perspective, Psychodynamaic perspective, Behavioral perspective, Cognitive perspective, Humanistic-Existential perspective, Community-Cultural perspective, Integrative approach.

UNIT 2

STRESS, COPING AND MALADAPTIVE BEHAVIOR

Stress and coping, Stressful life situations and transitions, Clinical reaction to stress and its management; adjustment disorder, post traumatic stress disorder, dissociative disorder

UNIT 3

- Personality disorders: paranoid, histrionic, schizoid, dependent, avoidant, narcissistic, borderline, obsessive-compulsive type & antisocial personality disorder
- Mental retardation, its causes, degrees of mental retardation, problems, helping the child and family .
- Disorders usually first diagnosed in infancy, childhood or adolescence
- ADHD, Autism, Learning disorders, Conduct disorder, Stuttering, Tics,

UNIT 4

Other Conditions of Clinical Attention

Parent – child relational problem, Physical abuse of child; Physical abuse of adult, Non-compliance with treatment, Mallingering, Bereavement..

Books Recommended

Sarason , I.G. & Sarason, B. R. (1993). *Abnormal Psychology; The Problem of Maladaptive Behaviour*. New Jersey: Prentice Hall

Coleman, J.C. (1986). *Abnormal Psychology and modern Life*. Bombay: Taraporevala Sons & Co. Pvt. Ltd.

Carson, R.C., Butcher, J. N. & Mineka, S. (1996).). *Abnormal Psychology and modern Life* (10th Ed.).N.Y.: HarperColins

Plante, T.G. (2005*). Contemporary Clinical Psychology* (2nd Ed.) New Jersey:. John Wiley & Sons

Ottmanns, T. F., Emery R. E. (1995). *Abnormal Psychology.* U. S. A.: Prentice Hall

Holmes, D.S. (1997). *Abnormal Psychology* (3rd Ed.). N.Y.: Addison –Wesley Education. Pvt. Ltd

Nevid, J.S., Rathus, S. A., Greene, B. (1997). *Abnormal Psychology in Changing World* (3rd Ed.). U.K.: Prentice Hall

Hales, R.E., Yudofsky, S.G.(2003). Text Book of Clinical Psychiatry. Washington D C: American Psychiatric Publishing, inc.

Semester III

(Stream A: Core Paper –II)

Code: PD& PTH A-3T2 **PSYCHODIAGNOSIS AND PSYCHOTHERAPY**

Objectives:

1) To provide the students a chance to study various therapeutic approaches.
2) To help in developing a balanced view of the various therapies and practical techniques employed.

UNIT 1

Concept of diagnosis, objective of psycho diagnosis, Indian and International classification, DSM and ICD revisions. Ethical issues, client -therapist relationship, confidentiality, legal liability, malpractice.

Historical trends, personal characteristics of therapist, personal counseling for therapist, problems faced by beginning therapist.

UNIT 2

Approaches to Counseling and Therapy: Directive, Non-directive-

The Psychoanalytic Psychotherapy, Rogers – Basic Concepts- Techniques – Evaluation

UNIT 3

Logo therapy, Brief psychotherapy, Reality therapy, Gestalt therapy

UNIT 4

Play therapy. Couple Counselling, Workplace Counselling, Transactional analysis

Books Recommended

Corey, G. (1991*). Theory and Practice of Counselling and Psychotherapy* (4th Ed.). California: Brooks.

Corey, G. (2006). *The Art of Integrative Counseling*. California: Brooks

Flanagan, J.S., Flanagan, R.S. (2004). *Counselling and Psychotherapy, Theories in Context and Practice.* New Jersey:. John Wiley & Sons.

Korchin, S. J. (1976). *Modern Clinical Psychology: Principles of Intervention in the Clinic and Community*. New York: Basic Books

Plante, T.G. (2005*). Contemporary Clinical Psychology* (2nd Ed.) New Jersey:. John Wiley & Sons

Bellack, A. S., Hersen, M., Johnston, D. W., & Johnston, M. (Eds.). (1998). *Comprehensive Clinical Psychology* (Vol. 8). New York: Pergamon

Stricker, G., Widiger, T.A. (Eds.)(2003). *Handbook of Psychology; Vol .8 Clinical Psychology*. New Jersey : John Wiley & Sons

Feltham C, Horton I (Ed), (2006): The Sage Handbook of Counselling and Psychotherapy, 2nd Ed. Sage Publication; New Ddelhi.

Gilliland B, Richard, J. Bowman, J: Theories and Strategies in Counselling and Psychotherapy, 2nd Ed. Allyn and Bacon Publishers

Flangan,J.S.,Flagman,R,S.(2004) Counselling and Psychotherapy,Theories in context and Practice.New Jersey:. John Wiley and sons

Semester – III

(Stream A: Paper – III, Core Elective -I-a)

Code: HP A-3T3 HEALTH PSYCHOLOGY

Objectives :

To acquaint the students with various aspect of health psychology, mental health

UNIT 1

Health psychology: definition, history, mind-body relation, bio-psycho-social model in health psychology, research.

The systems of body: Nervous system, endocrine system, cardiovascular system, respiratory system, digestive system, renal system, reproductive system, immune system.

UNIT 2

Health compromising behavior: alcoholism, smoking, indisciplined and rash driving, indiscriminate use of mobile phone

Health enhancing behavior: proper diet, exercise, regular medical checkup for senior citizens, weight control

UNIT 3

Health behaviour and Primary prevention. What is health behaviour? Barriers to effective health promotion. Factors influencing the practice of health behaviour.

Modification of health behavior. Changing health behaviours by changing health beliefs.

Changing health behaviours through social engineering.

UNIT 4

Stress management:, Basic techniques of stress management - identifying the stressors, self monitoring, recognizing negative self talk, handling negative emotions, relaxation, meditation.

Spiritual methods: avoiding negative thinking, fear, use of will, faith and prayer, establishing peace

Books Recommended

Taylor, S.E. (1991). *Health Psychology* . N.Y. McGraw Hill

Pitts, M., Phillis, K. (2003). *The psychology of Health; An introduction*. E-library: Taylor & Fransis

Khubalkar, R.(2008). *Know Your Stress Manage Your Stress.* New Delhi: NeelKamal Publication Pvt. Ltd.

Drifte, C. (2008). Encouraging Positive Behavior in the Early Years. Sage Pub. @ www.sagepublications.com

Hamilton-West, K. (2010). *Psychobiological Processes in Health and Illness*. . Sage Pub. @ www.sagepublications.com

Marks, D. F.(2010). *Health Psychology: Theory, Research and Practice (3rd Ed.).* . Sage Pub. @ www.sagepublications.com

Mitra, B.K. (2011*). Personality Development & Soft Skil*ls. U.K.: Oxford

Compilation from writings of mothers and Sri Arbindoo (2006).Towards Perfect Health.Pondichery: Sri Arbindoo Ashram Publication Departmaent

Compilation from works of mothers and Sri Arbindoo (2004). Integral Healing. Pondichery: Sri Arbindoo Ashram Publication Departmaent

Semester – III

(Stream A: Paper – III, Core Elective- I-b)

Code: **PAST A- 3T4**

Psychological Assessment and Specific Testing

Objective: 1) To train students for clinical diagnosis and assessment.
2) To acquaint them with various psychological tests for assessment and diagnostic purposes

UNIT 1

Informal assessment: person perception, clinical sensitivity, empathy, sources of error, communication strategies, importance of rapport, clinical relationship.

Informal assessment: clinical interview, method of behavioral assessment, case history, mental status examination,

UNIT 2

Interpreting and synthesizing assessment findings, impressionistic and psychometric approach, statistical method in decision making.

Process of interpretation, sources of error in interpretation.

Writing psychological report, ethical issues, research on the process of clinical judgment

UNIT 3

1. Psychological Assessment of Development:
   Vineland Social maturity Scale

Developmental Screening Test

Goddard's Seguin Form Board

Diagnostic Test of Learning Disability

Gilliam Autism Rating Scale

UNIT 4

. Intelligence Testing

a) Stanford Binet Scales and its Indian Adaptation
b) Wechsler's Intelligence Scale: Adults and Children
c) Cross Cultural Test- Culture Fair Intelligence Tests (CFIT),
d) Progressive Matrices
e) Draw a Man test,
f) Bhatia Battery

Books Recommended

Aiken R. L, Marnat. G (2009): Psychological Testing and Assessment, Dorling Kingdersley, India Pvt. Ltd

Plante, T.G. (2005): Contemporary Clinical Psychology (2nd Ed) New Jersey: John Wiley & sons

Hecker, J.E & Thorpe G.L (2007). Introduction to Clinical Psychology, Science and Ethics. India: Dorling Kindersley (India) Pvt. Ltd

Weiner, B. (1983) : Clinical Methods in Psychology,N.Y. John - Wiley and sons

Neizal, M.T., Bernstein (1995) : Introduction to clinical Psychology, 2nd edi.

Third semester

Paper IV- Foundation Course -I (Stream A)

Paper – IV (CBCS)

GENERAL PSYCHOLOGY

CODE: FCI(psy) A-3T5

Unit I:

Introduction to Psychology:
Definition and nature of psychology; Approaches: Biological, Psychodynamic, Behaviourist, and Cognitive.

Psychological Testing ,Function and origins of psychological testing ,Nature and the use of Psychological test; Social and ethical implications of testing.

Types of psychological tests.

Unit II :
Learning: Definition and nature of learning and.
Methods of learning: Trial and error, Insight, modelling.

Memory
Definition, Nature of memory, models of memory,- Encoding, Storage retrieval, Retention, Recall Recognition, Relearning, Reconstruction
Stages of Memory systems – Sensory memory, Short-term memory, Long -term memory; Nature and causes of forgetting- decay, Interference.

Unit III :

Motivation: Meaning of Motivation, Types of Motivation, Primary motive, General motive, Secondary Motives and Motivational process. Theories of Motivation.

Emotion: What is emotion?, Components of emotion, Expressing and Recognizing Emotion. Theories of Emotion.

Unit IV :

Personality:The concept of personlity(meaning ,definition,nature) .Approaches to Personality:Freud's psycoanalytic approach,The Neo-Freudian psychoanalysts Approach: Carl Jung,Alfred Adler, Trait and Type Approach:Cattell's trait approach,Eysenck's Tait-Type approach,The Five Robust Factors-Super traits.

REFERENCES:

- Anastasi, A., Urbina, S. (2004).*Psychological Testing* (7th Ed.). India: Pearson Education Pvt. Ltd. (Indian Branch
- Baran, R. A. (2001). *Psychology*.New Delhi: Pearson Education Pvt. Ltd.
- Baron R.A and Byrne (2000) *social psychology*. Delhi: Pearson Education Asia.
- Benjamin, L. T. (1997). *History Of Psychology: Original Sources and ContemporaryResearch*.New Delhi: McGraw-Hill Companies.
- Bernstein, D. A., Roy, E. J., Wickens, C. D. and Srull, T. K. (1988). *Psychology*.Boston:Houghton Mifflin co.
- Boeree, C. G. (2006) *Personality Theories*
- Borkar P. M. (2009). *ManasashastraiManavivadvaVikas.* Nagpur: PimpalapurePrakashan.
- Ciccarelli, S. & Meyer, G. E. (2006). *Psychology*. New Delhi: Pearson Education.

- Coon, D. &Mitterer, J. O. (2007). *Introduction to Psychology: Gateways to Mind andBehaviour*.Singapore: Thomson Wadsworth.
- Ewen R. B. (1988) *An introduction to theories of personality*. 6rd Ed. Lawrence Erlbaum Associates Inc. Mahwah New Jersey, London
- Hall C.S.&Lindzey(1991) *Theories of personality*,4th edn.john wily&sons,Inc U.S.A.
- Hjelle, L. A. and Ziegler, D. J. (1992) *Personality Theories. Basic assumptions, research and Applications,* 3rd edn. McGraw-Hill Inc.International Edition.
- Inamdar, M. K., Gadekar, K. N. &Patil, A. M. (2005). *AdhunikManasashastra.* Pune:Diamond Publication
- Kerlinger, F.N.(1973*). Foundation of Behavioural Research* (2nd edn). N.Y.: Holt Rinehart & Wilson
- Lahye, B. B. (2003). *Psychology: An Introduction.* New Delhi: Tata McGraw-Hilll.
- Morgan, C. T., King, R. A., Weisz, J. R. &Schopler, J. (1986). *Introduction to Psychology.McGraw-Hill Book Co.*
- Myers D.G. (2006) *Social Psychology*. New Delhi: Tata McGraw Hill.
- Myres, Sahajpal and Behera (2012). *Social Psychology*. New Delhi: Tata McGraw Hill.
- Pandit, Kulkarni and Gore (1999). *SamanyaManasashastra.* Nagpur: Pimpalapure Pub.
- Pandit, R. V., Borude, R. R. Abhnyakar, S. &Golvilkar, V. (2006). *Manasashastra.*Pune: Continental Publishing.
- Passer,M. W. & Smith, R. E. (2007). *Psychology: The Science of Mind and Behaviour.* NewDelhi: Tata McGraw-Hill.
- Pervin, L. A.(1991) *Personality: Theory and Research*, 6th edn, John Wiley & Sons, Inc. U.S.A.
- Robert S.Feldman (2004)*Understanding psychology*. Tata Mcgraw Hill Sixth Edition ,New Delhi.
- Smith, D. B. (1908). *Psychology: Science and Understanding.* Boston: McGraw-Hill.
- Smith, E. E., Hocksema, S. N., Fredrickson, B. & Loftus, G. R. (2003). *Atkinson andHilgard's.Introduction to Psychology.*Singpore: Thompson Wadsworth.
- Zimbardo, P.G. and Weber, A. L. (1997). *Psychology.*N. Y.: Longman.

- **Third semester**
- **Paper IV- CORE III(Stream A)**

CODE- PS-I A-3T6 POSITIVE PSYCHOLOGY -I

Unit 1

Positive psychology and its historical perspective

Understanding positive psychology

Eastern and western perspective

Unit 2

Positive emotional states

Understanding positive affect, Positive emotions: wellbeing, happiness,

Emotional hardiness

Unit 3

Positive cognitive states

Optimism, hope, wisdom, courage, self efficacy, resilence

Mindfulness, spirituality

Unit 4

Prosocial behaviour

Empathy, gratitude, forgiveness

Altruism, love

Reference books

- Snyder, C. R., & Lopez, S. J. (2007). *Positive Psychology: The Scientific and Practical Exploration of Human Strengths*. New Delhi: Sage Publications.
- Snyder, C. R., & Lopez, S. J., (Eds.), (2004). *Positive Psychological Assessment: A Handbook of Models and Measures.* Washington DC: APA, DOI 10.1037/10612.000
- Linley, P. A., Joseph, S. (Eds.), (2004). *Positive psychology in Practice*. USA: John Wiley & Sons

Semester – III

(Stream A: Paper – V)

Code: **P A-3P1**

Clinical Psychology Practicum (SEM III)

a) Student/s shall critically evaluate one recent research article and present the same in clinical / journal club meeting orally using audio- visual aids.

b) Practice sessions / exercise(s) – history taking, MSE and writing report of the same and submit for perusal

c) relevant tests to be administered interpreted and reported any **two** from among the following areas

Testing areas:

Giftedness

Mental Retardation

Diagnostic – anxiety, depression, brain function, memory, perception etc

Neuropsychological

Personality

Mood

Adjustment

Interest

Aptitude

D) Writing references from book, book chapters, journal articles, online magazine ,etc as per APA format.

e)Writing abstract as per APA FORMAT

Each student is required to complete practical file containing five reports and submit the same for practical examination.

The maximum marks for practical examination will be as per the following scheme of

distribution of marks->

Internal Assessment **Marks: 40**

- **performance during academic session :**

assessment, evaluation → journal article presentation, testing,

conduct of practice / structured exercise - 20 marks

- journal article, testing, practice/structured exercise reports - 20marks

External Practical examination **MARKS:160**

- testing and report writing for one simulated case - 60 marks
- MSE and report writing of one case and visits 60 Marks
- Viva voce - 40 marks

TOTAL MARKS:200

Semester III (Stream- B)

(Organizational Psychology and Human Resource Management)

Core Paper - I

Code: HRM B- 3T1

Management of Personnel and Human Resources

UNIT – I

Personnel & Human Resource Management: -

- Why Study PHRM

The PHRM functions and activities and objectives; Relationship influencing PHRM functions and activities; Relationship with the internal and external environment; PHRM growing importance; Organizing the PHRM department; Roles and responsibilities of PHRM department, Staffing the PHRM department.

- Emerging trends in PHRM

WORK force diversity and PHRM; Business strategy and PHRM; Impact of information technology on PHRM; International PHRM.

- Human resource planning system

Purpose and importance of human resource planning; Human resource planning and other personnel activities; Human resource planning process-gathering analyzing and forecasting supply and demand data, establishing human resource objectives and policies, human resource programmmes; control and evaluation of human resource planning; Human resource accounting, audit and information system.

UNIT – II

Recruitment and Selection:-

- Purpose and importance of recruitment and selection; Recruitment strategies in diverse workforce; Recruiting methods, External recruiting; Internal recruiting; Effectiveness of various recruiting methods.
- Internal staffing process-recruitment-selection for promotions, transfer and placement.

- The total selection process.
- Fundamentals of personnel measurement; Personnel measurement as psychological measurement; Measurement of individual differences; Predictors; Criteria and their relationship; Validation of predictors; Reliability of predictors; Interpreting scores on selection measures.
- Validity generalization, concept, importance and methodology
- Selection method

Application blanks; Measurement if cognitive abilities; Personality assessment; Other simulation techniques, In-basket, Behavioral Event Interviewing (BEI), Psychometric properties of various methods.

UNIT – III

Training and Development:-

- What is training and development; Purpose and importance of training and development; Types if training-substantive knowledge and skill training, human process, attitudinal and sensitivity (T group) training.
- Training process
- Evaluation of training, Kirkpatrik and CIRO models.
- Human process Training-Intervention theory; Action research; stages of OD change.
- Coaching and mentoring
- Career Planning-Occupational choice and occupational adjustment, Career stages of development and adjustment; Career anchors.
- Management Development – What is management development, Managerial competencies – various competency models, Planning and administering the management development program. Development through work experience.

UNIT - IV

Performance Appraisal System:-

- Define performance, its determinants and consequences
- Purpose, importance and uses of appraisal
- Performance appraisal process and procedures – identifying performance dimensions; establishing performance standards; choice of factors.
- Methods of performance appraisal – norm referenced methods, Behavioral methods; MBO; output methods, 360 degree performance appraisal, self-appraisal- advantages, disadvantages.
- Issues related to performance appraisal; Assessing the effectiveness of appraisal system.
- Feedback in appraisal; Performance appraisal interview, Performance counseling.

Books Recommended –

Ashwathappa, K. (2008) Human Resource Management: Text and Cases (5th Ed.) Tata McGraw Hill, New Delhi.

1. Dessler, G. (2006) Human Resource Management (10th Ed.) Pearson Education.

2. DeCENZO, D.A., & Robbins, S.P. (2001) Personnel/Human Resource Management (3rd Ed.) Prentice Hall India, New Delhi.
3. Dwivedi, R.S. (2006) Managing Human Resources: Personnel Management in Indian Enterprises (2nd Ed.) Galgotia Publishing Company, New Delhi.
4. Ghanekar, A. (2000) Human Resource Management: Managing Personnel the HRD Way (4th Ed.) Everest Publishing House.
5. Kandula, R.S. (2003) Human Resource Management in Practice with 300 Models, Techniques and Tools. Prentice Hall of India, New Delhi.
6. Mondy, W. R. & Noe R.M., (2006) Human Resource Management (9th Ed.) Pearson Education.
7. Mamoria, C.B. & Gankar, S.V. (2006) Personnel Management: Text & Cases Himalaya Publishing House, Mumbai.

Semester III

Stream B: Core PAPER – II

Code: OB B-3T2

Organizational Behavior

UNIT – I

Foundations of Individual Behavior -

- Personal Factors; Environmental Factors; Organizational Systems and Resources; Models of Individual Behavior

UNIT – II

Dynamics of Group Behavior –

- Defining and classifying groups; stages of group development; group structure; group decision making;
- Types of teams – problem solving teams, self managed work teams, cross functional teams, virtual teams.
- Creating effective teams – Context, Composition, Work Design, and Process.
- Teams and Quality Management.

UNIT – III

Work Motivation –

- Concept of Work Motivation
- Early theories of Motivation
- Contemporary theories of Motivation
- Integrating Contemporary Theories of Motivation
- Management By Objectives. Employee Recognition Programs

Employee Involvement Program

Job Redesign and Scheduling Programs

UNIT –I V

Applied Motivation Practices

Rewards – Membership and Seniority-Based Rewards, Job Status-Based Rewards, Contemporary-Based Rewards, Performance Based Rewards; Job Design – Factors affecting Job Design, Job Design Approaches; Some Cautions About Environment; Behavioral Modification – Identifying Behavior Problem, OB Models in Practice; Empowerment; Goal Setting Theory; Participative Management; Problem Employees; Quality of Work Life.

Books Recommended –

1. Luthans F., Organization behaviour (10th Ed.) McGraw Hill International
2. Matthewman L. Work Psychology Oxford University Press
3. Newstorm J. & Davis K. Organization behaviour at work (11th Ed.) Tata McGraw Hill
4. Robbins, S.P. (2005) Organization Behaviour (11th Ed.)Prentice Hall India, New Delhi
5. Rose A., & Hetherington A., Introduction to human behaviour at workplace
6. Schermerhorn J.R., Hunt J.G. & Osborn R. N. (2006) Organization Behaviour (9th Ed.) Wiley Student Edition
7. Sekaran, U. (2004) Organization Behaviour: Text & Cases (2nd Ed.) Tata McGraw Hill, New Delhi

Semester III

Stream B: (Organizational Psychology and Human Resource Management)

PAPER - III Core Elective I-a

Code- CB B-3T3a

Consumer Behaviour

UNIT – I

- Concept, Importance
- Bases for segmenting consumer market
- Consumer Perception
- Learning and Brand Loyalty

-

UNIT – II

- Consumer needs and motivation
- Personality and Consumer Behavior: Personality Concept and Nature,
- Personality and Product/Brand Usage. Consumer Innovators.
- Personality and Store Choice.

UNIT – III

Consumer Attitudes: Consumers' Attitude Formation, Structural Models of Attitude; Attitude Measurement; Attitude Change.

UNIT-I V

Consumer Decision Making –

- Different views on consumer decision making

- Models of consumer decision making
- Nicosia Model. Howard-Sheth Model. Engel-Kollat-Blackwell Model. Sheth Family Decision Making Model.

Books Recommended –

Stanon, William J., Fundamentals of Marketing, 7th Ed., McGraw-Hill Book Company, 1984.

Rogers, E. W. and Shoemaker, F. F., Communication of Innovations, 2nd Edition. The Free Press, New York, 1971.

Kassarjian H. H. and Robertson, T. H., Perspectives in Consumer Behavior. Scott, Foreman and Company, Glenview III, 1973.

Farley, J. U., Howard, J. A. and Ring, L. W., Consumer Behavior: Theory and Application, Allyn and Bacon, Inc, Inc., Boston, 1974.

SEMESTER III (Stream B)

(Organizational Psychology and Human Resource Management)

PAPER – III Core Elective I-b

Code- IND B- 3T3b

INDUSTRIAL PSYCHOLOGY

Objectives:

1. To explain the application of Psychology in industrial setting.
2. To impart knowledge and skills required for creating healthy work environment.

Unit I:

- Introduction to Industrial Psychology:

Definition, objectives and scope of Industrial Psychology; role of psychologist in industry, challenges for industrial psychology

- Work Environment:

Physical working conditions, work schedule, psychological and social issues

Unit II:

Ethical issues in Industrial Setting:

Ethics: Nature, sources of business ethics, importance, ethical dilemmas, ethical misconduct in personnel function, managing ethics

Unit III:

Safety and Health in the workplace:

- Purposes and importance occupational safety and health, causes and preventions of accidents; workplace health hazards: problems and remedies
- Health & well-being programmes- Alcoholism, Drug abuse, Smoking

Unit IV:

Human factor engineering:

Concept of human factor engineering and nature of man machine system, workspace design, control devices

Books Recommended

1. Ashwathappa K. (2008) Human Resource Management text and cases (5th Ed.) Tata McGraw Hill, New Delhi

2. Millward, L. (2006) Understanding Occupational & Organizational Psychology, Sage publications

3. Schultz D. & Schultz S. E. (2004) Psychology and work today (8th Ed.) Pearson education

4. Tiffin J. and Mc Cormick, E.J. (1971) Industrial Psychology, Prentice Hall of India. New Delhi

5. Muchinsky, P.M. (2000) Psychology applied to work (6th Ed.) Wadsworth

Foundation Course –I (Stream B)

Third semester

Paper – IV (CBCS)

GENERAL PSYCHOLOGY

CODE: FCI(psy) B-3T4a

Unit I:

Introduction to Psychology:
Definition and nature of psychology; Approaches: Biological, Psychodynamic, Behaviourist, and Cognitive.

Psychological Testing ,Function and origins of psychological testing ,Nature and the use of Psychological test; Social and ethical implications of testing.

Types of psychological tests.

Unit II :
Learning: Definition and nature of learning and.
Methods of learning: Trial and error, Insight, modelling.

Memory
Definition, Nature of memory, models of memory,- Encoding, Storage retrieval, Retention, Recall Recognition, Relearning, Reconstruction
Stages of Memory systems – Sensory memory, Short-term memory, Long -term memory; Nature and causes of forgetting- decay, Interference.

Unit III :

Motivation: Meaning of Motivation, Types of Motivation, Primary motive, General motive, Secondary Motives and Motivational process. Theories of Motivation.

Emotion: What is emotion?, Components of emotion, Expressing and Recognizing Emotion. Theories of Emotion.

Unit IV :

Personality:The concept of personlity(meaning ,definition,nature) .Approaches to Personality:Freud's psycoanalytic approach,The Neo-Freudian psychoanalysts Approach: Carl Jung,Alfred Adler, Trait and Type Approach:Cattell's trait approach,Eysenck's Tait-Type approach,The Five Robust Factors-Super traits.

REFERENCES:

- Anastasi, A., Urbina, S. (2004).*Psychological Testing* (7th Ed.). India: Pearson Education Pvt. Ltd. (Indian Branch
- Baran, R. A. (2001). *Psychology*.New Delhi: Pearson Education Pvt. Ltd.
- Baron R.A and Byrne (2000) *social psychology*. Delhi: Pearson Education Asia.
- Benjamin, L. T. (1997). *History Of Psychology: Original Sources and ContemporaryResearch*.New Delhi: McGraw-Hill Companies.
- Bernstein, D. A., Roy, E. J., Wickens, C. D. and Srull, T. K. (1988). *Psychology*.Boston:Houghton Mifflin co.
- Boeree, C. G. (2006) *Personality Theories*
- Borkar P. M. (2009). *ManasashastraiManavivadvaVikas.* Nagpur: PimpalapurePrakashan.
- Ciccarelli, S. & Meyer, G. E. (2006). *Psychology*. New Delhi: Pearson Education.
- Coon, D. &Mitterer, J. O. (2007). *Introduction to Psychology: Gateways to Mind andBehaviour*.Singapore: Thomson Wadsworth.
- Ewen R. B. (1988) *An introduction to theories of personality*. 6rd Ed. Lawrence Erlbaum Associates Inc. Mahwah New Jersey, London

- Hall C.S.&Lindzey(1991) *Theories of personality*,4th edn.john wily&sons,Inc U.S.A.
- Hjelle, L. A. and Ziegler, D. J. (1992) *Personality Theories. Basic assumptions, research and Applications,* 3rd edn. McGraw-Hill Inc.International Edition.
- Inamdar, M. K., Gadekar, K. N. &Patil, A. M. (2005). *AdhunikManasashastra.* Pune:Diamond Publication
- Kerlinger, F.N.(1973*). Foundation of Behavioural Research* (2nd edn). N.Y.: Holt Rinehart & Wilson
- Lahye, B. B. (2003). *Psychology: An Introduction.* New Delhi: Tata McGraw-Hilll.
- Morgan, C. T., King, R. A., Weisz, J. R. &Schopler, J. (1986). *Introduction to Psychology.McGraw-Hill Book Co.*
- Myers D.G. (2006) *Social Psychology*. New Delhi: Tata McGraw Hill.
- Myres, Sahajpal and Behera (2012). *Social Psychology*. New Delhi: Tata McGraw Hill.
- Pandit, Kulkarni and Gore (1999). *SamanyaManasashastra.* Nagpur: Pimpalapure Pub.
- Pandit, R. V., Borude, R. R. Abhnyakar, S. &Golvilkar, V. (2006). *Manasashastra*.Pune: Continental Publishing.
- Passer,M. W. & Smith, R. E. (2007). *Psychology: The Science of Mind and Behaviour.* NewDelhi: Tata McGraw-Hill.
- Pervin, L. A.(1991) *Personality: Theory and Research*, 6th edn, John Wiley & Sons, Inc. U.S.A.
- Robert S.Feldman (2004)*Understanding psychology*. Tata Mcgraw Hill Sixth Edition ,New Delhi.
- Smith, D. B. (1908). *Psychology: Science and Understanding.* Boston: McGraw-Hill.
- Smith, E. E., Hocksema, S. N., Fredrickson, B. & Loftus, G. R. (2003). *Atkinson andHilgard's.Introduction to Psychology.*Singpore: Thompson Wadsworth.
- Zimbardo, P.G. and Weber, A. L. (1997). *Psychology.*N. Y.: Longman.

CORE-III (Stream B)

Third semester

Paper – IV (CBCS)

POSITIVE PSYCHOLOGY –I

CODE- PS-I B-3T4b

Unit 1

Positive psychology and its historical perspective

Understanding positive psychology

Eastern and western perspective

Unit 2

Positive emotional states

Understanding positive affect, Positive emotions: wellbeing, happiness,

Emotional hardiness

Unit 3

Positive cognitive states

Optimism, hope, wisdom, courage, self efficacy, resilence

Mindfulness, spirituality

Unit 4

Prosocial behaviour

Empathy, gratitude, forgiveness

Altruism, love

Reference books

- Snyder, C. R., & Lopez, S. J. (2007). *Positive Psychology: The Scientific and Practical Exploration of Human Strengths*. New Delhi: Sage Publications.
- Snyder, C. R., & Lopez, S. J., (Eds.), (2004). *Positive Psychological Assessment: A Handbook of Models and Measures.* Washington DC: APA, DOI 10.1037/10612.000
- Linley, P. A., Joseph, S. (Eds.), (2004). *Positive psychology in Practice*. USA: John Wiley & Sons

Semester – III **(Stream B)**

Paper – V

Code: P B-3P1

Organizational Psychology Practicum (SEM III)

A)Student/s shall critically evaluate one recent research article and present the same in journal club meeting orally using audio- visual aids.

B)relevant tests' to be administered interpreted and reported: any Five from among the following areas:

Testing areas:

Job analysis

Job Design

Job attitudes

Job stress

Job attitudes

Communication

Organizational climate

Organizational commitment

Organizational culture

Leadership

Motivation

Self-perception

C) field visits to industries / organizations: 3

D) Writing references from book, book chapters, journal articles, online magazine ,etc as per APA format.

e)Writing abstract as per APA FORMAT

Each student is required to complete practical file containing five reports and submit the same for practical examination.

The maximum marks for practical examination will be as per the following scheme of

distribution of marks->

Internal Assessment **Marks: 40**

- **performance during academic session :**

assessment, evaluation → journal article presentation, testing,

conduct of practice / structured exercise - 20 marks

- journal article, testing, practice/structured exercise reports - 20marks

External Practical examination **MARKS:160**

- testing and report writing for one simulated case - 60 marks
- MSE and report writing of one case and visits 60 Marks
- Viva voce - 40 marks

TOTAL MARKS:200

Stream C: COUNSELLING PSYCHOLOGY

SEMESTER-III

(Stream C: Core PAPER- I)

Code- GCP C- 3T1

GUIDANCE AND COUNSELLING PSYCHOLOGY

UNIT-I

- Counselling psychology: definition, nature and scope, counselling psychology's roots in vocational guidance, historical development and current status. principles of counselling psychology.

- What is guidance? Basic principles of guidance. Guidance movement in India.
- The counsellor and the therapist.
- Introduction, personal characteristics, personal counselling for the counsellor, values philosophy, multiculturally skilled counsellor, problems and issues faced by the beginning counsellor.

UNIT- 2

Ethical issues:

Introduction ,therapists, competence, education & training foundation of ethical practice, issues in the client/therapist, relationship, confidentiality, legal liability and malpractice.

UNIT-3

Counselling process:

Counselling relationship

Counselling interview

Types of Counselling: Counsellor –oriented counselling; Counselee – oriented counselling; Eclectic – Counselling equally oriented to both the counsellor and counselee.

UNIT-4

Creative approaches to counselling:

Art, imagery, guided imagery, hypnotherapy, music, writing: structured writing, poetry, play - games,

Crisis intervention:

Books Recommended

Kinra, A. K. (2008). Guidance and counselling. Dorling Kinderseley (India) pvt. Ltd. Pearson Longman

Nugent, Frank A.(1995): An Introduction to the profession of counselling ,Maxwell Macmillan Canada, Inc. Toronto.

Gibson, R.L. and Marianne, H.M.(2008):Introduction to counselling and Guidance,7th edition, Prentice Hall of India, New Delhi.

Narayan Rao S.:(1991) A counselling psychology: Tata McGraw Hill Book company, New Delhi.

Forrest, C. (2011). Therapy Skills for Health Care; An introduction to brief psychological technics.UK: M & C Publishing

Korchin, S. J. (1976). *Modern Clinical Psychology: Principles of Intervention in the Clinic and Community*. N. Y.: Basic Books.

Semester III
Stream C: Core Paper - II

CODE : BCS C-3T2

BASIC COUNSELLING SKILLS

UNIT-I

Basic skills and concepts:

a)Attending : eye contact, attentive body language, distance, vocal tone, verbal tracking

b)Basic listening skills: active listening, client observation, verbal behaviour, encouraging, paraphrasing, summarising, reflection of feelings, use of open end and closed questions.

UNIT-2

c) Self attending skills: self awareness, centering and relaxing, humor, non judgemental attitude towards self and others, genuineness, concretness.

d)Advanced skills and concepts: self disclosure, confrontation, immediacy, action skills, termination skills.

UNIT-3

- Stress and coping: stress management

Stress and coping, coping skills, coping process, social support, stressful situations and life transition.

- Treating stress related problems:

Supportive therapy
Relaxation training
Systematic desensitization
Cognitive modification
Social intervention

UNIT-4

Assertiveness training, Self-monitoring, goal setting, Thought stopping, communication skills - TA

Spiritual methods; avoiding negative thinking, fear, use of will, faith and prayer, establishing peace

Books recommended

Drifte, C. (2008). Encouraging Positive Behavior in the Early Years. Sage Pub. @ www.sagepublications.com

Flanagan, J.S., Flanagan, R.S. (2004). Counselling and Psychotherapy, Theories in Context and Practice. New Jersey:. John Wiley & Sons.

Davis, M., Eshelman, E.R., McKay, M.(1996). The Relaxation & Stress Reduction Workbook. Mumbai: Jaico Publishing House
Compilation from writings of Mother & Sri Aurobindo (2006). Towards Perfect Health. Pondicherry: Sri Aurobindo Ashram Publication Dept.
Compilation from works of Sri Aurobindo &Mother (2004). Integral Healing. Pondicherry: Sri Aurobindo Ashram Publication Dept.
Khubalkar, R.(2008). Know Your Stress Manage Your Stress. New Delhi: NeelKamal Publication Pvt. Ltd
Snyder, C. R., Lopez, S. J. (2006). Positive Psychology; The Scientific and Practical Exploration of Human Strengths. Sage Pub. @ www.sagepublications.com

Semester III Stream C:
Paper III: Core Elective I-a
EDUCATIONAL & CAREER GUIDANCE

CODE : ECG C-3T3a

UNIT – 1
Educational Guidance
What is education? Relationship between Education and Guidance. Educational Guidance.
Importance of Guidance at various stages of Education
Career Masters

UNIT –2
Perspectives on career guidance and counselling: vocational guidance, comprehensive career guidance, perspectives on counsellor's role in career guidance
Preschool career guidance, career guidance techniques in the preschool age.

UNIT –3
Career guidance in the elementary school, organization of guidance program in the elementary school, objectives, functions of elementary career guidance, career counsellor and his role, career guidance techniques.

UNIT-4
Career guidance in senior high school: organization of guidance program, objectives, functions and career guidance techniques.
Information in career guidance and counselling: types of delivery system.
Career development and choice behaviour, influencing factors: theories of career development and choice.
.

Books recommended

Kinra, A. K. (2008). Guidance and counselling. Dorling Kinderseley (India) pvt. Ltd. Pearson Longman

Narayan Rao S.:(1991) A counselling psychology: Tata McGraw Hill Book company, New Delhi.

Greenhaus, J.H., Callanan, G.A., Godshaik, V. M.(2010*). Career Management* (4th Ed.). Sage Pub. @ www.sagepublications.com

Herr, E.L. & Cramer, S.H. (1987). *Career Guidance and Counselling through the life span, Systematic approach* (3rd Ed.). London: Scoot, Oresman & Co.

Drummond, R.J. & Ryan, C.W. (1995). Career Counselling ;A developmental approach. New Delhi: Prentice Hall India

Noonam, E. (1983). *Counselling Your People*. N.Y.: Methuen Inc.

Betz, N.E., Fit Garald, L.E. (1987). *The Career Psychology of Women*. N.Y.: Academic Press

Subesh, D. (2010). *Managing people at work; Employment relations in Globalizing India*. Sage Pub. @ www.sagepublications.com

Arulmani, G. Arulmani, S.N. (2004). *Career Counselling*; A Handbook. New Delhi: Tata McGraw Hill

Crow & Crow. (1962). *An Introduction to Guidance*. New Delhi: Eurasia Publishing House

McLean & Holan. (1955). *Counselling Psychology*. London: Tata McGraw Hil

Semester III
Stream C: Paper – III Core Elective I-b
CODE- ACG C- 3T3b

ASSESSMENT IN COUNSELLING AND GUIDANCE

UNIT-I

- The history and meaning of assessment: introduction, the use of tests, the psychometric and impressionistic approach, diagnosis and assessment, measurement and assessment, tests and assessment.

- Empathy, person perception, errors in person perception, good judge of personality.

UNIT- 2

Ethics of psychological assessment.

Writing case study report and preparing profile.

Report writing.

UNIT-3

The assessment of development:

The vineland social maturity scale

Beley Scale for Infant Development

Developmental screening test.

UNIT –4

The assessment of intelligence:

Kamat- Binet verbal test of intelligence

Weschler intelligence scale for children(WISC- R), Wechsler adult intelligence scale (WAIS- R)

Culture fair intelligence test,

Progressive matrices, CPM

Seguine form board,Draw a man test

Bhatia's performance test of intelligence.

Books recommended

Aiken, L.R.(2000):*Psychological Testing and Assessment* (10th ed.). Allyn and Bacon, inc.

Walsh, W.B. and Betx, N.E.(1997): Tests and Assessment,3rd edition, Prentice-Hall, Inc., Englewood Chifts , New jersey.

Anastasi ,A & Urbania, S(1997): Psychological Testing, 7th edition, Prentice Hall, Inc., Englewood chiffs, New jersey.

Graham, J. R., Naglieri, J.A. (Eds.), (2003). *Handbook of Psychology; vol.10 Assessment Psychology*. New Jersey:. John Wiley

Freeman (1960). *Theory and Practice of Psychological Testing*

Korchin, S. J. (1976). *Modern Clinical Psychology: Principles of Intervention in the Clinic and Community*. New York: Basic Books.

Manuals of the Psychological Tests mentioned in curriculum

Paper IV Foundation Course I

Third semester

Paper – IV (CBCS)

GENERAL PSYCHOLOGY

CODE: FCI(psy) C-3T4a

Unit I:

Introduction to Psychology:
Definition and nature of psychology; Approaches: Biological, Psychodynamic, Behaviourist, and Cognitive.

Psychological Testing ,Function and origins of psychological testing ,Nature and the use of Psychological test; Social and ethical implications of testing.

Types of psychological tests.

Unit II :
Learning: Definition and nature of learning and.
Methods of learning: Trial and error, Insight, modelling.

Memory
Definition, Nature of memory, models of memory,- Encoding, Storage retrieval, Retention, Recall Recognition, Relearning, Reconstruction
Stages of Memory systems – Sensory memory, Short-term memory, Long -term memory; Nature and causes of forgetting- decay, Interference.

Unit III :

Motivation: Meaning of Motivation, Types of Motivation, Primary motive, General motive, Secondary Motives and Motivational process. Theories of Motivation.

Emotion: What is emotion?, Components of emotion, Expressing and Recognizing Emotion. Theories of Emotion.

Unit IV :

Personality:The concept of personlity(meaning ,definition,nature) .Approaches to Personality:Freud's psycoanalytic approach,The Neo-Freudian psychoanalysts Approach: Carl Jung,Alfred Adler, Trait and Type Approach:Cattell's trait approach,Eysenck's Tait-Type approach,The Five Robust Factors-Super traits.

REFERENCES:

- Anastasi, A., Urbina, S. (2004).*Psychological Testing* (7th Ed.). India: Pearson Education Pvt. Ltd. (Indian Branch
- Baran, R. A. (2001). *Psychology*.New Delhi: Pearson Education Pvt. Ltd.
- Baron R.A and Byrne (2000) *social psychology*. Delhi: Pearson Education Asia.
- Benjamin, L. T. (1997). *History Of Psychology: Original Sources and ContemporaryResearch.*New Delhi: McGraw-Hill Companies.
- Bernstein, D. A., Roy, E. J., Wickens, C. D. and Srull, T. K. (1988). *Psychology*.Boston:Houghton Mifflin co.
- Boeree, C. G. (2006) *Personality Theories*
- Borkar P. M. (2009). *ManasashastraiManavivadvaVikas.* Nagpur: PimpalapurePrakashan.
- Ciccarelli, S. & Meyer, G. E. (2006). *Psychology*. New Delhi: Pearson Education.

- Coon, D. &Mitterer, J. O. (2007). *Introduction to Psychology: Gateways to Mind andBehaviour*.Singapore: Thomson Wadsworth.
- Ewen R. B. (1988) *An introduction to theories of personality*. 6rd Ed. Lawrence Erlbaum Associates Inc. Mahwah New Jersey, London
- Hall C.S.&Lindzey(1991) *Theories of personality*,4th edn.john wily&sons,Inc U.S.A.
- Hjelle, L. A. and Ziegler, D. J. (1992) *Personality Theories. Basic assumptions, research and Applications,* 3rd edn. McGraw-Hill Inc.International Edition.
- Inamdar, M. K., Gadekar, K. N. &Patil, A. M. (2005). *AdhunikManasashastra.* Pune:Diamond Publication
- Kerlinger, F.N.(1973*). Foundation of Behavioural Research* (2nd edn). N.Y.: Holt Rinehart & Wilson
- Lahye, B. B. (2003). *Psychology: An Introduction.* New Delhi: Tata McGraw-Hilll.
- Morgan, C. T., King, R. A., Weisz, J. R. &Schopler, J. (1986). *Introduction to Psychology.McGraw-Hill Book Co.*
- Myers D.G. (2006) *Social Psychology*. New Delhi: Tata McGraw Hill.
- Myres, Sahajpal and Behera (2012). *Social Psychology*. New Delhi: Tata McGraw Hill.
- Pandit, Kulkarni and Gore (1999). *SamanyaManasashastra.* Nagpur: Pimpalapure Pub.
- Pandit, R. V., Borude, R. R. Abhnyakar, S. &Golvilkar, V. (2006). *Manasashastra.*Pune: Continental Publishing.
- Passer,M. W. & Smith, R. E. (2007). *Psychology: The Science of Mind and Behaviour.* NewDelhi: Tata McGraw-Hill.
- Pervin, L. A.(1991) *Personality: Theory and Research*, 6th edn, John Wiley & Sons, Inc. U.S.A.
- Robert S.Feldman (2004)*Understanding psychology*. Tata Mcgraw Hill Sixth Edition ,New Delhi.
- Smith, D. B. (1908). *Psychology: Science and Understanding.* Boston: McGraw-Hill.
- Smith, E. E., Hocksema, S. N., Fredrickson, B. & Loftus, G. R. (2003). *Atkinson andHilgard's.Introduction to Psychology.*Singpore: Thompson Wadsworth.
- Zimbardo, P.G. and Weber, A. L. (1997). *Psychology.*N. Y.: Longman.

- **Paper IV CORE-III**

Third semester

CODE: **PS-I C-3T4b**

POSITIVE PSYCHOLOGY -I

Unit 1

Positive psychology and its historical perspective

Understanding positive psychology

Eastern and western perspective

Unit 2

Positive emotional states

Understanding positive affect, Positive emotions: wellbeing, happiness,

Emotional hardiness

Unit 3

Positive cognitive states

Optimism, hope, wisdom, courage, self efficacy, resilence

Mindfulness, spirituality

Unit 4

Prosocial behaviour

Empathy, gratitude, forgiveness

Altruism, love

Reference books

- Snyder, C. R., & Lopez, S. J. (2007). *Positive Psychology: The Scientific and Practical Exploration of Human Strengths*. New Delhi: Sage Publications.
- Snyder, C. R., & Lopez, S. J., (Eds.), (2004). *Positive Psychological Assessment: A Handbook of Models and Measures.* Washington DC: APA, DOI 10.1037/10612.000
- Linley, P. A., Joseph, S. (Eds.), (2004). *Positive psychology in Practice*. USA: John Wiley & Sons

Semester – III

Stream C: Paper - V

Code: P C-3P1

Counselling Psychology Practicum

Journal article evaluation

A)Student/s shall critically evaluate one recent research article and present the same in counseling - journal club meeting orally using audio- visual aids.

B)Practice exercises – history taking and writing report of the same and submit for perusal.

C)Relevant tests' to be administered interpreted and reported any Three from among the following areas:
Testing areas:

Aptitude

Adjustment

Attitude

Intelligence

Personality

Interest

Values

d) Out reach program: Guidance and or counseling workshop for specified groups→ e.g., students, teachers, parents, old people or any other as decided by the concerned teachers' committee.

e) Institutional visits: 3

f) Writing references from book, book chapters, journal articles, online magazine ,etc as per APA format.

g) Writing abstract as per APA FORMAT

Each student is required to complete practical file containing five testing reports, two case history reports, visit report and workshop report and submit the same for practical examination.

The maximum marks for practical examination will be as per the following scheme of

distribution of marks->

Internal Assessment **Marks:40**

- **performance during academic session :**

assessment and evaluation → journal article presentation,

testing, conduct of workshop and case history taking - 20 marks

- journal article written report, testing reports,
- case history report, and workshop reports - 20 marks

External Practical examination **MARKS:160**

- testing and report writing for one simulated case - 60 marks
- evaluation of journal article written report, testing, case history , and workshop reports - - 60 marks
- Viva voce - 40 marks

TOTAL MARKS:200

Semester IV

(Stream A: Core Paper – I)

Code: PP A- 4T1

PSYCHOPATHOLOGY

UNIT 1

I] Anxiety disorders and their management: generalized anxiety disorder, panic disorder, phobia, obsessive-compulsive disorder

ii] Impulse control disorders: kleptomania, pyromania, pathological gambling

UNIT 2

MOOD DISORDERS

Depression; major depressive disorder, Dysthymic disorder

Bipolar disorder I and II, Cyclothymic disorder

Suicide, Theories of Suicide

UNIT 3

- Schizophrenic disorders: Disorganized, catatonic, paranoid, undifferentiated, residual, schizoaffective, atypical
- Sleep Disorders: Parasomnias – nightmare disorder, sleepwalking disorder. Insomnia.
- ORGANIC MENTAL DISORDERS

i] Alzheimer's disease, Parkinson's disease, Epilepsy, Delirium, Dementia

ii] Substance induced, infections, tumors, head injury, toxin induced disorders

UNIT 4

i] Somatoform disorders: Somatization, conversion disorder, hypochondriasis

ii] Dissociative disorders: Dissociative amnesia. Dissociative Fugue,

iii] Sexual disorders: sexual dysfunction, gender identity disorder, paraphilias

iv] Sexual victimization: rape, pedophilia.

Books Recommended

Sarason , I.G. & Sarason, B. R. (1993). *Abnormal Psychology; The Problem of Maladaptive Behaviour*. New Jersey: Prentice Hall

ICD 10. Jeneva: W.H.O. Publication

DSM IV (TR), Diagnostic Statistical Manual of Mental Disorder DSM-IV TR, American Psychological Association; Jaypee publication

Davidson, G.C. & Neal, J.M. (1990). *Abnormal Psychology.* N.Y.: John Wiley

Kaplan, H.I., Sadock, B.J. (Eds.), (2000*). Comprehensive Text book of Psychiatry* (7th Ed.). London: Williams & Wilkins

Maddux, J.E., Winstead, B.A. (Eds.) (2005). *Psychopathology; Foundations for Contemporary Understanding* . New Jersey: Lawrence, Earlbaum Associates

Barlow D, and Durand M. (2nd Ed.) (1998): Abnormal Psychology: An Integrative Approach, India, Bangalore; Eastern Press

Walker, C.E, (Ed) (1983): The Handbook Of Clinical Psychology, Illinois, Dow Jone- Irwin

Carson, R.C, Butcher, J.N. & Mineka, S. (1996). Abnormal Psychology and modern Life (10th Ed): N.Y.: HarperColins

Ottmanns, T.F., Emery R.E. (1995). Abnormal Psychology. U.S.A: Prentice Hall

Nevid, J.S., Rathus, S.A., Greene, B. (1997): Abnormal Psychology in Changing World (3rd Ed). U.K.: Prentice Hall

Hales, R.E., Yudofsky, S.G. (2003): Textbook of Clinical Psychiatry. Washington D.C: American Psychiatry Publishing,inc.

Colman, J.C (1986): abnormal psychology and Modern Life. D.B.Taraporevala Sons & Co. Pvt. Ltd; Mumbai, India

Semester IV

(Stream A: Core Paper – II)

Code: **TIS A-4T2**

THERAPEUTIC INTERVENTION STRATEGIES

Objectives:

1) To provide the students a chance to study various therapeutic approaches.

2) To help in developing a balanced view of the various therapies and practical techniques employed.

UNIT 1

Biological approaches: Chemotherapy, E.C.T., Brain wave therapy, Bio-feedback, Narcoanalysis

Neuro- Linguistic Programming

UNIT 2

Behavioral techniques: Systematic desensitization, Contingency contracting, Shaping,

Aversive conditioning, Modeling REBT, CBT.

UNIT 3

- Group therapy, Family therapy, Psycho-drama, Play therapy

  Supportive Psychotherapy

- Milieu therapy, Progressive relaxation, Flooding, Hypnosis, Crisis intervention, Hospitalization

UNIT 4

Traditional approaches: Yoga, Shavasan, Meditation, Vipashyana

Recent methods: Cyber therapy, tele-counseling

Books Recommended

Agras, W.S., Kazadin, A.E., Wilson, G.T. (1979). Behaviour Therapy. San Fransisco: Freeman &Co.

Lanyon, R.I., Layon, B.P. (1978).). Behaviour Therapy: A Clinical Introduction. Philippines: Addison-

Wesley. Korchin, S. J. (1976). Modern Clinical Psychology: Principles of Intervention in the Clinic and Community. New York: Basic Books

Plante, T.G. (2005). Contemporary Clinical Psychology (2nd Ed.) New Jersey:. John Wiley & Sons

Bellack, A. S., Hersen, M., Johnston, D. W., & Johnston, M. (Eds.). (1998). Comprehensive Clinical Psychology (Vol. 8). New York: Pergamon

Wolberg, L.S., Aronson, M.L. (1991). Group and Family Therapy. N.Y.: Brunner /Mazal

Davis, M., Eshelman, E.R., McKay, M.(1996). The Relaxation & Stress Reduction Workbook. Mumbai: Jaico Publishing House

Pandit, M.P. (1990). Dhyana. Pondicherry: Dipti Publication

Corey, G. (1991): Theory and Preactice Of Counselling and Psychotherpay, 4th Ed., California: Brooks

Feltham C, Horton I (Ed), (2006): The Sage Handbook of Counselling and Psychotherapy, 2nd Ed. Sage Publication; New Ddelhi.

Nelson. J,R: (2001): Therory and Practice of Counselling and Therapy 3rd Ed. Sage Publication, New Delhi

Agras,W.S.,Kazadin,A.E.,Wilson,G.T.(1979).Behavioral Therapy. San Fransisco: Freeman &Co

Lanyon, R.I., Layon, B.P.(1979). Behavioral Therapy: A Clinical Introduction.Philippines: Addison-

Semester IV

(Stream A: Paper – III Core Elective II-a)

Code: CMM A-4T3a

COMMUNITY MENTAL HEALTH AND MEDICAL PSYCHOLOGY

Objective: To acquaint the students with various aspect of community psychology and Medical Psychology

UNIT 1

Community psychology: evolution and orientation. Research in Community psychology,: evaluation research

.Ecology, effect of crowding,.

UNIT 2

Helping people with long-standing illness, psychiatric patients, physical disability or amputation, suicide prevention

Methods of community intervention:- day care centre, consultation, non-professional in community psychology, mental health education

UNIT 3

Medical psychology and behavioral medicine,: definition, role, history, area of work of psychologists in hospital set-up and problems encountered by them

UNIT 4

- Psychological assessment of: Cancer, Chronically ill geriatric patients, Arthritis; Type A behavior and CHD and Hypertension

- Modification and prevention of risk factors in cardio-vascular disorders

Psychological preparation for stressful medical procedures

Rehabilitation of patients with CNS dysfunction, intervention with cancer patients

Behavioral treatment of alcoholism, smoking

Books Recommended

Korchin, S. J. (1976). Modern Clinical Psychology: Principles of Intervention in the Clinic and Community. New York: Basic Books

Kapoor, M. (1995). Mental Health of Indian Children. India: Sage Pub.

Prokop, C.K.& Bardley, L.A. (1981). Medical Psychology; Contribution to Behavioral Medicine. N.Y.: Academic Press.

Kimble, D.P. (1998). Biological Psychology. N.Y.: Holt Rinehart

Ayers, S., De Visser, R (2010). Psychology for Medicine. . Sage Pub. @ www.sagepublications.com

Plante, T.G. (2005). Contemporary Clinical Psychology (2nd Ed.) New Jersey:. John Wiley & Sons

Ader,R.: (1981) Psychoneuro Immunology, San Diego Acad, Press.

Taylor, S.E.: (1991) Health Psychology, New York, McGraw Hill.

Semester IV

(Stream A: Paper – III Core Elective II-b)

Code: PT A- 4T3b

PSYCHOLOGICAL TESTING IN CLINICAL PSYCHOLOGY

Objective:

To acquaint students with various psychological tests for assessment and diagnostic purposes

UNIT I

- Testing – Concept – Purposes – Types – interest inventories and
- Aptitude Testing – Purposes–Techniques of measuring- Aptitude Scales

- Adjustment and Health Inventories
- Attitude and value tests

UNIT 2

Objective Tests of Personality: MMPI, 16PF, EPQ, MCMI

Projective techniques; Rorschach, TAT, CAT, DAPT, SCT, Rosenzweig Picture Frustration Study.

UNIT 3

Clinical Scales for anxiety, depression and psychopathology

Loneliness scale, Assertiveness assessment

UNIT 4

Psychological testing for Brain Damage: LNNPB, Halstead Reitan, Benton Retention Test, Neuropsychological batteries of AIMMS, NIMHANS, PGI.

Psychological testing for handicaps

Psychological testing for learning disability.

Books Recommended

Groth-Marnat,G. (2003).*Handbook Of Psychological Assessment(4th ed.).* New Jersey:. John Wiley & Sons

Anastasi, A., Urbina, S. (2004).*Psychological Testing* (7th Ed.). India: Pearson Education Pvt. Ltd. (Indian Branch)

Graham, J. R., Naglieri, J.A. (Eds.), (2003). *Handbook of Psychology; vol.10 Assessment Psychology*. New Jersey:. John Wiley

Urbania, S. (2004). *Essentials of Psychological Testing*. New Jersey:. John Wiley & Sons

Freeman. Theory and Practice of Psychological Testing

Korchin, S. J. (1976). *Modern Clinical Psychology: Principles of Intervention in the Clinic and Community*. New York: Basic Books.

Weiner, B. (1983) : Clinical Methods in Psychology,N.Y. John - Wiley and sons
Lezak, M.D. (1995) : Neuropsychological Assessment N. Y. Oxford University, Press.
Manuals of the Psychological Tests mentioned in curriculum

Paper IV Foundation Course II (stream:A)

Forth Semester

Paper- IV (CBCS)

Applied Psychology

CODE: FCII(psy)-A-4T4a

Unit I:

Positive Psychology: Definitions, Goals and Assumption of positive psychology. Emotional perspective- positive Emotions. Broaden and Build theory of positive psychology. The meaning and measure of happiness.

Strategies to enhance happiness. Happiness and the facts of life-Happiness and the facts of life-Happiness across the life span-Gender and happiness-other facts of life. Spirituality and well-being.

Unit II:

Health Psychology: Introduction to health psychology, Concept of health – Models of health. Health behaviour and belief. Health awareness and Health seeking behaviour. Chronic illness-Causes and consequences; Management of health problems like obesity and chronic illness like cancer, cardiac problems and Diabetes.

Unit III:

Leadership:

What is Leadership? Types of Leadership. Basic Approaches to Leadership, Trait theory,Behavioral Theory,Contingency Theory.

Communication:

Function,process and direction of communication. Methods of communication.

Unit IV:

Stress and its management: Stress and Stressors, Basic techniques of stress management - identifying the stressors, self monitoring, recognizing negative self talk, handling negative emotions, relaxation, meditation ,avoiding negative thinking, fear, use of will, faith and prayer, establishing peace.

Books Recommended:-

- Barannon L and Feist J (1989) *Health Psychology*: An Introduction. 4th Edition, Wordsworth
- Baron R.A and Byrne (2000) social psychology. Delhi: Pearson Education Asia.
- Baumgarder S.T and Crothers. (2009) *Positive psychology*. New Delhi: Pearson.
- Compilation from works of mothers and Sri Arbindoo (2004). Integral Healing. Pondichery: Sri Arbindoo Ashram Publication Department.
- Dimmates M.R and Martin L.R (2007). *Health Psychology*. Pearson.
- Health.Pondichery: Sri Arbindoo Ashram Publication Department.
- Khubalkar, R.(2008). *Know Your Stress Manage Your Stress.* New Delhi: Neel Kamal Publication Pvt. Ltd.
- Luthans F. (2002), *Organizational Behaviour*. McGraw Hill, Arvin, New Delhi.

- Marks D.F(2002). *The Health Psychology*. Reader, Sage.
- Myers D.G. (2006) *Social Psychology*. New Delhi: Tata McGraw Hill.
- Myres, Sahajpal and Behera (2012). *Social Psychology*. New Delhi: Tata McGraw Hill.
- Proshansky, H. M. (1987). "The field of environmental psychology: securing its future." In *Handbook of Environmental Psychology*, eds. D. Stokols and I. Altman. New York: John Wiley & Sons.
- Slyder R. S (2007) *Positive Psychology*. New Delhi: Sage Publication.
- Steve B. R and Marie C. K. (2009) . *Positive psychology*. Dorling Kindersley: India
- Weinberg, R.S. & Gould, D. (2010). *Foundations of Sport and Exercise Psychology*. Champaign, IL: Human Kinetics.

Paper IV CORE III (stream:A)

Forth Semester

POSITIVE PSYCHOLOGY –II

CODE- PS-II A-4T4b

Unit 1

Changing human behaviour towards positive

Preventing the bad and enhancing the good

Unit 2

Positive environments

Positive schooling, psychology of gainful employment

Unit 3

Assessment of positive behaviour

Assessment of problem solving behaviour, locus of control, creativity, self-esteem, emotional intelligence, sense of humor

Unit 4

Community orientation towards positivity

Focusing on resources, focus on sports; physical activities, empowerment, person centered rehabilitation

Positive psychology in cultural context

Reference books

- Snyder, C. R., & Lopez, S. J. (2007). *Positive Psychology: The Scientific and Practical Exploration of Human Strengths*. New Delhi: Sage Publications.
- Snyder, C. R., & Lopez, S. J., (Eds.), (2004). *Positive Psychological Assessment: A Handbook of Models and Measures.* Washington DC: APA, DOI 10.1037/10612.000
- Linley, P. A., Joseph, S. (Eds.), (2004). *Positive psychology in Practice*. USA: John Wiley & Sons

Semester – IV

(Stream A: Paper –V)

Code: P A-4P1

Clinical Psychology Practicum (SEM IV)

a) Each student shall evaluate 5 cases in this semester period and subsequently submit

reports for perusal. The report of evaluated cases will include

2) clinical observation
3) case history
4) diagnostic impression
   and

4) treatment strategies

b) In addition each candidate shall complete mini Field-work project based on a problem of his / her choice (in consultation with concerned teacher) from clinical psychology.

c) Practice sessions / exercise(s) to be – conducted interpreted and reported -

any two from the following –

i) preparing hierarchy for anxiety / phobia case

ii) relaxation / progressive muscle relaxation / Shavasan

iii) abdominal breathing / pranayam

iv) preparing strategic plan for behaviour modification for a simulated

c) Institutional visits : 3 with an aim to foster insight into working in clinical conditions.
d) Preparing charts (2 variable data) with computer.
e) Calculating “t”, ANOVA with computer.

Each student is required to complete practical file containing five case reports and project report and submit the same for practical examination.

The maximum marks for practical examination will be as per the following scheme of distribution of marks->

Internal Assessment **MARKS: 40**

- performance during academic session :

assessment, evaluation →visit & case reports - 20 marks

- field- work project report - 20 marks

External Practical examination **MARKS:16O**

- simulated case presentation - 60 marks
- Presentation and evaluation of written report and Structured exercise - 60 marks

Viva voce - 40 marks

TOTAL MARKS:200

Semester IV (Stream B)

(Organizational Psychology and Human Resource Management)

Core PAPER - I

Code: OD B- 4T1

ORGANIZATION DEVELOPMENT

Objectives:

1. To develop an understanding of the theory and practice relating to the processes of organization development.
2. To develop insight and competence in diagnostic and intervention processes and skills for initiating and facilitating change in organisations.

Unit I:

Introduction to Organization development:

- Definition, History of organization development; Values, Assumptions and beliefs; OD consultant

Foundations of Organization development:

- Models and theories of planned change: Kurt Lewin, Burke-Litwin Model, Porras and Robertson model
- Systems theory, Participation empowerment, Teams and teamwork, Parallel learning structures, A normative re-educative strategy of changing, Applied behavioural science

Unit 2:

Managing the OD process:

- Diagnosis, the action component, program management component
- Action research and OD: Process and approach, history and varieties, examples of action research

Unit 3:

Nature of Organization Development interventions:

- Classification of OD interventions
- Team interventions, inter-group and third party peacemaking interventions, comprehensive OD interventions, Structural intervention

Unit 4:

Challenges and future of OD

- Training experiences: T-groups, behavioural modelling, life and career planning
- Issues in consultant- client relationship
- Future of Organization Development

Books Recommended

1. French, W.L.; & Bell, C.H. Jr. (2004) Organizational Development (4th Ed.) Prentice Hall of India, New Delhi.
2. French, W.L., Bell, C.H. Jr. & Zawacki C. (2006) Organization Development and Transformation: Managing effective change (6th Ed.) Tata McGraw Hill, New Delhi
3. French, W.L., Bell, C.H. & Vohra V. (2006) Organization Development: Behavioural science interventions for organization improvement (6th Ed.) Pearson Education
4. Cummings T.G. & Worley C.G. (2007) Organization Development and Change (8th Ed.)Thomson-South Western

Semester IV

Stream B: (Organizational Psychology and Human Resource Management)

Core PAPER - II

Code: EC B-4T2

Employee Counselling

Unit 1: A] Nature, Scope and Need for employee Counseling.

Counseling process.

Employee Counseling: Types.

Employee counseling skills.

B] Workplace Counseling.

Models of Workplace Counseling

Performance counseling

Career Planning and counseling.

Unit-2.

- Stress and related concepts.

  Nature, Types, Sources, Effects/Consequences.

  Burn out.

- . Stress Management

  Personal -Self Management. Increasing Self-awareness

  through;Yoga,Meditation,Vipashana.

Unit 3. Biofeedback, Assertiveness training, Time management.

Enhancing coping with role stress, mergers, acquisitions and change.

Unit 4 Enhancing Quality of Work Life. Concept of subjective well-being.

Management by consciousness, A Spirituo-technical Approach

Books Recommended:-

Kamaraju P., N; Reddy, P.N.; and Ramana, W.D.V.(2008)Performance Appraisal and

counseling. Ist Edition. Himalaya Publishing House Pvt.Ltd.Mumbai, India.

Ashwathappa, K. (2008):Organizational Behavior. 8th Revised Edition

Himalaya Publishing House Pvt.Ltd.Mumbai, India.

Shekaran,U. (2004) Organization Behaviour. Text and cases 2nd edn. Tata MxGraw Hill, New Delhi. India.

Argyris,C (1957) Personality in Organization. New York. Harper Collins.

Hackman, R.J. and Shuttle, J.L.(eds).Improving life at Work: Behavioral Approach to

Organizational Change. Santa Monica; Goodyear.

Snyder, C. R. & Shane, J. L.(2007) Positive Psychology. The scientific and practical

explorations of human strengths, Sage South Asia edition, Sage publication India pvt. Ltd. New Delhi. India

Gupta, G.P.:(2009) Management by consciousness, A Spirituo-technical Approach.Sri Aurbindo Institute of research in Social –Sciences, Pondicherry, .India.

Semester IV

Stream B:

(Organizational Psychology and Human Resource Management)

PAPER - III Core Elective II- a

Code: LCO B-4T3a

Leadership and Communication in Organizations

Unit I:

- Personality: Concept and Nature. Determinants of Personality. Personality Theories: Type, Trait and Psycho-analytic.

Unit 2:

- Leadership: Basic Approaches to Leadership.

  What is Leadership? Trait theory, Behavioral theory,

  Contingency Theory. Implications for managers.

- Assessment tools.

  MBTI, FIRO-B, Leadership Style, Leadership

  Effectiveness

Unit 3: Contemporary issues in Leadership

Trust: The foundation of leadership.

Framing: Using words to shape meaning and inspire

Others.

Online leadership, challenges to the leadership concept.

Finding and creating effective leaders.

Unit 4: Communication

Functions, Process and direction of communication. Methods of communication. Organizational communication: formal small group network, the grapevine and computer aided communication. Choice of communication channels. Barriers to effective communication. Current issues in communication.

Books recommended:

Robbins's. (2005) Organizational Behavior, 11th edi. New Delhi PHI Pvt. Ltd.

Luthans, F.(1998) Organization Behavior, 8th edn. Boston Irwin McGraw Hill.

Ashwathappa,K. (2008):Organizational Behavior. 8th Revised Edition Himalaya Publishing House Pvt.Ltd.Mumbai, India.

Semester IV

(Stream B: Organizational Psychology and Human Resource Management)

PAPER - III Core **Elective- II-b**

Code: OCO B- 4T3b

Organizational Culture, Organizational Learning and Organizational Change.

Unit 1:
Organizational Culture: Meaning and Definition, Effects of culture, Creation of culture, Innovation in organization, Innovation process, Studies in culture & innovation.

Unit 2: Organizational Learning:
How organizations learn? Developing a learning strategy .Perspectives of Learning Organization. Advantages of Learning organization.
Learning organization: Difference between learning organizations and organizational learning. Five disciplines of learning organization.

Unit 3

- : Organizational Climate:
  Meaning, Importance of Organizational Climate, Factors affecting Organizational Climate, Creating conducive Organizational Climate.

- **:** Organization Structure and Design: Concept. Importance. Types of Organizational designs. Organizational designs and employee behavior.

Unit 4: Organizational Change - Nature, levels and dilemmas of change, Pressures for change, The Domino effect, Responses to change, Force field analysis, Change process, Resistance to change, Dynamics of change.

Books Recommended:

Dassler,G. (2002) Human Resource Management>New Delhi. Pearson Education Pvt.Ltd.

Arnold, H. J.and Fieldman, D.E.(1988):Organizational Behavior. New York. McGraw Hill Book Company.

Paper IV Foundation Course II (stream:B)

Forth Semester

Paper- IV (CBCS)

Applied Psychology

CODE: FCII(psy)-B-4T4a

Unit I:

Positive Psychology: Definitions, Goals and Assumption of positive psychology. Emotional perspective- positive Emotions. Broaden and Build theory of positive psychology. The meaning and measure of happiness.

Strategies to enhance happiness. Happiness and the facts of life-Happiness and the facts of life-Happiness across the life span-Gender and happiness-other facts of life. Spirituality and well-being.

Unit II:

Health Psychology: Introduction to health psychology, Concept of health – Models of health. Health behaviour and belief. Health awareness and Health seeking behaviour. Chronic illness-Causes and consequences; Management of health problems like obesity and chronic illness like cancer, cardiac problems and Diabetes.

Unit III:

Leadership:

What is Leadership? Types of Leadership. Basic Approaches to Leadership, Trait theory,Behavioral Theory,Contingency Theory.

Communication:

Function,process and direction of communication. Methods of communication.

Unit IV:

Stress and its management: Stress and Stressors, Basic techniques of stress management - identifying the stressors, self monitoring, recognizing negative self talk, handling negative emotions, relaxation, meditation ,avoiding negative thinking, fear, use of will, faith and prayer, establishing peace.

Books Recommended:-

- Barannon L and Feist J (1989) *Health Psychology*: An Introduction. 4th Edition, Wordsworth
- Baron R.A and Byrne (2000) social psychology. Delhi: Pearson Education Asia.
- Baumgarder S.T and Crothers. (2009) *Positive psychology*. New Delhi: Pearson.
- Compilation from works of mothers and Sri Arbindoo (2004). Integral Healing. Pondichery: Sri Arbindoo Ashram Publication Department.
- Dimmates M.R and Martin L.R (2007). *Health Psychology*. Pearson.
- Health.Pondichery: Sri Arbindoo Ashram Publication Department.
- Khubalkar, R.(2008). *Know Your Stress Manage Your Stress.* New Delhi: Neel Kamal Publication Pvt. Ltd.
- Luthans F. (2002), *Organizational Behaviour*. McGraw Hill, Arvin, New Delhi.
- Marks D.F(2002). *The Health Psychology*. Reader, Sage.

- Myers D.G. (2006) *Social Psychology*. New Delhi: Tata McGraw Hill.
- Myres, Sahajpal and Behera (2012). *Social Psychology*. New Delhi: Tata McGraw Hill.
- Proshansky, H. M. (1987). "The field of environmental psychology: securing its future." In *Handbook of Environmental Psychology*, eds. D. Stokols and I. Altman. New York: John Wiley & Sons.
- Slyder R. S (2007) *Positive Psychology*. New Delhi: Sage Publication.
- Steve B. R and Marie C. K. (2009) . *Positive psychology*. Dorling Kindersley: India
- Weinberg, R.S. & Gould, D. (2010). *Foundations of Sport and Exercise Psychology*. Champaign, IL: Human Kinetics.

Paper IV CORE III (stream:B)

CODE: PS-II B-4T4b

POSITIVE PSYCHOLOGY -II

Unit 1

Changing human behaviour towards positive

Preventing the bad and enhancing the good

Unit 2

Positive environments

Positive schooling, psychology of gainful employment

Unit 3

Assessment of positive behaviour

Assessment of problem solving behaviour, locus of control, creativity, self-esteem, emotional intelligence, sense of humor

Unit 4

Community orientation towards positivity

Focusing on resources, focus on sports; physical activities, empowerment, person centered rehabilitation

Positive psychology in cultural context

Reference books

- Snyder, C. R., & Lopez, S. J. (2007). *Positive Psychology: The Scientific and Practical Exploration of Human Strengths*. New Delhi: Sage Publications.
- Snyder, C. R., & Lopez, S. J., (Eds.), (2004). *Positive Psychological Assessment: A Handbook of Models and Measures.* Washington DC: APA, DOI 10.1037/10612.000
- Linley, P. A., Joseph, S. (Eds.), (2004). *Positive psychology in Practice*. USA: John Wiley & Sons

Semester – IV

Stream B: Paper V

Code: P B-4P1

Organizational Psychology Practicum (SEM IV)

a) Each student shall conduct Structured Exercises (SE*) – SE to be conducted, interpreted and reported and subsequently submit reports for perusal.

*(*Generic Skills: Stress management, Conflict resolution techniques for effective management, Assertiveness Training, Importance of verbal and non verbal communication, Significance of body language in communication, Key communication skills: Active listening & feedback; Presentation Skills; Emotional intelligence and leadership effectiveness; Time management: tips and strategies)*

b) In addition each candidate shall complete mini Field-work project based on a problem of his / her choice (in consultation with the concerned teacher) from Industrial psychology.

Each student is required to complete a practical file containing five reports of conducted structured exercises and field work project report and shall submit the same for practical examination.

C)Preparing charts (2 variable data) with computer.

d)Calculating "t", ANOVA with computer.

The maximum marks for practical examination will be as per the following scheme of distribution of marks->

Internal Assessment Marks:40

- performance during academic session :

Structured exercises' assessment, evaluation → - 20 marks

- field- work project report - 20 marks

External Practical examination **MARKS:160**

- structured exercise: conduct and evaluation of written report - 80 marks

- Viva voce - 80 marks

-

TOTAL MARKS=200

Semester IV(COUNSELLING PSYCHOLOGY)
Stream C: Core Paper - I

Code: PD C- 4T1

PSYCHOLOGICAL DISORDERS

Unit 1

What is Abnormality?

Definition. Different ways to define abnormal behaviour. Statistical Definition, Social norm deviance, Subjective discomfort.

Models of Abnormality: The Biological Model, The Psychological Model,

DSM – IV – TR, ICD-10

Unit 2

Disorders usually first diagnosed in infancy, childhood or adolescence: mental retardation, learning disability, motor skills disorders.

Autism, attention deficit hyperactivity disorders, disruptive behaviour conduct disorder.

Communication disorder: stuttering

Pica, Bulimia

Elimination disorders: Encopresis and enuresis

Selective mutism,

Unit 3

- Generalised Anxiety Disorder, Phobic disorders: Social Phobias, Specific Phobias – Agoraphobia, Acrophobia, Claustrophobia,
- Obsessive - Compulsive Disorder; Panic disorder;
- Somatoform Disorders: Hypochondriasis, Somatization disorder, Conversion disorder.
- Adjustment disorders
- Dissociative Disorders: Dissociative amnesia; Dissociative fugue;, Dissociative identity disorder.
- Mood Disorders: Major depression, Bipolar disorders

Unit – 4

Schizophrenia: Main Symptoms, Categories of Schizophrenia: Disorganized, Catatonic, Paranoid, Undifferentiated, Residual.;

Important causes of Schizophrenia.

Personality Disorders: Antisocial personality disorder; Borderline personality disorder, Paranoid personality disorder.

Books recommended:

APA American Psychiatric Association. (2000). DSM – IV – TR: Diagnostic and statistical manual of mental disorders (4th ed., Text Revision). Washington D.C.

The ICD – 10. Classification of mental and behavioural disorders. Clinical descriptions and diagnostic guidelines. W.H.O., Geneva. A.I.T.B.S. Publishers & Distributors (regd.) Delhi-51. India

Sarason , I.G. & Sarason, B. R. (1993). *Abnormal Psychology; The Problem of Maladaptive Behaviour*. New Jersey: Prentice Hall

Holmes, D.S. (1997). *Abnormal Psychology* (3rd Ed.). N.Y.: Addison –Wesley Education. Pvt. Ltd

Nevid, J.S., Rathus, S. A., Greene, B. (1997). *Abnormal Psychology in Changing World* (3rd Ed.). U.K.: Prentice Hall

Coleman, J.C. (1986). *Abnormal Psychology and modern Life*. Bombay: Taraporevala Sons & Co. Pvt. Ltd.

Semester IV
Stream C: Core Paper - II

CODE : ISC C-4T2

INTERVENTION STRATEGIES IN COUNSELLING

UNIT-I

a) Biological approaches**:**

chemotherapy ,brain wave therapy, biofeedback.

b) Psychoanalytic approaches/intervention strategies**:**

Freudian: free association, resistance, transference, insight, working through.

neo Freudian: jung, adler, fromm, rank, horney and others.(?)

UNIT- 2

a) behavioural approaches: token economy, systematic desensitization , aversion technique, reinforcement, operant conditioning, shaping, modelling, biofeedback.

b) cognitive behaviour approaches: R.E.T. & others.

UNIT-3

- humanistic-existential approaches: person centered approach(empathy, congruence).
- Transactional analysis.
- Traditional approaches-yoga therapy, shavasan, meditation, vipashyana.
- Family therapy, group therapy ,drug therapy

UNIT-4

a) Recent methods in psychotherapies: cybertherapy
b) Brief psychotherapy & crisis intervention
c) Hospitalization & milieu therapy

Books Recommended

Corey, G : (1991) Theory and practice of counselling and psychotherapy,4th edition, California :Brooks.

American psychological Asso. : (1981) ethical principles of psychologist Washington, D.C.: Author.

Pandit, M.P. : (1990) Dhyana, Dipti Pub.Sri Aurobindo Ashram, Pondicherry, India.

Plante, T.G. (2005*). Contemporary Clinical Psychology* (2nd Ed.) New Jersey:. John Wiley & Sons

Agras, W.S., Kazadin, A.E., Wilson, G.T. (1979). *Behaviour Therapy*. San Fransisco: Freeman & Co

Wolberg, L.S., Aronson, M.L. (1991). *Group and Family Therapy*. N.Y.: Brunner /Mazal

Davis, M., Eshelman, E.R., McKay, M.(1996). *The Relaxation & Stress Reduction Workbook*. Mumbai: Jaico Publishing H

SEMESTER IV
Stream C: Paper – III Core Elective II-a

CODE: SAC C-4T3a

SPECIAL AREAS OF COUNSELLING

UNIT-I

Counselling children and adolescent: emotionally disturbed, under achievers, slow learners, socially disadvantaged.

UNIT –2

Counselling marital, sexual and role related problems : premarital , marital counselling, identification of sex related problems, role conflict and counselling.

UNIT-3

Counselling for drug addicts, alcoholic and attempted suicides: identification of psychological problems and counselling.

UNIT-4

- Counselling the physically and mentally handicapped : psychological and vocational evaluation and rehabilitation.
- Counselling for terminal diseases and chronic illness : cancer , HIV,AIDS etc; evaluation and counselling.
- Counselling the aged : identification of psychological problems and counselling.

Books recommended:

Nugent, Frank A.(1995): An Introduction to the profession of counselling ,Maxwell Macmillan Canada, Inc. Toronto.

Gibson, R.L. and Marianne, H.M.(2008):Introduction to counselling and Guidance,7th edition, Prentice Hall of India, New Delhi.

Narayan Rao S.:(1991) *A counselling psychology*: Tata McGraw Hill Book company, New Delhi.

Arulmani, G. Arulmani, S.N. (2004). *Career Counselling*; A Handbook. New Delhi: Tata McGraw Hill

Crow & Crow. (1962). *An Introduction to Guidance*. New Delhi: Eurasia Publishing House

McLean & Holan. (1955). *Counselling Psychology*. London: Tata McGraw Hill

Brian, B. (1982). *Vocational Adjustment of Disabled Persons*. Paper Text Ed. Pro. Ed.

Crites, J.O. (1981). *Career counselling – Models Methods and Materials*. N.Y.: McGraw Hill

De Board, R. (1981). *Career development for college students* (5th Ed.). Carrell Press

Loughary, J.W. & Ripley, T.M. *Career and Life Planning Guide* (Revised Ed.). Cambridge: B.K.

Semester IV
Stream C: Paper - III Core Elective -II-b

CODE:
PCG C- 4T3b

PSYCHOLOGICAL TESTING IN COUNSELLING AND GUIDANCE

UNIT-I

The assessment of personality:

Children personality questionnaire, High school personality questionnaire, 16 PF, CAQ

Eysenk personality inventory(EPQ-R); NEO –PI

UNIT- 2

- Projective techniques and tests:

  Sentence Completion Test (SCT),Children apperception test-CAT

  Rosenzweig Picture Frustration Test (children and adult), House Tree Personality (HTP)

- Behavioural techniques and tests:

  Behavioural questionnaires, Problem checklist, Self monitoring, Observation in natural environment

UNIT-3

Bell's adjustment inventory

Edwards personal preference schedule

The assessment of aptitude and interest :

Differential Aptitude Tests (DAT), Scientific Aptitude Test (SAT)

Strong's Interest Inventory (SII),Vocational Interest Record

UNIT-4

Stanford –Binet Intelligence scale (SB-IV), Differential ability scales (DAS)

Wechsler scales

Peabody picture vocabulary test (PPVT_III), Kaufman's intelligence tests (K-ABC)

Death anxiety, PGI-AMEE, Adjustment inventory (for adult)

Books recommended

Aiken, L.R.(2000):psychological testing and assessment,10th edition, Allyn and Bacon, inc.

Walsh, W.B. and Betx, N.E.(1997): tests and assessment,3rd edition, Prentice-Hall, Inc., Englewood Cliffs , New jersey.

Anastasi , A & Urbania, S(1997): psychological testing, 7th edition, Prentice Hall, Inc., Englewood cliffs, New jersey.

Graham, J. R., Naglieri, J.A. (Eds.), (2003). *Handbook of Psychology; vol.10 Assessment Psychology*. New Jersey:. John Wiley

Freeman (1960). Theory and Practice of Psychological Testing

Korchin, S. J. (1976). *Modern Clinical Psychology: Principles of Intervention in the Clinic and Community*. New York: Basic Books.

Manuals of the Psychological Tests mentioned in curriculum

Paper IV Foundation Course II (stream:C)

Forth Semester

Paper- IV (CBCS)

Applied Psychology

CODE: FCII(psy)-C-4T4a

Unit I:

Positive Psychology: Definitions, Goals and Assumption of positive psychology. Emotional perspective- positive Emotions. Broaden and Build theory of positive psychology. The meaning and measure of happiness.

Strategies to enhance happiness. Happiness and the facts of life-Happiness and the facts of life-Happiness across the life span-Gender and happiness-other facts of life. Spirituality and well-being.

Unit II:

Health Psychology: Introduction to health psychology, Concept of health – Models of health. Health behaviour and belief. Health awareness and Health seeking behaviour. Chronic illness-Causes and consequences; Management of health problems like obesity and chronic illness like cancer, cardiac problems and Diabetes.

Unit III:

Leadership:

What is Leadership? Types of Leadership. Basic Approaches to Leadership, Trait theory,Behavioral Theory,Contingency Theory.

Communication:

Function,process and direction of communication. Methods of communication.

Unit IV:

Stress and its management: Stress and Stressors, Basic techniques of stress management - identifying the stressors, self monitoring, recognizing negative self talk, handling negative emotions, relaxation, meditation ,avoiding negative thinking, fear, use of will, faith and prayer, establishing peace.

Books Recommended:-

- Barannon L and Feist J (1989) *Health Psychology*: An Introduction. 4th Edition, Wordsworth
- Baron R.A and Byrne (2000) social psychology. Delhi: Pearson Education Asia.
- Baumgarder S.T and Crothers. (2009) *Positive psychology*. New Delhi: Pearson.
- Compilation from works of mothers and Sri Arbindoo (2004). Integral Healing. Pondichery: Sri Arbindoo Ashram Publication Department.
- Dimmates M.R and Martin L.R (2007). *Health Psychology*. Pearson.
- Health.Pondichery: Sri Arbindoo Ashram Publication Department.
- Khubalkar, R.(2008). *Know Your Stress Manage Your Stress.* New Delhi: Neel Kamal Publication Pvt. Ltd.
- Luthans F. (2002), *Organizational Behaviour*. McGraw Hill, Arvin, New Delhi.
- Marks D.F(2002). *The Health Psychology*. Reader, Sage.
- Myers D.G. (2006) *Social Psychology*. New Delhi: Tata McGraw Hill.

- Myres, Sahajpal and Behera (2012). *Social Psychology*. New Delhi: Tata McGraw Hill.
- Proshansky, H. M. (1987). "The field of environmental psychology: securing its future." In *Handbook of Environmental Psychology*, eds. D. Stokols and I. Altman. New York: John Wiley & Sons.
- Slyder R. S (2007) *Positive Psychology*. New Delhi: Sage Publication.
- Steve B. R and Marie C. K. (2009) . *Positive psychology*. Dorling Kindersley: India
- Weinberg, R.S. & Gould, D. (2010). *Foundations of Sport and Exercise Psychology*. Champaign, IL: Human Kinetics.

Paper IV CORE III (stream:C)

Forth Semester

CODE: PS-II C-4T4b

POSITIVE PSYCHOLOGY -II

Unit 1

Changing human behaviour towards positive

Preventing the bad and enhancing the good

Unit 2

Positive environments

Positive schooling, psychology of gainful employment

Unit 3

Assessment of positive behaviour

Assessment of problem solving behaviour, locus of control, creativity, self-esteem, emotional intelligence, sense of humour

Unit 4

Community orientation towards positivity

Focusing on resources, focus on sports; physical activities, empowerment, person cantered rehabilitation

Positive psychology in cultural context

Reference books

- Snyder, C. R., & Lopez, S. J. (2007). *Positive Psychology: The Scientific and Practical Exploration of Human Strengths*. New Delhi: Sage Publications.
- Snyder, C. R., & Lopez, S. J., (Eds.), (2004). *Positive Psychological Assessment: A Handbook of Models and Measures.* Washington DC: APA, DOI 10.1037/10612.000
- Linley, P. A., Joseph, S. (Eds.), (2004). *Positive psychology in Practice*. USA: John Wiley & Sons

Semester IV
Stream C: Paper – V

Code: P C-4P1

Counselling Psychology Practicum (SEM IV)

a) Each student shall evaluate 3 problem cases (scholastic, adjustment or emotional problems) in this semester period and subsequently submit reports for perusal. The report of evaluated cases will include

1) Case problem observation

5) case history
6) identification of problem: forming impression
7) suggested and employed intervention strategies

b)Each student shall complete field-work project based on a problem of his / her choice from counselling psychology in consultation with concerned teacher.

c)In addition each candidate will prepare and conduct one Structured exercise* on any one of the counseling skills and subsequently submit the report for perusal.

*(*Counselling skills / Listening skills / Communication skills / Decision making skills / stress inoculation / Swot analysis. Topic(s) / area will be decided by the concerned teachers committee)*

d)Preparing charts (2 variable data) with computer.

e)Calculating “t”, ANOVA with computer.

Each student is required to complete practical file containing three case reports and project report and structured exercise report and submit the same for practical examination.

The maximum marks for practical examination will be as per the following scheme of

distribution of marks->

Internal Assessment **Marks:40**

- performance during academic session :

Assessment and evaluation of case reports,

Conduct and report of structured exercise - 20 marks

- Field- work project report - 20 marks

External Practical examination **MARKS:160**

- simulated case presentation - 50 marks
- and evaluation of written report - 30 marks
- conduct of structured exercise - 30 marks
- Viva voce - 50 marks
- **TOTAL MARKS: 200**

-

APPENDIX – E

MCM Part-I

Semester-I

Paper - I: Fundamental of Information Technology

Unit – I

Computers: Introduction to computers, Characteristics of computer, Evolution of computer, Generations of computer, Basic organization of computer system (Block Diagram), Functioning of computer, Concept of system. **Number system:** non-positional number systems, Positional number systems, Conversion from one number system to another, Fraction numbers. **Computer codes:** BCD, EBCDIC, ASCII, Unicode, Collating sequence. **Computer arithmetic:** Need of binary, Binary arithmetic.

Unit – II

Processor & memory: Central processing unit (CPU), Components of CPU (CU, ALU, Instruction set, Registers, Processor speed, Type of processor), Main memory, Types of memory. **Secondary storage devices:** Sequential & direct access devices, Magnetic tapes, Magnetic disks, Optical disks, Memory storage devices, Mass storage devices, Data backup, On-line, Near line and Off-line storage, Hierarchical storage devices(HSS), Input-output devices.

Unit – III

Computer software: Define software, Types of software, Logical system architecture, Firmware, Middleware, Acquiring software, Software development life cycle (SDLC), Software engineering, CASE tools. **System implementation & operation:** Software testing & debugging (Types of program errors, Testing a program, Debugging a program for syntax errors & logical errors, Difference between testing & debugging), Software documentation, Software deployment, System evaluation, Software maintenance. **Business data processing:** Meaning of data processing, Data storage hierarchy, Standard methods of organizing data, File management system, Database management system.

Unit – IV

Data communication and computer networks: Basic elements of a communication system, Data transmission modes, Data transmission speed, Data transmission media, Digital & analog data transmission, Data transmission services, Multiplexing techniques, Switching techniques, Routing techniques, Network topologies, Types of network, Communication protocols, Network interface card (NIC), OSI model, Ernet working tools, Wireless Networks. **Multimedia:** What is multimedia, Multimedia components, Multimedia applications, and media center computer. **Classification of computers:** Notebook computers (Laptops), Personal computer (PCs), Workstations, Mainframe

systems, Super computers, Client & server computers, Handheld computers (Tablet PC, PDA/Pocket PC, Smartphone).

Text Book:

1. P. K. Sinha & Priti Sinha, Computer Fundamentals, BPB Publication.

Reference Books:

1. Madhulika Jain, Shashank Jain, Satish Jain, Information Technology Concepts, BPB Publication.
2. B. Ram, Computer Fundamentals (Architecture & organization), New Age International Publisher.
3. Turban, Rainer, Potter, Introduction to Information Technology, Wiley India Edition.
4. Peter Norton, Introduction to Computers, McGraw-Hill Education.
5. S. Jaiswal, I.T. Today, Encyclopedia.

Practical List of Fundamental of Information Technology

A1. Use a contemporary letter template of MS-WORD and provide information about launching of new products of a company.
Also write down the steps to perform above in MS-WORD.

A2. Use a professional letter template of MS-WORD and write an application to the principal for two days leave.
Also write down the steps to perform above in MS-WORD.

A3. Using Mail Merge of MS-WORD, write a letter to the students of MCM-I to submit their Original Documents (Mark Sheet, Migration Certificate, TC etc) along with their balance fees up to 10th March 2008 in the office of the college during office timings morning 8:00 AM to 5:00 PM.
Also write down the steps to perform above in MS-WORD.

A4. Using Mail Merge of MS-WORD, write a letter to your friends, invite them on your Birth Day Party on 10th March 2008 at the Venue- B04, Amar Apartment, Narendranagar, Nagpur-440021
Also write down the steps to perform above in MS-WORD.

A5. Using Mail Merge of MS-WORD, write a letter to all the selected candidate for their final interview on 10th March 2008 at the Centre Point College, 7 Nawab Layout, Tilaknagar, Nagpur-10 at 11:00 AM along with all original documents and 2 passport size photographs.
Also write down the steps to perform above in MS-WORD.

A6. Draw and Analyze the DFD of Book Issuing System of College Library in MS-PowerPoint.
Also write down the steps to perform above in MS-POWERPOINT.

A7. Draw and Analyze the DFD of Hotel Management System in MS-PowerPoint.
Also write down the steps to perform above in MS-POWERPOINT.

A8. Draw and Analyze the DFD of Examination Management System in MS-PowerPoint.
Also write down the steps to perform above in MS-POWERPOINT**.**

A9. Create a Mark-Sheet of MCM-Part I using MS-Excel. Mark-Sheet format should be as per below. Fill the information about 10 students.

Roll No.	Name of Student	IT (100)	ICP (100)	IOS (100)	C (100)	MIS& SA (100)	Practical-I (100)	Practical-II (100)	Total Marks (Out of 700)	% age
1										

Draw a pie chart for above Mark-sheet
Also write down the steps to perform above operation in MS-EXCEL.

A10. Create a Employee Payment Sheet using MS-Excel. Employee Payment Slip format should be as per below. Fill the information about 10 employees.

Sr.No.	Name of Employee	Basic Salary	HRA 5%	TA 7%	DA 9%	Gross_Salary
1						
Total salary						

Draw a bar chart for above Employee Payment Sheet
Also write down the steps to perform above operation in MS-EXCEL.

A11. Create the following Product sheet in MS-EXCEL and perform the operation given below:

Sr.No.	Product Name	Company Name	Country	Quantity	Rate
1	Butter	Amul India ltd	India	20	Rs.19.00
2	Milkmaid	Amul India ltd	India	10	Rs.35.00
3	Tea	Hindustan Lever ltd	Malaysia	15	Rs.40.00
4	Biscuits	Parle ltd	India	32	Rs.12.00
5	Papad	Haldiram ltd	India	12	Rs.10.00
6	Chocolate	Cadbury ltd	Australia	150	Rs.15.00
7	Paneer	Amul India ltd	India	23	Rs.25.00
8	Bournvita	Cadbury ltd	Australia	20	Rs.45.00
9	Poppins	Parle ltd	India	27	Rs.6.00
10	Sauce	Amul India ltd	India	16	Rs.21.00

a) Sort by Product Name, by company name, by country in ascending order.
b) Sort by Country in descending order.
Also write down the steps to perform above operation in MS-EXCEL.

A12. Create the following Product sheet in MS-EXCEL and perform the operation given below:

Sr.No.	Product Name	Company Name	Country	Quantity	Rate
1	Butter	Amul India ltd	India	20	Rs.19.00
2	Milkmaid	Amul India ltd	India	10	Rs.35.00
3	Tea	Hindustan Lever ltd	Malaysia	15	Rs.40.00
4	Biscuits	Parle ltd	India	32	Rs.12.00
5	Papad	Haldiram ltd	India	12	Rs.10.00
6	Chocolate	Cadbury ltd	Australia	150	Rs.15.00
7	Paneer	Amul India ltd	India	23	Rs.25.00
8	Bournvita	Cadbury ltd	Australia	20	Rs.45.00

9	Poppins	Parle ltd	India	27	Rs.6.00
10	Sauce	Amul India ltd	India	16	Rs.21.00

a) List only those records whose country =”India”.
b) List only those records whose company name=”Amul”.
Also write down the steps to perform above operation in MS-EXCEL.

A13. Create the following Product sheet in MS-EXCEL and perform the operation given below:

Sr.No.	Product Name	Company Name	Country	Quantity	Rate
1	Butter	Amul India ltd	India	20	Rs.19.00
2	Milkmaid	Amul India ltd	India	10	Rs.35.00
3	Tea	Hindustan Lever ltd	Malaysia	15	Rs.40.00
4	Biscuits	Parle ltd	India	32	Rs.12.00
5	Papad	Haldiram ltd	India	12	Rs.10.00
6	Chocolate	Cadbury ltd	Australia	150	Rs.15.00
7	Paneer	Amul India ltd	India	23	Rs.25.00
8	Bournvita	Cadbury ltd	Australia	20	Rs.45.00
9	Poppins	Parle ltd	India	27	Rs.6.00
10	Sauce	Amul India ltd	India	16	Rs.21.00

a) List the records whose quantity is >= 10 and <= 100.
b) List the records whose rate is >= Rs. 35.00.
Also write down the steps to perform above operation in MS-EXCEL.

A14. By the help of following information prepare cost sheet for the month of March 1980:

	Rs.
1. Stock (1-3-1980)	
a) Raw Materials	25,000
b) Finished goods	17,360
2. Stock (31-3-1980)	
a) Raw Materials	26,250
b) Finished goods	15,750
3. Raw material purchased	21,900
4. Work-in-progress (1-3-80)	8,220
5. Work-in-progress (31-3-80)	9,100
6. Sale of finished goods	72,310
7. Direct wages	17,150
8. Unproductive Wages	830
9. Factory Expenses	8,340
10. Office and management expenses	3,160
11. Selling and distribution expenses	4,210

Prepare cost sheet and find out following information:
1) Total Cost 2) Cost of goods sold 3) Profit on sold out goods
Also write down the steps to perform above operation in MS-EXCEL.

A15. Following information is received from the books of a factory:

1. Closing stock of raw materials	25,150
2. Closing stock of finished goods	14,650
3. Raw materials purchased	20,800
4. Work in progress (1-1-78)	8,220
5. Work in progress (31-12-78)	8,000

6. Opening stock of raw material	24,000
7. Opening stock of finished goods	16,200
8. Sale of finished goods	62,800
9. Office expenses	2,150
10. Selling and Distribution expenses	4,000
11. Direct wages	16,000
12. Factory expenses	9,000

Prepare cost sheet and find out the following items:
1) Cost of materials consumed 2) Production Cost 3) Cost of goods sold 4) Net profit.
Also write down the steps to perform above operation in MS-EXCEL.

A16. By the help of following information prepare a statement of cost and in that statement indicate prime cost, works cost, office cost (production cost) and cost of goods sold, for the half year ending 30th June, 1978. Production 500 units.

1. Material consumed	30,000
2. Direct Wages	40,000
3. Direct Expenses	4,000
4. Works on Cost Expenses	
a) Unproductive wages	9,000
b) Factory lighting and heating	11,000
c) Factory rent, rates and insurance	3,000
d) Factory Director's fees	
e) Depreciation of machinery	1,500
f) Factory stationery	375
g) Factory cleaning	400
h) Depreciation of loose tools	900
i) Indirect material	500
j) Estimating expenses	500
5. Office expenses (Office overhead)	
a) Director fees	3,000
b) Office printing and stationery	750
c) Legal Expenses	500
d) Depreciation of office building	800
e) Bank fee	75
f) Salary of office employees	5,000
6. Selling and Distribution expenses	
a) Selling commission	1,000
b) Rent of warehouse	1,800
c) Bad debt	150
d) Advertisement	500
e) Depreciation and maintenance of delivery vans	700

Also write down the steps to perform above operation in MS-EXCEL.

A17. Prepare cost sheet by the help of following information and find out (i) Prime cost (ii) Factory cost (iii) Total Cost; (iv) Net Profit.

1.Raw Material purchased	66,000
2.Direct wages	52,500
3.Indirect wages	2,750
4.Stock of Raw Materials (1-9-83)	75,000
5.Stock of Raw material (30-9-83)	91,500
6.Stock of finished goods (1-9-83)	54,000
7.Stock of finished goods (30-9-83)	31,000
8.Stock of work in progress (1st Sep.83)	28,000

9.Stock of work in progress (30th sept.83)	35,000
10.Sales	2,11,000
11.Rent, rates and electric of factory	15,000
12.Depreciation of machinery	3,500
13.Carriage inward	1,500
14.Sundry factory exp.	10,000
15.Travelling wages and commission	6,500
16.Office rent and rates	2,500
17.Sundry Office expenses	6,500
18.Advertisement	3,500
19.Carriage outward exp.(exp. on sale)	2,500

Also write down the steps to perform above operation in MS-EXCEL.

A18. By the help of following information prepare cost sheet for the year 1976.

1.Opening Stock (1-1-1976)	
a) of Raw Materials	22,000
b) of Unfinished goods	5,000
c) of Finished goods	10,000
2.Closing Stock: (31-12-76)	
a) of Raw Materials	2,350
b) of Unfinished goods	3,000
c) of Finished goods	2,000
3.Direct Wages	30,000
4.Direct Expenses	10,000
5.Material Purchased	70,500
6.Carriage Inward	2,000
7.Factory on cost	70,000
8.Factory Supervision	8,800
9.Office Rent	6,000
10.Factory Rent	9,000
11.Rent of sales department	6,000
12.Lighting bill (out of this 30% of factory, 20% of sales dept. and balance for office)	10,000
13.Advertisement	6,000
14.Salary of Manager (30% of Factory, 40% of Sales dept. and balance for office)	37,000

15.Profit 10% on total cost.

Also write down the steps to perform above operation in MS-EXCEL.

A19. Following information is available from the books of Zenith manufacturing company as on 31st Dec. 1974.

1.Salary of Drawing room staff	6,500
2.Salary of distribution department	12,600
3.Outward carriage expenses	4,300
4.Cash discount	2,900
5.Inward carriage exp. on purchase	7,150
6.Bad debts written off	6,500
7.Machine repairing	4,450
8.Rent, taxes and insurance (Factory)	8,500
9.Rent, taxes and insurance (office)	2,000
10.Sales	4,61,100
11.Stock of Raw material (31-12-73)	62,800
12.Stock of Raw material (31-12-74)	48,000
13.Material Purchased	1,85,000
14.Travelling Expenses	2,100

15.Salary and Commission of travelling agent	7,700
16.Productive wages	1,26,000
17.Depreciation of machinery & equipment	6,500
18.Depreciation of office furniture	300
19.Director fee	6,000
20.Gas and Water (Factory)	1,200
21.Gas and Water (Office)	400
22.Salary of manager (3/4 for factory & 1/4 for office)	10,000
23.General Expenses	3,400
24.Income tax	1,500
25.Dividend	1,000

Prepare cost sheet and indicate the following items:-
1) Materials Consumed (2) Prime cost (3) Factory on cost and factory cost(4) General and selling overhead (5) Total cost (6) Net profit (7) Percentage of factory on cost to wages (8) percentage of general overhead to factory cost.
Also write down the steps to perform above operation in MS-EXCEL.

A20. From the given information prepare Flexible budget for the capacity 70%, 80% & 100 % & show the results.
The sales for the above capacity would be 50,00,000/-, 60,00,000/-, 85,00,000 respectively. Fixed expenses will be constant at all capacities. Semi variable will be constant between 55% to 75% capacity.
It will be increased by 10% between the capacity 75% to 90% & will be increased by 20% between the capacity 90% & 100%. Following exp are on the capcity of 60%.

Particulars	Rs.
Semi variable exp:	
Maintenance & repairs	1,25,000
Labour	5,00,000
Sales dept. Expenses	1,50,000
Other overheads	1,25,000
	9,00,000
Variable Cost :	
Material	12,00,000
Labour	13,00,000
Other Expenses	2,00,000
	27,00,000
Fixed Cost :	
Wages & salaries	4,20,000
Rent & Taxes	2,80,000
Depreciation	3,50,000
Other overheads	4,50,000
	15,00,000
Total Cost	51,00,000

Also write down the steps to perform above operation in MS-EXCEL.

A21. The following data is taken from the manufacturing record of a company for 1/2 year period.

Fixed expenses:	
Wages & salaries	84,000
Rent, rates & taxes	56,000
Depreciation	70,000
Sundry administration Exp.	89,000
	2,99,000

Semi-variable exp : (at 50% capacity)

Maintenance & Repairs	25,000
Indirect Labour	99,000
Sales Department salaries	29,000
Sundry administration exp.	26,000
	1,79,000

Variable Exp. (at 50% capacities)

Materials	2,40,000
Labour	2,56,000
Other expenses	38,000
	5,34,000

Assume that the fixed expenses remain constant for all levels of production. Semi- Variable expenses remain constant between 45% & 65% of capacity. Increasing by 10% between 65% & 80% capacity & by 20% between 80% & 100% of capacity. Sales at various levels are :-

Capacity	Rs.
60%	10,00,000
75%	12,00,000
90%	15,00,000
100%	17,00,000.

Prepare Flexible budget for the above capacity.
Also write down the steps to perform above operation in MS-EXCEL.

A22. The following budget is prepared for 10,000 units. Per unit cost will be as under :-

Particualrs	P.U. (Rs.)
Material	60
Wages	55
Fixed cost (2,00,000)	20
Variable expenses	5
Selling expenses (10% fixed)	15
Administration exp. (90,000)	9
Distribution exp. (20% fixed)	15

Prepare budget for 7,500 & 6,500 units.
Also write down the steps to perform above operation in MS-EXCEL.

A23. The following figures are available from sales & cost forecast of M/s ALANKAR & Co. for the year ended 31st.Dec. 1990 at 50% (5,000 units) capacity. Prepare a profit forecast statement through flexible budget at 60%, 75%, 90% & 100% capacity assuming that

1) The fixed expenses remain constant for all levels of production & sales.
2) Selling price between 50% & 75% capacity is Rs. 25/- per unit.
3) Semi variable expenses will remain unchanged at 50% & 65% capacity but will increase by 10% between 65% to 80% capacity & by 30% between 80% & 100% capacity.
4) At 90% level (capacity) material Cost increase by 5% & Selling Price is reduced by 5%.
5) At 100% level both material & labour cost increase by 10% & selling Price is reduced by 8%.
6) Semi variable expenses are Rs. 50,000 /-
7) Fixed expenses are Rs. 50,000/-
8) Variable expenses are : Material Rs. 5 p.u.
Labour Rs. 2 p.u.
Direct Exp. Rs. 1 p.u.

Also write down the steps to perform above operation in MS-EXCEL.

A24. Prepare Flexible budget & find out overhead rate.

Particulars	50% Rs.	60% Rs.	70% Rs.
Variable Overheads			
A) Material	---	60,000	---
B) Labour	---	24,000	---
Semi-Variable Exp.			
1) Electric (20% fixed)	---	15,000	---
2) Repairs & Maint. (20% variable)	---	7,500	---
Fixed Expenses			
a) Depreciation	---	20,000	---
b) Rent & tax	---	2,250	---
c) Insurance	---	2,500	---
d) Salary	---	15,000	---
e) Indirect wages	---	8,000	---
Budgeted Direct labour hours	---	30,000	---

Also write down the steps to perform above operation in MS-EXCEL.

A25. Estimated cash balance on 1st may 1990 Rs. 2,50,000 From the following information Prepare Cash budget for the month of may, June, July 90.

Month	Sales	Purchase	Wages	Manu. Exp.	Office Exp.	Selling Exp.
March	50,000	30,000	6,000	5,000	4,000	3,000
April	56,000	32,000	6,500	5,500	4,000	3,000
May	60,000	35,000	7,000	6,000	4,000	3,500
June	80,000	40,000	9,000	7,500	4,000	4,500
July	90,000	40,000	9,500	8,000	4,000	4,500

Adjustments :-

a) Out of total sale 20% sales in cash & balance will be collected in the next month.

b) Suppliers allowed the credit period of 2 months.

c) Wages and all other exp. will be paid in the following months.

d) Dividends to share holders & Bonus to employees will be paid in the month of may Rs. 10,000 & Rs. 15,000 Respectively.

e) An order of machine is given, the cost of which is Rs. 80,000, Machine will be received in the month of June & payment will be done in same month.

f) Income tax will be paid Rs. 25,000/- in the month of July.

Also write down the steps to perform above operation in MS-EXCEL.

A26. From the following information Prepare Cash budget for the 3 months ending 30th June.

Month	Sales	Materials	Wages	Overheads	
Jan		60,000	40,000	11,000	6,200
Feb.		56,000	48,000	11,600	6,600
Mar.		64,000	50,000	12,000	6,800
Apr.		80,000	56,000	12,400	7,200
May		84,000	62,000	13,000	8,600
June		76,000	50,000	14,000	8,000

a) Payment of material & overheads will be done in the following month.

b) Payment of wages will be done in the same month.

c) Terms & conditions of sales as under :- Half amount of credit sales will be recovered in following months & balance amount will be recovered in the next month of the following month.
d) Dividend on Preference shares Rs. 30,000/- will be paid on 1st may.
e) The amount of share call each Rs. 25,000/- will be received on 1st April & of 1st June each.
f) Machines costing Rs. 10,000/- will be established in the month of January but payment will be done in the month of June.
g) The selling commission 5% will be paid in the following months of actual sales.
h) On 1st April Expected Cash balances Rs. 20,000/-
Also write down the steps to perform above operation in MS-EXCEL.

A27. From the following information Prepare Cash budget for 3 months commencing from 1st June. On 1st June Cash balance is Rs. 1,00,000/-

Month	Sales	Purchase	Wages	Manu. Exp	Selling & Admn. exp.
April	80,000	41,000	5,600	3,900	10,000
May	76,500	40,500	5,400	4200	1400
June	78500	38500	5400	5100	15000
July	90,000	37,000	4,800	5,100	17000
Aug.	95,500	35,000	4,700	6,000	13000

Additional Information :-
1) Commission on sales 5% will be paid after 2 months of the sales. (This commission is in addition of Selling Exp.)
2) Machine Costing Rs. 65,000/- will be purchased in the month of April but payment will be done in the month of August.
3) Dividend of last year Rs. 15,000/- will be paid in the month of July.
4) Lag time allowed to customers for the payment is 2 months, and 2 months credit period allowed from suppliers.
Also write down the steps to perform above operation in MS-EXCEL.

A28. Budgeted information given as under :-

Month	Sales	Purchases	Wages	Manu. Exp.	Office Exp.	Selling
Mar.	50,000	30,000	5,000	1,000	1,000	6,000
April	60,000	35,000	6,000	4,000	2,000	7,000
May	70,000	37,000	7,000	2,000	3,000	8,000
June	80,000	42,000	8,000	4,000	3,000	9,000
July	90,000	60,000	9,000	3,000	2,000	15,000
Aug	1,00,000	70,000	11,000	4,000	1,000	20,000

Additional Information :-
1) Cash balance on 1st may Rs. 80,000/-
2) 20% sales in cash & out of total Credit sales 50% amount Recovered in the following month & balances 50% in the next month of the following month.
3) Suppliers allowed a credit period of 2 months.
4) Lag time for wages 1/2 month.
5) Delay in payment of office expenses 1 month.
6) Delay in payment of manufacturing exp. 1 month.
7)Amount of shares call money willbe received in the months of may Rs. 50,000/-
8) Payment of tax will be done in July Rs. 80,000/-.
9) Machine will be purchased in June Rs. 20,000/-.

Prepare Cash Budget for May, June, & July.
Also write down the steps to perform above operation in MS-EXCEL.

A29. A newly established Company wants to prepare Cash budget for four months ending on 30th June.

Month	Sales	Materials	Wages	Overheads	Selling&Admn. Exp
Jan	20,000	20,000	4,000	3,200	800
Feb.	22,000	14,000	4,400	3,300	900
Mar.	24,000	14,000	4,600	3,300	800
Apr.	26,000	12,000	4,600	3,400	900
May	28,000	12,000	4,800	3,500	900
June	30,000	16,000	4,800	3,600	1,000

Adjustment :-

1) Expected Cash balance on 1st March Rs. 10,000/-.

2) A machinery is Purchased for Rs. 30,000/- payment will be done in two equal instalments March & April.

3) Selling Commission 5% on total sales & this commission will be paid in the following months of actual sales.

4) Amount of 2nd call will be received in the month of march Rs. 10,000/- & Amount of share premium Rs. 2,000/- will be received with 2nd call.

5) Period allowed to customer for payment is1 month.

6) Remaining all other exp. will be paid in the following months.

7) The delay in the payment of wages 1/2 month.

8) You may presume that 50% sales are in cash.

9) Suppliers allowed period of 2 months for payment.

Also write down the steps to perform above operation in MS-EXCEL.

A30.By the help of following information prepare cost sheet for the month of March 1980:

1. Stock (1-3-1980)	
a) Raw Materials	25,000
b) Finished goods	17,360
2. Stock (31-3-1980)	
a) Raw Materials	26,250
b) Finished goods	15,750
3. Raw material purchased	21,900
4. Work-in-progress (1-3-80)	8,220
5. Work-in-progress (31-3-80)	9,100
6. Sale of finished goods	72,310
7. Direct wages	17,150
8. Unproductive Wages	830
9. Factory Expenses	8,340
10. Office and management expenses	3,160
11. Selling and distribution expenses	4,210

Prepare cost sheet and find out following information:

1) Total Cost 2) Cost of goods sold 3) Profit on sold out goods

Also write down the steps to perform above operation in MS-EXCEL.

Paper - II: Programming in C& OOP's Concepts

UNIT – I

Design methods, Programming language, Translators, Introduction to C, C character set and keywords, Escape sequence, Constants and variables, Data types, Conversion specification, Input and output statements in C, Operators and expressions (Arithmetic, Relational, Logical, Assignment, Ternary, Bit Wise and Increment & Decrement Operator). **Storage class:** Automatic, Static, External, Register. **Control statement:** If-else, Looping statements (while, do- while and for loop), Switch, Go-to, Use of break and continue statements.

UNIT – II

Function: Arithmetic and string library function, User defined functions, Function definition & declaration, Function call, Return statement, Function arguments, use of void, Types of function, Function with call by value and call by reference, Recursion.
Arrays: Declaration, Referring individual elements, Entering data in to an array, Reading data from array, Array initialization, Printing of array, Searching, Sorting and merging of array. **Pointer:** Introduction to pointer, Pointer and function, pointer and structure, Pointer and array, Pointer and string. **Dynamic memory allocation:** Sizeof ( ), malloc (), calloc ( ), realloc(), free().

UNIT – III

String: String manipulation using string library function, **Structure:** Declaration structure, initializing structure, Structure variables, accessing structure elements, Arrays of structure, Array within structure. **Unions:** Concept and applications. **Files:** Concept of file, Modes of files, Open and close, Creation and reading of files, Character input/output function, Formatted input/output function, String input and output: sscanf, sprint, gets, puts. **File input/output:** fprintf, facanf, getc, putc, and **Block read/write:** fread, fwrite, random access to files, Other file function, command line argument.

UNIT – IV

Introduction to OOP, Characteristics of OOP's, Advantages & disadvantages of OOP's, Steps in developing the OOP Program, Object Oriented Languages, Importance of C++, Classes and objects, Member function, Concept of overloading, Inheritance & types of inheritance, Data abstraction, Data encapsulation, Concept of polymorphism and virtual function, Namespace and exception handling.

Text Books:

1. S. K. Shrivastava & Dipali Srivastava, C in Depth, BPB Publication.
2. D. Ravichandran, Programming with C++, McGraw-Hill.

Reference Books:

1. Steve Oualline, Practical C Programming, SPD, O'Reilly.
2. Harshal Arolkar, Simplifying C, Dreamtech Press.
3. Dr. S. Dey & Mridul Ghosh, Computer Fundamentals and C Programming, SPD.
4. Yashwant Kanetkar, Let Us C, BPB Publication.
5. Veugopal Prasad, Mastering C, McGraw-Hill.
6. Balguruswamy, Programming in ANSI C, McGraw-Hill.
7. E. Balguruswamy, Object Oriented Programming with C++, McGraw-Hill.

Practical List of Programming in C& OOP's Concepts

1. Write an algorithm, draw a flowchart and develop 'C' program to compute the factors of a given number.
2. Write an algorithm, draw a flowchart and develop 'C' program to interchange the values of two numbers without using any temporary variable.
3. Write an algorithm, draw a flowchart and develop 'C' program to calculate and find the nature of roots of given quadratic equation.
4. Write an algorithm, draw a flowchart and develop 'C' program to check given number is prime number.
5. Write an algorithm, draw a flowchart and develop 'C' program to calculate LCM & HCF of two numbers.
6. Write an algorithm, draw a flowchart and develop 'C' program to reverse an n digit number.
7. Write an algorithm, draw a flowchart and develop 'C' program to calculate sum of odd digits and product of even digits of a given n digit number.
8. Write an algorithm, draw a flowchart and develop 'C' program to check a given number is an Armstrong number.
9. Write an algorithm, draw a flowchart and develop 'C' program to convert a decimal number into its equivalent binary number.
10. Write an algorithm, draw a flowchart and develop 'C' program to display the Fibonacci series of n terms.
11. Write an algorithm, draw a flowchart and develop 'C' program to print the following output:-

    1
    1 2
    1 2 3
    1 2 3 4
    1 2 3 4 5
    1 2 3 4
    1 2 3
    1 2
    1

12. Write an algorithm, draw a flowchart and develop 'C' program to display the following pattern;-

    1 1
    1 2 2 1
    1 2 3 3 2 1
    1 2 3 4 3 2 1

13. Write an algorithm, draw a flowchart and develop 'C' program to calculate the series of n terms foe x as;-
    $S = x + x^2 + x^3 + x^4 + \ldots\ldots\ldots$
14. Write an algorithm, draw a flowchart and develop 'C' program to calculate the sum of the n terms of the series;-
    S= 1/2!+2/3!+3/4!+4/5!.....
15. Write an algorithm, draw a flowchart and develop 'C' program to display the following pattern:-

1
2 3 2
3 4 5 4 3
4 5 6 7 6 5 4
5 6 7 8 9 8 7 6 5

16. Write an algorithm, draw a flowchart and develop ‘C’ program to insert an element in an array at appropriate position.
17. Write an algorithm, draw a flowchart and develop ‘C’ program to sort the given array using bubble sort.
18. Write an algorithm, draw a flowchart and develop ‘C’ program to find the transpose of a given matrix.
19. Write an algorithm, draw a flowchart and develop ‘C’ program to check whether the given word is palindrome or not.
20. Write an algorithm, draw a flowchart and develop ‘C’ program to count vowels in given word using switch statement.
21. Write an algorithm, draw a flowchart and develop ‘C’ program to count number of letters, words and blank spaces in a given line.
22. Write an algorithm, draw a flowchart and develop ‘C’ program to find largest and smallest element of given array using function concept.
23. Write an algorithm, draw a flowchart and develop ‘C’ program to find factorial of given number using recursion function.
24. Write an algorithm, draw a flowchart and develop ‘C’ program to find reverse of digits of given number using recursion concept.
25. Write an algorithm, draw a flowchart and develop ‘C’ program to swap the values of two array using user defined function. Use the concept “Call by Value” and “Call by Reference”.
26. Write an algorithm, draw a flowchart and develop ‘C’ program to find and replace a numeric value from an array using function and pointer.
27. Write an algorithm, draw a flowchart and develop ‘C’ program to Create a structure Student containing fields for Roll No., Name, Class, Year and Total Marks. Create 10 students and store them in a file.
28. Write an algorithm, draw a flowchart and develop ‘C’ program to create a file “abc.txt” and store the text. Copy the content from “abc.txt” to another file “xyz.txt” using putc() and getc() function. Also read the content of both files.
29. Write an algorithm, draw a flowchart and develop ‘C’ program to write and read the ‘n’ records as an entire block (structure) on a file using fwrite() and fread(). The block structure contains Roll Number and Name of the Students.
30. Write an algorithm, draw a flowchart and develop ‘C’ program to copy the content of one file to another file by using command line argument.

Paper-III: Introduction to Operating Systems

UNIT – I

Introduction – What operating systems do, Computer system organization, Computer system architecture, Operating system architecture, Operating system operations, Process management, Memory management, Storage management, Protection & Security, Kernel data structures, Computing environments, Open source operating systems. **System Structures –** Operating system services, User and operating system interface, system calls, types of system calls.

UNIT – II

Process Management – Process concept, Process Scheduling, Operations on processes, Interprocess Communication. Deadlocks – Deadlock characterization, Deadlock prevention, Deadlock Avoidance. **Memory Management Strategies –** Background, Swapping, Contiguous memory Allocation, Segmentation, Paging. **File System –** File concept, File system mounting, File sharing.

UNIT – III

Introduction to Disk Operating System (DOS)

- File types, Directory Structure
- Booting - Warm and Cold Booting
- Types of DOS commands (Internal and External)
- Introduction of Autoexe and Config files.
- Directory commands: DIR, MD, RD, TREE, PATH, SUBST ETC.
- Wild card Definitions
- Commands related to file management: COPY, DEL, ERASE, REN, ATTRIB, XCOPY, BACKUP and RESTORE .
- General commands: TYPE DATE, TIME, PROMPT etc.
- batch commands, wild card characters & its use.

UNIT – IV

Introduction to Unix overview

- File systems and structure of directories and file
- File Oriented Commands – Cat, op, In mv, rm etc.
- File Permissions
- Directory Oriented commands – ls, mkdir, rmdir, cd, pwd etc.
- Inter user connection commands – write, mail, used, at, wall etc.
- Common commands – skill, date, wo, sleep, who ps.
- Unix Utility Commands – grep, pr, cut, paste, sort, lp shutdown, halt, sys, tar, find etc.
- Basics of shell scripts
- Writing shell scripts, running scripts, using variables, controlling the flow of statement
- Introduction of Linux.

Text Books:

1. Abraham Silberschatz, Peter Galvin, Gerg Gagne, Operating System Concepts, Wiley.
2. Robert M. Thomas, DOS 6 & 6.2, BPB Publications.
3. Yashavant Kanetkar, Unix Shell Programming, BPB Publications.

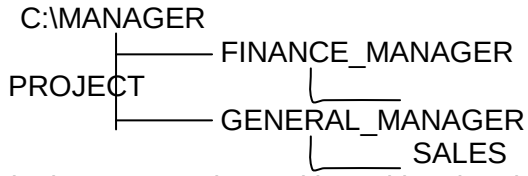
Reference Books:

1. Tanenbaum, Modern Operating Systems, PHI.
2. Stuart E. Madnick, John J. Donovan, Operating Systems, McGraw-Hill.
3. Dhananjay M. Dhamdhere, Operating Systems, McGraw-Hill
4. Sumitabha Das, Unix Concepts & Applications, McGraw-Hill.
5. Kernighan & Pike, The Unix Programming Environment, PHI.
6. Christopher Negus, Ubuntu Linux Toolbox, Wiley.
7. S. Jaiswal, DOS / Unix & Windows: IT Today, Encyclopedia.
8. Burnett, Using Linux: Tackett, PHI.
9. MS-DOS Manual.

Practical List of Introduction to Operating Systems

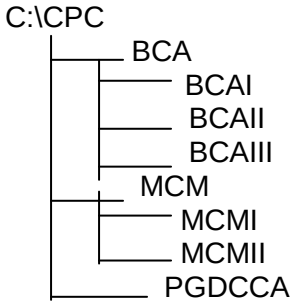
1. Make a directory naming VMV in DOS. Under that make three sub directories BCAI, BCA II, BCAIII. Also explain the commands used in making the directories and subdirectories in DOS.

2. Using Tree Command in DOS make the following tree diagram



   Also explain the commands used in making the above tree diagram.

3. Using tree command in DOS makes the following tree diagram



   Also explain the commands used in making the above tree diagram.

4. Make a file named "compute.txt" in DOS and write the definition and characteristics of computer in that file. Rename the file compute.txt to computer.txt.
   Also explain the commands used in making the file and renaming file. Explain the difference between copy and ren Command.

5. Make a file named “compute.txt” in DOS and write the definition and characteristics of computer in that file. Copy the contents of file compute.txt to computer.txt. Also explain the commands used in making the file and copying the contents of one file to another file.

6. Make a file named file1.txt in DOS and enter the following text in that file.
   WWW can be defined as a set of standards for storing, retrieving, formatting and displaying information using client/server architecture, graphical user interfaces and a hypertext language that enables dynamic link to documents. World Wide Web is a repository of information spread all over the world and linked together.

7. Write a shell script in UNIX to calculate area of a triangle.
8. Write a shell script in UNIX to calculate area and circumference of a circle.
9. Write a shell script in UNIX to calculate the simple interest.
10. Write a shell script in UNIX to calculate the total marks and percentage of five subjects.
11. Write a shell script in UNIX to calculate largest and smallest number among three numbers.
12. Write a shell script in UNIX to calculate the gross salary of an employee. The salary includes – Basic Salary, HRA (20% of Basic Salary), DA (20% of Basic Salary) and CCA (10% of Basic Salary).
13. Write a shell script in UNIX to enter the two strings and then compare the two strings. If strings are equal then display the message “Strings are Equal” else “Strings are not Equal”.
14. Write a shell script in UNIX to check whether the given file is directory or ordinary file.
15. Write a shell script in UNIX to check entered character is in uppercase or in lowercase.
16. Write a shell script in UNIX to check whether the entered number is EVEN or ODD.
17. Write a shell script in UNIX to check whether the entered number is prime or not.
18. Write a shell script in UNIX to print the Fibonacci series.
19. Write a shell script in UNIX to calculate the factorial of a given number.
20. Write a shell script in UNIX to calculate reverse a number.
21. Write a shell script in UNIX to find sum of digits of a number.
22. Write a shell script in UNIX to implement Break statement.
23. Write a shell script in UNIX to search whether element is present is in the list or not.
24. Write a shell script in UNIX to copy contents of one file to another.
25. Write a shell script in UNIX to count number of files in a directory.
26. Write a shell script in UNIX to implement FCFS Algorithm.

Paper - IV: Computerized Accounting (TALLY ERP 9)

UNIT - I

Accounting Basics - Defining the need for accounting, Defining accounting, Exploring the branches of accounting, Describing the functions of accounting, Listing the advantages of accounting, Listing the limitations of accounting, Explaining important terms in accounting, Exploring the concepts of accounting, Understanding the conversions of accounting, Describing an account and its types, Explaining the rules of debit and credit, Describing a journal, Describing a ledger, Describing trial balance, Describing a financial entries, Understanding adjustment entries.

Introduction to Tally.ERP 9 – Features of Tally, Enhancement in Tally.ERP 9, Installation procedure of Tally.ERP 9, Opening Tally.ERP 9, Components of the Tally.ERP 9 window, Creating a Company.

UNIT - II

Stock and Godown in Tally.ERP 9 – Stock groups, Stock categories, Stock items, Units of measure, Godowns. **Group, Ledgers, Vouchers and Orders –** Introducing groups, Introducing ledgers, Introducing vouchers, Introducing purchase orders, Introducing a sales order, Introducing invoices.

UNIT - III

Reports in Tally.ERP 9 – Working with balance sheet, Working with profit & loss A/c report, Working with stock summary report, Understanding ratio analysis, Working with trial balance report, Working with day book report. **Payroll –** Exploring payroll in Tally.ERP 9, Required features to create a pay slip, Description of payroll info, Working with payroll vouchers, Defining payroll reports, working with statements of payroll report, Describing salary discursement.

UNIT - IV

Taxation – Indian Tax Structure, Tax deducted at source in tally.ERP 9, Create a Tax Ledger, TDS Vouchers, Printing a TDS Challan, Tax collected at source in Tally.ERP 9, TCS reports in Tally.ERP 9, Calculating VAT in Tally.ERP 9, VAT Classification, VAT Vouchers, VAT Reports in Tally.ERP 9, Service Tax.

Text Book:

1. Vikas Gupta, Business Accounting with MS Excel and Tally.ERP 9 Course Kit, Dreamtech Press.

Reference Books:

1. Computerized Accounting using Tally ERP 9, Sahaj Enterprise, Tally Education Private Ltd (TEPL).
2. Vishnu Priya Singh, Tally 9.
3. K. K. Nadhani, Accounting with Tally, BPB Publication.
4. K. K. Nadhani and A.K. Nadhani, Tally Tutorial, BPB Publication.
5. Anthony R. N. and J. S. Richard, Accounting Principles, Irwin Inc.

Practical List of Computerized Accounting (TALLY ERP 9)

1. Create a company in Tally ERP 9 with the following details:

Name of company	Universal Company Ltd.
Address	1804, world Tower, AB road, Baner, Pune _411080
Country	India
State	Maharashtra
Contact number	7894561230
Mobile number	7741258963
Email-Id	info@universalmfg.co.in
Books beginning from	01-04-2015
Financial year Beginning from	01-04-2015

2. Create a company in Tally ERP 9 with the following details:

Name of company	Sambhav trading Company
Address	a/512, palm court, girgaam chaupaty, charni road, Mumbai-400007
Country	India
State	Maharashtra
Contact number	022-22886512
Mobile number	9898745555
Email-Id	enquiry@sambhav.com
Books beginning from	01-04-2014
Financial year Beginning from	01-04-2014

3. Create the following ledgers in the books of universal company ltd in Tally ERP 9.

Name of ledger	**Under (group)**	**Bill wise details set to**	**Opening balance**
Share capital	Capital account	No	15,00,000
Purchase account	Purchase account	No	Nil
Sales accounts	Sales accounts	No	Nil
Ultra tech cement ltd	Sundry creditors	yes	270000
Building	Fixed assets	No	1200000
Computers	Fixed assets	No	50000
Office furniture	Fixed assets	No	175000
Cash in hand	Cash accounts	No	20000
Civic centre association	Sundry debtors	yes	290000
Bank of india	Bank accounts	No	80000
Petty cash	Cash in hand	No	50000

4. **Create the following ledgers in the books of universal company ltd in Tally ERP 9.**

Name of ledger	Under (group)	Bill wise details set to	Opening balance
Proprietors Capital	Capital Account	No	10,00,000
Purchase Account	Purchase Account	No	Nil
Sales Accounts	Sales Accounts	No	Nil
Hindustan Lever Ltd	Sundry creditors	yes	355000
Land and Building	Fixed Assets	No	850000
Computers and Peripheral	Fixed Assets	No	30000
Office Furniture	Fixed Assets	No	75000
Cash in hand	Cash Accounts	No	18000
Tahuraa Traders Pvt Ltd	Sundry Debtors	yes	310000
Bank of Baroda	Bank Accounts	No	102000

5. **Record the following vouchers in the books of Universal company ltd.**
   a. 04-04-2014 withdrawn Rs. 20000 from bank of india and transferred to petty cash book.
   b. 08-04-2014 paid 2000 from petty cash for buying stationery for office.
   c. 15-04-2014 made purchase from ultra tech cement ltd. Worth Rs. 45000
   d. 19-04-2014 issued cheque to ultra tech cement ltd for Rs. 45000
   e. 21-04-2014 sold goods worth of Rs. 75000 to civic centre association
   f. 25-04-2014 received a cheque from civic center association for Rs. 75000. The same was deposited in the bank on the same date.
   g. 30-04-2014 paid staff salary of Rs. 9800 from petty cash

6. **Record the following vouchers in the books of Sambhav Trading Co. Pvt. ltd.**
   a. 02-04-2014 withdrawn RS. 10000 From bank of baroda and transeferred to petty cash book.
   b. 05-04-2014 paid 1000 from petty cash for office expences.
   c. 11-04-2014 made purchase from Hindustan unilever ltd. Worth Rs. 33000
   d. 13-04-2014 Issued cheque to Hindustan Unilever Ltd. For Rs. 20000
   e. 14-04-2014 Made purchase from Hindustan Unilever Ltd. Worth Rs. 26000
   f. 18-04-2014 Issued cheque of Rs. 38000 to Hindustan Unilever Ltd.
   g. 21-04-2014 sold goods worth of Rs. 90000 to Tahuraa Traders Pvt Ltd.
   h. 22-04-2014 received a cheque from Tahuraa Traders Pvt Ltd. For Rs. 75000 . The same was deposited in the bank on the same date.
   i. 23-04-2014 sold goods worth of rs. 85000 to Tahuraa Traders Pvt Ltd.
   j. 25-04-2014 received cheque from Tahuraa Traders Pvt Ltd. From Rs.75000. The same was deposited in the bank on the same date.
   k. 30-04-2014 Paid staff salary of Rs. 7200 from petty cash.

7. **Create cost centers Project A and Project B under primary cost category and record the following transaction in the books of sambhav trading company**

a. On 07-09-2014, purchased Cement worth Rs. 1, 50,000/- from Ultratech cement Ltd. That will be shared equally between Project A and Project B . A credit period of 30 days was provided.
b. Record transaction on 09-09-2014 for the purchase of Steel worth Rs. 450000 from Embee Enterprises. Allocate Rs. 50000 to Project A and the the rest to Project B . a credit period of 45 days was allowed .

8. Create cost centers Mumbai and Pune under primary cost category and record the following transaction in the books of Universal co. Limited

a. On 05-10-2014, purchases done worth Rs. 2, 50,000/- from Hindustan Unilever Ltd. That will be shared equally between Mumbai and Pune.
b. Record transaction on 09-10-2014 for the purchase worth Rs. 600000 from Hindustan Unilever Ltd. Allocate Rs. 250000 to Mumbai and the rest to Pune. . a credit period of 45 days was allowed.
c. On 18-10-2014 record a transaction for the sale on Super technologies for Rs. 1575000/- of which 1200000 would be allocated to Mumbai branch and the rest to Pune.
d. On 22-10-2014 one more sales entry was made for 1600000 to Super technologies of which 10,00,000 was allocated to pune branch and the rest to Mumbai.

9. Record the following transaction in the books of Universal Co. Ltd.

a. On May 11, 2014 they received a bill no. May /005/2014 for a sum of Rs. 125000/- from M/s. Rajesh shah and Co., architects for consultancy towards designing their office and training centre.
b. Universal company Ltd. Made the payment after deducting the TDS amount.
c. On 27th May 2014, company received bills no May/015/2014 for a sum of Rs. 75000 from M/s Rajesh shah and co., architects for consultancy.
d. On 28th May, company made the payment after deducting TDS.

10. Journalize the following Transaction in the books of Mr. Anil for the month of March 2012 and prepare Trial balance

March 2010	Particular	Amt
1	Start business with cash	80000
3	Purchase goods for cash	5000
4	Purchase goods from Akash	9000
6	Sold goods to Vikas	7000
7	Return goods to Akash	700
9	Goods return by Vikash	400
11	Cash paid to Raman	4000
17	Withdrew from Bank	10000
20	Wage paid	1000

11. Akhilesh started his business on 1st Jan. 2012 with Rs.5000, his transaction for the month were as following, prepare Cash A/C.

January 2012	Particular	Amt
1	Bought goods on credit from Sachine & Sons	5000

5	Paid salary	500
10	Sold to Roy	2000
15	Cash sales	2200
19	Cash Purchase	3000
25	Deposit in Bank	1000
27	Goods returned to Sachine & Sons	500
31	Cash Withdrawn by Akhilesh for personal use	500

12. Journalize the following transactions in the books of Sudhir Kumar 2003 and prepare a Trial Balance :

Jan 2003	Particular	Amt
1	Sudhir Commenced business with cash	40000
3	Purchased goods for cash	500
5	Sold goods for cash	300
6	Purchased one Motor Car for cash	15000
9	Sold Machinery for cash	9000
11	Purchased a Building on credit from Narendra	20000
15	Sold Furniture on credit to Randhir Kappor	9500
17	Paid Cartage	110
22	Received Commission	50
27	Cash Sales	1200
29	Cash Purchase	600
30	Received on account from Ahmed	350
31	Paid cash to Sunitkumar on account	190

13. **Journalize the following transactions in the books of Royal & Co. and prepare a Trial Balance :**

Nov. 2003	Particular	Amt
1	Cash invested in Business	150000
2	Cash deposited In to SBI Current A/C	30000
3	Goods Purchased in cash	20000
4	Goods Sold in cash	12000
5	Commission received Rs. 500 from Sushma Traders	
6	Goods Sold on credit to Roshan	25000
7	Goods return from Roshan	5000
8	Depreciation charged on Machine @ 12% for four month Machine Cost	45000
10	Cheque received from Roshan	10000
11	Salary Paid	1500

14. Journalize the following transaction in the books of Sanjay Potdar for the month of March 2012.

1. Ashok starts business with Rs. 100000/-
2. Purchase machinery for Rs. 50000/ and furniture for Rs. 10000
3. Paid amount for rent Rs. 1000/
4. Deposits Rs,. 10000/- in Bank
5. Purchase of goods for Rs. 20000/ from Mr. Ram on credit.
6. Sold goods to Mr. Rakesh for Rs. 10000/
7. Rs. 5000/ withdraws from bank for personal use.
8. Withdraws Rs. 1000/ for office use.
9. Received cash from Mr. Rakesh.
10. Paid to Mr. Ram.

15. Record the following transaction in the books of Raj enterprises.

1. Goods purchase from “Kirti sales” on credit Bill no. 115 Rs. 62000
   a. Color tv (lg) 4% 3qty Rs. 30000
   b. Washing machine (samsung) 4% 4 qty Rs. 32000
2. Cash received from sangam enterprizes Rs. 15000
3. Goods purchase in cash bill no. 69 Rs. 35000
   a. B/W tv (sony) 4% 4 qty Rs. 20000
   b. Audio (onida) 4% 5 qty Rs. 15000
4. Goods sale on cash rs, 19000
   a. Color tv (lg) 4% 1 qty Rs. 15500
   b. Audeo (onida) 4% 1 qty Rs. 3500
5. Goods purchase in cash from vikram enterprises bill no. 45 Rs. 40000
   a. Color tv (lg) 4% 2 qty Rs. 20000
   b. Refregerator (vedeocon) 4% 2qty Rs. 20000
6. Cheaque no. received from ravi agency Rs. 10000 and deposited in state bank.
7. Credit sale to vijay enterprises bill no. 93 Rs.17200
   a. Washing machine (samsung) 4% 1qty Rs. 8000
   b. B/W tv (sony) 4% 1 Qty Rs. 5700
   c. Audio (onida) 4% 1 qty Rs. 3500
8. Cash paid to ravi kulkarni rs. 1500
9. Cheque no. 159 paid to central engineering co. Rs 15000
10. Refregerator purchase on cash Rs. 30000 fom k k agency 3 qty (videocon) 4%
11. Office rent paid in cash Rs. 1700
12. Received cheque from vijay enterprises Rs. 10000 & deposited in canara bank.
13. Bill received from lokmat Rs. 1500 bill no.5
14. Amount received from vaishali agency in cash rs. 5000 & cheque no. 336791 Rs. 10000 only. Cheque deposited in state bank.
15. Cash sale to telco ltd. Rs. 29900
    a. Color tv (Lg) 4% 1 qty Rs. 10000
    b. Washing machine (samsung) 4% 1 qty Rs. 9100
    c. Refregerator (vedeocon) 4% 1qty Rs. 10800
16. Cheque deposited in canara bank Rs.5000
17. Cash withdrawn from bank Rs. 34000

16. Record the following transaction in the books of Maharashtra Traders.

1. Opening stock for Wadi Godown
   a. Akai color Tv 4% 10 qty Rs.10500 each.
   b. Refregerator (videocon) 7qty 12000 each.
   c. Washing machine (samsung) 5 qty 8000 each
   d. Audio (Philips) 4% 2Qty 2000
   e. Onida color tv 4% 5 qty 12000 each
   f. B/W tv (akai) 4% 5 qty 18000

2. Opening stock for nandanwan godown
   a. Akai color tv 2 qty 10500 each
   b. refrigerator (videocon) 3qty 12000 each
   c. Audio (Philips) 3 qty 1000 each.

3. Cash sale to Bhagwandas Co. Rs. 41500 in wadi godown.
    a. Color tv (akai) 4% 2 qty Rs.21000.
    b. Refrigerator (Vedeocon) 4% 1qty Rs. 11300
    c. Washing Machine (samsung) 4% 1 qty Rs. 9200.
4. Goods purchase in cash from national Trading co. & store Nandanwan godown.
    a. Audio (Philips) 2qty 4% Rs.6000
    b. W/M (Samsung) 1qty 4% Rs. 10000
5. Credit sales to Ravina traders Rs. 51800 wadi godown.
    a. Refrigerator (vedeocon) 2qty 4% Rs. 22000.
    b. W/M (Samsung) 1qty 4% Rs.8300
    c. Color tv (akai) 2qty 4% 21500
6. Cheque received from vikas enterprises Rs. 20000 & deposited in state bank.
7. Cash withdrawn from state bank cheque no. 16 Rs. 15000/-
8. Received loan from state bank Rs. 10,00,000/- invensted in business, interest 10%.
9. Cheque paid to kirti sales rs. 25000/-
10. Goods purchase on credit from rama & sons Rs. 44000 store nandanwan.
    a. W/M (Lg) 3 qty 4% Rs. 24000
    b. Refrigerator (videocon) 1qty 4% Rs. 10000.
    c. Color tv (onida) 1qty 45 Rs. 10000
11. Akai color TV purchase in cash Rs. 20000 2qty 4% Rao store in nandanwan.
12. Paid salary Rs. 10000
13. Paid bank loan Rs. 8,00,000
14. Cash sale on wadi godown Rs 42000\
    a. Audio 2 qty 4% Rs.7000
    b. w/m (s.s.) 2qty 4% Rs. 17000
    c. b/w tv (akai) 3qty 4% Rs. 18000
15. Paid to rama & sons by cheque rs. 18000 chq. No. 1152.
16. Paid electric bill Rs. 10000
17. Total cash sale after allowing discount Rs. 1000.
18. Paid total balance loan on state bank.
19. Advertisement exp. Rs.10000
20. Carriage exp. Rs. 5000
21. Purchase furniture for nandanwan godown Rs.28000 in cash.
22. Withdrawn for personal use Rs, 10000.

17. Record the following transaction in the books of Rathore Traders.

1. Goods purchase from sohan & sons Rs. 20000/-
    a. Gold 10gm (12.5%) rs. 10000/-
    b. Silver 1kg (12.5%) Rs.10000/-
2. Goods purchase from sagar computer Rs. 25000/-
    a. Monitor (compaq) 1qty 5000/- 4%
    b. Cpu (intel) 1qty 15000/- 4%
    c. Speaker (Logitex) 1qty 5000/- each
3. Goods sold on cash Rs. 22000/-
    a. Gold (12.5%) 10gm 12000/-
    b. Silver(12.5%) 1kg 10000/-

4. Withdrawn 400/- Rs. From canara bank.
5. Cash given to sagar computers Rs. 24000/- in full settlement.
6. Cheque given to mr. sohan & sons. Rs 20000.
7. Salary given to mr. sahil Rs. 2000/-
8. Withdrawn Rs. 4000/-
9. Paid insurance premium Rs. 200/-
10. Purchase table without vat Rs.2000/-

MCM Part-I

Semester-II

Paper - I: Management Information Systems

UNIT - I

Strategic View of MIS:

Management information system in a digital firm: Management Information System (MIS): Concept, Definition, Role of MIS, Impact of the MIS, MIS and the user, Management as a control system, MIS: A support to the management, Management effectiveness and MIS, Organization as a System, MIS: Organization Effectiveness, MIS for a digital firm. **E-Business Enterprise:** A digital firm - Introduction, Organization of business in a digital firm, E-Business, E-Commerce, E-Communication, E-Collaboration, Real Time Enterprise.

Strategic Management Of Business Performance: Concept of corporate planning, Essentiality of strategic planning, Development of the business strategies, Types of strategies, Short range planning, Tools of planning, Strategic analysis of business, Balance score card, Score card and dash board, MIS: Strategic business planning.

Information security challenges in E-Enterprises: Introduction, Security threats and vulnerability, Controlling security threats and vulnerability, Managing security threat in E-Business, Disaster management, Information security.

UNIT - II

Basic of Management Information Systems:

Decision-Making: Concept, Process, Decision analysis by analytical modeling, **Behavioral concepts in Decision -** Making, Organizational Decision Making. **Information, Knowledge, Business Intelligence:** Information concepts, Information: A quality product, Classification of the information, Methods of data and information collection, Value of the information, General model of a human as an information processor, Summary of information concept and their implications, Knowledge and knowledge management systems, Business intelligence MIS and the information and knowledge. **System Engineering: Analysis And Design:** System concepts, System control, Types of system, Handling system complexity, Classes of systems, General model of MIS, The need for system analysis, System analysis of the existing system, System analysis of a new requirement, System development model, Structured system analysis and design (SSAD), Object oriented analysis (OOA), System development through OOT: A use case model, OOSAD development life cycle.

UNIT – III

Development process of MIS: Development of long range plans of the MIS, Ascertaining the class of information, Determining the information requirement, Development and implementation of the MIS, Management of information quality in MIS, Organization for development of MIS, MIS: Development Process Model. **Strategic Design of MIS:** Strategic management of the business, Why strategic design of MIS?, Balance score card, Score card, and dash board, Strategic design of MIS, Development

process steps for strategic design(SD) of MIS, illustrating SD of MIS for Big Bazzar, Strategic management of business and SD of MIS, Business strategy determination, Business strategy implementation. **Business Process Re-Engineering (BPR):** Introduction, Business process, Process model of organization, Value stream model of the organization, What delays the Business Process? Relevance of information technology (IT), MIS and BPR.

UNIT - IV

Applications of Management Information Systems to E-Business:

Application in manufacturing sector: Introduction, Personnel management (PM), Financial management (FM), Production management (PM), Raw material management(RMM), Marketing management, Corporate overview. **Application in Service Sector:** Introduction to service sector, Creating a distinctive service, Service concept, Service process cycle and analysis, Customer service design, Service management system , MIS application in service industry, MIS: Service industry. **Decision support systems and knowledge management: Decision support systems (DSS):** Concept and philosophy, Group decision support system(GDSS), DSS application in E-Enterprise, Knowledge management , Knowledge management systems, Knowledge based expert system (KBES), MIS and the benefits of DSS. **Enterprise Management Systems:** Enterprise management systems(Ems), Enterprise resource planning (ERP) system, ERP models and modules, Benefits of the ERP, ERP product evaluation, ERP implementation, Supply chain management (SCM), Information management in SCM, Customer relationship management (CRM), EMS and MIS.

Text Book:

1. Waman S. Jawadekar, Management Information Systems, McGraw-Hill.

Reference Books:

1. D. P. Goyal, Management Information Systems, Vikas Publishing.
2. D. P. Nagpal, Management Information Systems, S. Chand.
3. S. Sadagopan, Management Information Systems, PHI.
4. A. K. Gupta, Management Information Systems, S. Chand.
5. Mahesh Halale, Management Information Systems, Himalaya publishing house.
6. Kanter, Managing with Information, PHI.

Paper - II: Core Java

UNIT - I

Java Evolution - Java history, Java features, How java differ from C and C++, Java and internet, Java and world wide web, Web browsers, Hardware and software requirements, Java support systems, Java environment. **Overview of Java Language** – Introduction, Simple Java programs, More of Java, An application with two classes, Java program structure, Java tokens, Java statements, Implementing a Java program, Java virtual machine, Command line arguments, Programming style. **Constants, Variables, and Data Types** – Introduction, Constants, Variables, Data Types, Declaration of variables, Giving value to variables, Scope of variables, Symbolic constants, Type casting, Getting values of variables, Standards default values. **Operators and Expressions** - Introduction, Arithmetic operators, Relational operators, Logical operators, Assignment operators, Increment and decrement operators, Conditional operators, Bitwise operators, Special operators, Arithmetic expression, Evaluation of expression, Precedence of arithmetic operators, Type conversion in expression, Operator precedence and associativity, Mathematical functions. **Decision Making and Branching** – Introduction, Decision making with If Statement, Simple If statement, The If…Else statement, Nesting of If...Else statement, The Else If ladder, The switch statement, The? : Operators. **Decision Making and Looping** – Introduction, The while statement, The do statement, The for statement, Jumps in loops, Labeled loops.

UNIT - II

Classes, Objects and Methods – Introduction, Defining a class, Fields declaration, Methods declaration, Creating objects, Accessing class members, Constructors, Method overloading, Static members, Nesting of methods, Inheritance: Extending a class, Overriding methods, Final variables and methods, Final classes, Finalizer methods, Abstract methods and classes, Methods with varargs, Visibility Controls. **Arrays, Strings and Vectors** – Introduction, One-Dimensional Array, Creating an array, Two-Dimensional Array, Strings, Vectors, Wrappers classes, Enumerated types, Annotations. **Interfaces: Multiple Inheritance** – Introduction, Defining interfaces, Extending interfaces, Implementing interfaces, Accessing interface variables.

UNIT - III

Packages: Putting Classes Together – Introduction, Java API Packages, Using system packages, Naming conventions, Creating packages, Accessing a package, Using a package, Adding a class to package, Hiding classes, Static import. **Multi Threaded Programming** – Introduction, Creating threads, Extending the thread class, Stopping and blocking a thread, Life cycle of thread, Using thread methods, Thread exception, Thread priority, Implementing the 'Runnable' interface, Inter-thread communication. **Managing Errors and Exceptions** – Introduction, Types of errors, Exceptions, Syntax of exceptions handling code, Multiple catch statements, Using finally statements, Throwing our own exceptions, Improved exception handling in Java ES 7, Using exceptions for debugging.

UNIT - IV

Applet Programming – Introduction, How applet differ from application, Preparing to write applet, Building applet code, Applet life cycle, Creating an executable applet, Designing a web page, Applet tag, Adding applet to HTML file, Running the applet, More about applet tag, Passing parameters to applet, Aligning the display, More about HTML tags, Displaying numerical values, Getting input from the user, Event handling. **Graphics Programming** – Introduction, The graphics class, Lines and rectangles, Circles and ellipses, Drawing arcs, Drawing polygons, Line graphs, Using controls loops in applets, Drawing bar charts, Introduction to AWT packages, Introduction to swing. **Managing Input / Output Files in JAVA** – Introduction, Concepts of streams, Streams classes, Bytes streams classes, Character streams classes, Using streams, Other useful I/O classes, Using the file classes, Input / Output exception, Creation of files, Reading/Writing character, Reading/Writing bytes, Handling primitive data types, Concatenating and buffering files, Random access file, Interactive input and output, Other stream classes. **JAVA Collections** – Introduction, Overview of interfaces, Overview of classes, Overview of algorithm.

Text Book:

1. E. Balagurusamy, Programming with Java, McGraw-Hill.

Reference Books:

1. Dr. R. NageswaraRao, Core Java – An Integrated Approach, Dreamtech Press.
2. Rashmi Kanta Das, Core Java for Beginners, Vikas Publishing.
3. Joel Murach, Murach's Java Programming, Shroff Pubishers.
4. Sharanam Shah & Vaishali Shah, Core Java 8 for Begineers, Shroff Pubishers.
5. Patrick Naughton & Herbert Schildt, JAVA 2 – The Complete Reference 3/E, McGraw-Hill.
6. B. M. Harwani, Java for Professionals, Shroff Pubishers.

Practical List of Core Java

1. Write an algorithm, draw a flowchart and develop a Java program to find the sum of any number of integers entered as command line arguments.
2. Write an algorithm, draw a flowchart and develop a Java program to perform addition, subtraction, multiplication and division using switch case statement.
3. Write an algorithm, draw a flowchart and develop a Java program to find the factorial of a given number.
4. Write an algorithm, draw a flowchart and develop a Java program to display the following pattern –

```
        *
      * * *
    * * * * *
  * * * * * * *
```

5. Write an algorithm, draw a flowchart and develop a Java program to learn use of single dimensional array by defining the array dynamically.
6. Write an algorithm, draw a flowchart and develop a Java program to convert a decimal number to binary number.

7. Write an algorithm, draw a flowchart and develop a Java program to find the sum of any number of integers interactively, i.e., entering every number from the keyboard, whereas the total number of integers is given as a command line argument.
8. Write an algorithm, draw a flowchart and develop a Java program to Write a program that show working of different functions of String and StringBufferclasss like setCharAt(, setLength(), append(), insert(), concat()and equals().
9. Write an algorithm, draw a flowchart and develop a Java program to create a -distance class with methods where distance is computed in terms of feet and inches, how to create objects of a class and to see the use of this pointer.
10. Write an algorithm, draw a flowchart and develop a Java program to show that during function overloading, if no matching argument is found, then java will apply automatic type conversions(from lower to higher data type).
11. Write an algorithm, draw a flowchart and develop a Java program to show the use of static functions and to pass variable length arguments in a function.
12. Write an algorithm, draw a flowchart and develop a Java program to demonstrate the concept of boxing and unboxing.
13. Write an algorithm, draw a flowchart and develop a Java program to find the area of rectangle using constructor.
14. Write an algorithm, draw a flowchart and develop a Java program to demonstrate the method overloading concept.
15. Write an algorithm, draw a flowchart and develop a Java program to find even, odd, factorial of a number using inheritance.
16. Write an algorithm, draw a flowchart and develop a Java program to demonstrate the Interfaces.
17. Write an algorithm, draw a flowchart and develop a Java program to create a multilevel package and also creates a reusable class to generate Fibonacci series, where the function to generate Fibonacci series is given in a different file belonging to the same package.
18. Write an algorithm, draw a flowchart and develop a Java program that creates illustrates different levels of protection in classes/subclasses belonging to same package or different packages.
19. Write an algorithm, draw a flowchart and develop a Java program to create your own exception types to handle situation specific to your application (Hint: Define a subclass of Exception which itself is a subclass of Throwable).
20. Write an algorithm, draw a flowchart and develop a Java program to implement the concept of loading & displaying images.
21. Write an algorithm, draw a flowchart and develop a Java program to demonstrate the animation.
22. Write an algorithm, draw a flowchart and develop a Java program to demonstrate multithread communication by implementing synchronization among threads (Hint: you can implement a simple producer and consumer problem).
23. Write an algorithm, draw a flowchart and develop a Java program to create URL object, create a URLConnection using the openConnection() method and then use it examine the different components of the URLand content.
24. Write an algorithm, draw a flowchart and develop a Java program to implement a simple datagram client and server in which a message that is typed into the server window is sent to the client side where it is displayed.
25. Write an algorithm, draw a flowchart and develop a Java program that creates a Banner and then creates a thread to scrolls the message in the banner from left to right across the applet‘s window.
26. Write an algorithm, draw a flowchart and develop a Java program to get the URL/location of code (i.e. java code) and document(i.e. html file).
27. Write an algorithm, draw a flowchart and develop a Java program to demonstrate different mouse handling events like mouseClicked(), mouseEntered(), mouseExited(), mousePressed, mouseReleased() and mouseDragged().

28. Write an algorithm, draw a flowchart and develop a Java program to demonstrate different keyboard handling events.
29. Write an algorithm, draw a flowchart and develop a Java program to generate a window without an applet window using main() function.
30. Write an algorithm, draw a flowchart and develop a Java program to display the following output using applet -

    A
    A P
    A P P
    A P P L
    A P P L E
    A P P L E T

Paper - III: Quantity Techniques & Operation Research

UNIT - I

Introduction to statistics - Origin and growth of statistics, meaning of statistics, Definitions of statistics, Characteristics of statistics, Main division of statistics, Nature of statistics: a Science or an Art, Scope of statistics , relation of statistics to other sciences, Function of statistics, Importance of statistics, Limitations of statistics, Distrust Misuse of statistics, Statistical thinking, statistical inferences. **Measures of central Tendency or Averages -** Definition and meaning of average, Qualities of good average, Types of averages, Arithmetic mean, median, Mode, geometric mean ,harmonic mean, Relation among mean ,median and mode, Relation among arithmetic mean, geometric mean and harmonic mean, Quartiles ,deciles, and percentiles. **Measures of dispersion -** Definition of dispersion , meaning of dispersion , purpose of dispersion, quartiles of a good Measures of dispersion, Measures of dispersion, range, quartile deviation or semi-inter quartile range, mean deviation or average deviation, standard deviation or root-mean square deviation, co-efficient of variation, variance, combined standard deviation, relation among quartile deviation, mean deviation and standard deviation, Lorenz curve—graphical presentation of dispersion.

UNIT - II

Correlation Analysis - Meaning of correlation, definition of correlation, usefulness of correlation analysis, types of correlation, co-efficient of correlation , measurement of correlation, probable error of co-efficient of correlation, standard error of co-efficient of correlation, co-efficient of determination, correlation ratio. **Regression Analysis -** Introduction, meaning of regression, definition of Regression, usefulness of Regression analysis, types of Regression, Regression lines, Regression equation, Regression co-efficients, standard erroe of estimate (SEE), ratio of variation, galton graph, limitations of Regression analysis, distinguish between correlation and Regression. **Probability Analysis -** Introduction, meaning of Probability, properties of Probability, importance of Probability, Probability related events, theorems of Probability, fundamental rules of Probability, calculation of Probability.

UNIT - III

Operation Research: An Introduction – Operation Research – Quantitative approach to decision making, The history of Operation Research, Definition of Operation Research, Characteristics of Operation Research approach, Applications of Operation Research, Computer software for Operation Research. **Linear Programming: Application & Model Formulation –** Introduction, Structure of linear programming model, Advantage of using linear programming, Limitations of linear programming, Application areas of linear programming, General mathematical model of linear programming problem, Guidelines on linear programming model formulation, Example of linear programming model formulation. **Linear Programming: The Graphical Method –** Introduction, Important definitions, Graphical solution methods of LP problem. **Linear Programming: The Simplex Method –** Introduction, Standard form of an LP problem, Simplex algorithm (Maximization & Minimization Case), Types of linear programming solutions.

Transportation Problem – Introduction, Mathematical model of transportation problem, Methods of finding initial solution. **Assignment Problem –** Introduction, Mathematical model of statement assignment problem, Solution methods of assignment problem (Hungarian Method).

UNIT - IV

Decision Theory and Decision Trees – Introduction, Steps of decision making process, Types of decision making environments, Decision making under uncertainty, Decision making under risk, Decision trees analysis, Decision making with utilities. **Theory of Games -** Introduction, Two Person zero sum games, Pure strategies (Minimax and minimum principles): games with saddle point, Mixed strategies: game without saddle point, The rules of dominance, Solution methods for games without saddle point. **Project management: PERT and CPM –** Introduction, Basic difference between PERT and CPM, Phases of project management, PERT/CPM network components and precedence relationships, Critical path analysis, Project scheduling with uncertain activity times, Project time-cost trade-off, Updating of the project progress. **Replacement and Maintenance Models –** Introduction, Types of failure, Replacement of items whose efficiency deteriorates with time, Replacement of items that fail completely, Other replacement problems.

Text Book:

1. E. Narayanan Nadar, Statistics, PHI.
2. J. K. Sharma, Operation Research – Theory & applications, Macmillan.

Reference Books:

1. P. N. Arora, S. Arora, Statistics, S. Chand.
2. Richard A. Johnson & Gouri K. Bhattavharyya, Statistics – Principles and Methods, Wiley.
3. S. C. Gupta, V. K. kapoor, Fundamentas of Mathematical Statistics, S. Chad & Sons.
4. Ken Black, Applied Business Statistics, Wiley.
5. Ravindran, Phillips & Solberg, Operation Research – Principles & Practice, Wiley.
6. R. Panneerselvam, Operations Research, PHI.
7. Prem Kumar Gupta, D. S. Hira, Operations Research, S. Chand.

Paper - IV: E-Commerce & Web Designing

UNIT - I

Introduction- Electronic Commerce And Physical Commerce, The DIGITAL Phenomenon, Looking At E-Commerce From Different Perspectives, Different Types Of E-Commerce, Some E-Commerce Scenarios, Changes Brought By E-Commerce, Advantages Of E-Commerce, Myths About E-Commerce Development And Implementation, System Model And Road Map Of This Book. **Internet And World Wide Web-** An Overview Of The Internet, Brief History Of The Web, Web System Architecture, Uniform Resource Locator, Overview Of The Hypertext Transfer Protocol, Hypertext Transfer Protocol (HTTP), Generation Of Dynamic Web Pages, Cookies, HTTP/1.1, Example. **Client Side Programming**- Important Factors In Client-Side Or Web Programming, Web Page Design And Production, Overview Of HTML, Basic Structure Of An HTML Document, Basic Text Formatting, Links, Images, ImageMap, Tables, Frames, Form, Cascading Style Sheets, Javascript.

UNIT - II

Server-Side Programming I: Servlet Fundamentals- Revisiting The Tree-Tier Model, Common Gateways Interface (CGI), Active Server Page (ASP), Overview Of Java Servlet, Java Servlet Architecture, Overview Of Servlet API, Building The Virtual Bookstore- Step By Step, Your First Servlet- Welcome To VBS, Compilation And Execution Of Servlets, An Interactive Servlet Program Example: Topics Of Interest, Topics Of Interest: Cookie Approach.

Server-Side Programming II: Database Connectivity- Introduction, Relational Database Systems, JDBC Perspectives, A JDBC Program Example: Simple Servlet Book Query, An Advance Book Query: Servletbookquerymulti, Advanced JDBC Servlet: VBS Advance Book Search Engine. **Server-Side Programming III: Session Tracking-** Introduction, Traditional Session Tracking Techniques, The Servlet Session Tracking Techniques, The Servlet Session Tracking API, A Practical Case: VBS Shopping Cart. **Basic Cryptography Enabling E-Commerce-** Security Concern, Security Requirements, Encryption, Two Basic Principles For Private Key Encryption, The Key Distribution Problem, Diffie-Hellman Key Exchange Protocol, Public Key Encryption, RSA Encryption Algorithm, Hybrid Encryption, Other Public Key Encryption Methods, Stream Cipher And Block Cipher, Message Digest, Message Authentication Code, Digital Signature, Digital Signature Standard, Authentication.

UNIT - III

Internet Security- IPSec protocol, setting up associations, the authentication header (AH) service, the encapsulating security payload (ESP) service, preventing replay attack, application of IPSec: virtual private network, firewalls, different types of firewalls, example of firewall system, secure socket layer (SSL), putting everything together. **Advanced techniques for e-commerce-** introduction to mobile agents, WAP: the enabling technology for mobile commerce, XML (eXtensible Markup Language), Data mining.

UNIT - IV

Internet Payment System- Characteristics Of Payment System, 4C Payment Methods, SET Protocol For Credit Card Payment, E-Cash, E-Check, Micropayment System, Overview Of Smart Card, Overview Of Mondex, Putting It All Together For Payment In The VBS. Consumer **Oriented E-Commerce**- Introduction, Traditional Retailing And E-Retailing, Benefits Of E-Retailing, Key Success Factors, Models Of E-Retailing, Features Of Retailing, Developing A Consumer-Oriented E-Commerce System, The PASS Model. **Business Oriented Commerce- Features** Of B2B E-Commerce, Business Model, Integration. **E-Services-** Categories Of E-Services, Web-Enabled Services, Matchmaking Services, Information-Selling On The Web, E-Entertainment, Auctions And Other Specialized Services, Traditional Versus Internet Advertising, Internet Advertising Techniques And Strategies, Business Models For Advertising And Their Revenue Streams, Pricing Models And Measurement Of The Effectiveness Of Advertisements, Web Publishing- Goals And Criteria, Web Site Development Methodologies, Logical Design Of The User Interface I- Abstract User Interface, Logical Design Of The User Interface II- Flow Of Interaction, Usability Testing And Quality Assurance, Web Presence And Visibility.

Text Book:

1. Henry Chan, Raymond Lee, Tharam Dillon, & Elizabeth Chang, E-Commerce – Fundamentals and Applications, Wiley.

Reference Books:

1. Eric van der Vlist, Danny Ayers, Erik Bruchez, Joe Fawcett, AlessandroVernet, Professional Web 2.0 Programming, Wiely.
2. Michael P. Papazoglou, Pieter M.A. Ribbers, e-Business, Wiely.
3. Brian P. Hogan, HTML5 and CSS3, Shroff Publishers.
4. Sandeep panda, AngularJS – Novice to Ninja, Shroff Publishers.

Practical List of E-Commerce & Web Designing

1. Write a program in HTML to illustrate the use of Formatting tags => BOLD, ITALIC, UNDERLINE, SUPERSCRIPT, SUBSCRIPT, AND STRIKETHROUGH.

2. Write a paragraph centrally aligned and change the color of text to BLUE and Background to YELLOW. The size of the font should be 6.

3. Write a program in HTML to illustrate the below given formats.
    a) The page should contain a paragraph which is centrally aligned.
    b) FIRST line of the paragraph should be BOLD and ITALIC.
    c) STRIKEOUT the Second Line.
    d) Underline and change the color to RED, of the third line.
    e) Change the font size of the fourth Line to 5.
    f) Change the color of the text to GREEN.
    g) Two horizontal lines below the paragraph.

4. Write a program in HTML to link two files.

a) The name of the first file is LINK1.HTML and that of second file is LINK2.HTML.
b) LINK2.HTML should contain a Back link also.

5. Write a program in HTML to Design a Table containing 5 columns and 4 rows. The name of the columns should be ENO, NAME, DESIGNATION, SALARY and CITY.

6. Write a program in HTML to design a Table containing 5 columns and 4 rows. The name of the columns should be ENO, NAME, DESIGNATION, SALARY and CITY. The table should also contain the below given specifications.
   a) Table should contain BORDER.
   b) Background color of the Table should be GREEN.
   c) Color of the Text should be BLUE.
   d) Text should be centrally aligned in the cell.

7. Write a program in HTML to Design a Table containing 5 columns and 4 rows. The name of the columns should be ENO, NAME, DESIGNATION, SALARY and CITY. Illustrate the usage of cell padding and cell spacing. Also align the Table to the CENTRE of the page.

8. Write a program in HTML to illustrate the usage of ROWSPAN in the below given format.

CITY	TOWN
NAGPUR	SHANKAR NAGAR
	DHARAMPETH
	RAMDASPETH
BOMBAY	DADAR
	V.T.
	THANE

9. Write a program in HTML to illustrate the usage of COLUMN SPAN (COLSPAN) in the below given format.

NAME	LIVING CITY	COMPANY CITY
SUJEET	CHHINDWARA	
TAPAN	NAGPUR	BOMBAY
RAM	BOMBAY	
MOHAN	BANGALORE	
KRISHNA	PUNE	
MANGESH	BOMBAY	NAGPUR
AVINASH	DELHI	

10. Write a program in HTML to divide the screen horizontally into two sections.

11. Write a program in HTML to divide the screen vertically into two sections.

12. Write a program in HTML to divide the Screen into 4 sections.

13. Write a program in HTML to demonstrate the usage of Marquee text with the below given Specifications.
    Marquee text is INTERNATIONAL COLLEGE.
    Color of text is BLUE.
    Background color is YELLOW.

Size of Text is 7.
Direction is LEFT to RIGHT.

14. Write a program in HTML to demonstrate the use of the Marquee Text with the below given Specifications.
    a) Marquee Text is INTERNATIONAL COLLEGE.
    b) Text color is BLUE.
    c) Repeat the Marquee Text five Times.
    d) Make use of SCROLLAMOUNT.
    e) Make use of SCROLLDELAY.

15. Write a program in HTML to demonstrate the usage of Image file with the below
    a) given specification.
    b) Background color of page is GREEN.
    c) The size of Image is 400 x 400 pixels.
    d) The Image should contain a border.
    e) Alternate text is “IMAGE NOT FOUND”.
    f) Image should appear on the centre of the page.

16. Write a program in HTML to Demonstrate the usage of Image file with the below given specifications.
    a) Background color is RED.
    b) The size of Image is 300 x 300 pixels.
    c) The image should contain a BORDER.
    d) Alternate Text is “IMAGE is NOT FOUND”.
    e) Vertical space should be 100 pixels.
    f) Horizontal space should be 350 pixels.

17. Write a program in Java Script which should prompt the user to enter the result of Question-“What is the result of 10+10?”. The user will be given a chance to answer the question. If the answer is correct then the program should raise a message-“Congratulations”. If the answer is wrong then the program should again ask the same question. If the answer is correct then the message should be –“Cleared in the second round” else another message should be generated specifying –“ Sorry, try next time” and the program should exit. Note – Make use of If. Else.

18. Write a program in Java Script which should prompt the user to enter the result of question –“ What is the Result of 10 +10?. At the most the user will get 5 chances to answer the question. If the user gives the correct answer during the attempts then the program should exit the loop by raising a message-“Congratulations “. Otherwise, whenever the answer is wrong the program should alert the user that the answer is wrong. Even during the 5^{th} attempt, if the answer is wrong then it should raise another alert message also specifying- “Sorry- Try Next Time”. (Use Loop, Prompt and Alert).

19. Write a program in Java Script which prompt the user to enter the Result of Question- “ What is the Result of 10+10?.
    The program should repeat the question in two cases-
    a. If the user is wrong.
    b. And he wants to continue.
    The program should exit the loop in two cases-
    b) If the answer is correct.
    c) If the answer is wrong but the user doesn’t want to continue.
    d) (Use odd Looping, Prompt, Alert and Confirm Dialog Boxes).

20. Write a program in Java Script which raises a Message:"
    "Welcome To Our Website" as soon as the Site is loaded. It should also display a message: -"Thank You " when the user switch over from the page.

21. Write a program in Java Script to check the username. If the user name is correct, the program should give an alert message-: "Welcome" along with user name else the program should alert the user specifying that the user name is wrong. Use DOM and onchange event.

22. Write a suitable program in Java Script which displays a message depending on the radio button being clicked using DOM and onclick event.

23. Write a program in Java Script to count the number of elements in a forms elements array. Check the number of elements returned against the number of form elements described between < Form> and </Form> tag in HTML page that is running in the browser. Recognize that number of elements in the array match the number of elements described between <FORM> and </FORM> tag in HTML page exactly.

24. Write a program in Java Script to check whether the form is filled or not. If one of the elements is not filled then display an alert message to fill the particular element using DOM and BUTTON.

25. Write a program in Java Script to check whether the form is completely filled or not. If one of the elements is not filled then display an alert message to fill the particular element using DOM and onsubmit event.

MCM Part-II

Semester - III

Paper - I: Advance Database Management Systems

UNIT - I

Introduction to Database Management System(DBMS) – Introduction, Why a Database, Characteristic of Data in a Database, Database Management System, Why DBMS, Types of Database Management System, Object-Oriented Model, Object-Relational Model, Deductive/Inference Model, Compression Between the various Database Model. **Introduction to Relational Database Management System(RDBMS)-** Introduction , RDBMS Terminologies, The Relational Data Structure, Relational Data Integrity, Relational Data Manipulations, Codd's Rule. **Database Architecture and Data Modeling** – Introduction, Conceptual, Physical and Logical Database Model, External or Logical Level. **Entity-Relationship Modeling**- Introduction, E-R Model, Components of an E-R Model, E-R Modeling Symbols. **Data Normalization-** Introduction, First Normal Form(1NF), Second Normal Form(2NF), Third Normal Form(3NF), Boyce-Codd Normal Form(BCNF), Fourth Normal Form(4NF), Fifth Normal Form(1NF), Domain-Key Normal Form(DKNF), Renormalizations. **Relational Algebra and Relational Calculus**- Relational Algebra, Relational Calculus.

UNIT - II

Introduction to Structured Query Language(SQL) – Introduction, History of SQL, Characteristic SQL, Advantages of SQL, SQL in Action, SQL Data Types and Literals, Types of SQL Commands, SQL Operators, Arithmetic Operators, Compression Operators, Logical Operators, Set Operators, Operators Precedence. **Tables, View and Index** – Tables, View , Index. **Nulls** – Introduction, Nulls in Action, When not to Use Nulls, Effect of Nulls, Null Indicators, Null and Compression Operator, Testing of Nulls, Tests of true, False and Unknown, BETWEEN, LIKE and IN Condition, ALL and ANY Condition, EXITS Condition, ORDERED BY Clause. **Query And Subqueries** - Query , Subqueries. **Aggregate Function** – Introduction, General Rule, COUNT() and COUNT(*), SUM(), AVG(), MAX() and MIN(). **Insert, Update and Delete Operation** – Introduction, Insert Statement, Bulk Insert of Data, Update Statement, Delete Statement **Cursors** – Introduction, Cursor Operation, Cursor Positions, Cursor Coding Guideline. **Join And Union** - Join , Union.

UNIT - III

Programming with SQL- Introduction, Query Processing, Embedded SQL, Dynamic SQL. **Query-By-Example(QBL)** – Introduction, Select Query in QBE, Make-Table Query, DELETE Query, UPDATE Query, APPEND Query, QBE and SQL. **QUEL**- Introduction, Data Definition in QUEL, Data Retrieval in QUEL, Data UPDATE Operation in QUEL. **Triggers** – Introduction, What is Trigger?, Types of Triggers, Triggers Syntax,

Combining Triggers Types, Setting Inserted Value, Disabling and Enabling Triggers, Replacing Triggers, Dropping Triggers, Advantages and Limitations of Triggers.
Introduction- PL/SQL Blocks, PL/SQL Architecture, SQL Support, PL/SQL Variables, PL/SQL Data Types, PL/SQL Precompilers, Conditional And Sequential Control Statements, Control Statements, Cursors, Iterative Control Statements, PL/SQL Exceptions, PL/SQL Blocks, PL/SQL Triggers, Types Of Triggers, Procedures And Packages.

UNIT - IV

Data Ware House and Data Marts – Introduction, Data in the Data Ware House, Data Ware House, Design Issues, OLTP vs. Data Ware House, Configuration of Data Ware House Process, Data Ware House Components, Structure of Data Ware House, Data Ware House Life Cycle, Data Ware House Environment, Data Architecture Data Ware House Operation, How much Data?, Data Integration and Transformation Process. **Data Mining** - Introduction, What is Data Mining?, Evaluation of Data Mining, Data Mining Verification vs. Discovery, Tasks Solve by Data Mining, Advantages of Data Mining. On-Line Transaction Processing(OLTP) - Introduction, Designing Criteria OLTP Features, Practical Application of OLTP, Future trends in OLTP. **On-Line Analytical Processing(OLAP)** – Introduction, OPAP and OPAP, OLAP and Data Ware Housing, Use of OLAP, Benefits of OLAP, Evaluation of OLAP, OLAP Concept and Characteristic, Cood's OPLAP Product Evaluation Rules, Different Style of OLAP.

Text Book:

1. Alexis Leon, Mathews Leon, Database Management System, Leaon Vikas.

Reference Books:

1. Rini Chakrabarti, Shilbhadra Dasgupta & Subhash K. Shinde, Advance Database Management System, Dreamtech Press.
2. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, Database System Concepts, McGraw-Hill.
3. G. K. Gupta, Database System Concepts, McGraw-Hill.
4. Dr. P. S. Deshpande, SQL & PL/SQL for Oracle 11g, Dreamtech Press.
5. Ivan Bayross, SQL, PL/SQL, BPB Publications.

Practical List of SQL & PL/SQL

1. Write a SQL Query to create a table**"employee"**:

Field Name	Datatype	Size
Emp_no	varchar2	5
Emp_name	varchar2	25
Address	varchar2	50
Phone_number	number	10
Designation	varchar2	15
Salary	number	15

1. Display the structure of table.
2. Add qualification field at the end of employee table.
3. Modify the size of the name field 25 to 30.

4. Display the employee name whose salary is greater than 20,000.
5. Display the employee details whose name starts with “A”.

2. Write a SQL Query to create a table **“student”**:

Field Name	Datatype	Size	Constraint
Roll	number	5	primary key
Name	varchar2	30	first letter must start with ‘A’
Address	varchar2	30	not null
City	varchar2	30	
DOB	date		
	Phone	number	11 unique key
Class	varchar2	10	All upper letter
Marks	number	(10, 2)	Not null can’t be 0

1. Display the structure of database and insert 10 records.
2. Display student information for all student in city Pune and Nagpur.
3. Display student information where marks greater than 80 and less than 90.
4. Display student name where first two character of student name ‘An’.
5. Change student name to Ashish where student roll number A001.

3. Write a SQL Query to create a table **“sales_details”**:

Field Name	Datatype	Size
S_id	varchar2	8
P_id	varchar2	8
P_name	varchar2	15
Price	number	10
Qty	number	8

1. Drop foreign key constraint on column p_no in table sales_details.
2. Add foreign key constraint on column sale_no in table sales_details.
3. Modify the column qty to include not null constraint.
4. Insert 10 records in sale_details.
5. Display p_id and total of quantity qty for each product.
6. Display p_id and total of price for all the products.

4. Write a SQL Query to create a table **“customer”**:

FieldName	Datatype	Size
Cust_no	varchar2	10
Cust_name	usertype	
Address	varchar2	10
Salary	number	10

1. Modify address field with not null.
2. Add city field as it must keep city name Mumbai, Delhi and Kolkata.
3. Add salary field where salary greater than 20,000.
4. Display the structure of table customer.
5. Insert 10 records into the table customer.
6. Display all the customer details who lives in Mumbai and Kolkata.
7. Display all the customer records whose salary>20,000 and salary<30,000.
8. Modify the address field where customer number is ‘C001’.

5. Write a SQL query to create **c_master** with fields c_no, name, address, city, state and pin_code:

Field Name	Datatype	Size
C_no	varchar2	10
Name	varchar2	10
Address	varchar2	10
State	varchar2	20

City	varchar2	20
Pin_code	number	10

1. Create sequence which will generate number from 1..999 in ascending order, with an interval of 1 and in cyclic order.
2. Insert 10 records.
3. Create index on c_master which column name c_no and state.
4. Create view on c_master .
5. Select columns c_no, city which belongs to Nagpur and Mumbai.

6. Write a SQL query to create a syntax seq_order which generating numbers from 1…9999 in ascending will number with an interval of 1 in cyclic order.

Field Name	**Datatype**	**Size**
P_no	varchar2	10
P_name	varchar2	20
Qty	varchar2	10
P_rate	varchar2	10

1. Display next value of sequence seq_order.
2. Display current value of sequence seq_order.
3. Insert values in sal_order table must be generated using sal_order sequence.
4. Display all records of sal_order table.
5. Change a cache memory of 50 seq_order sequence having interval 2.
6. Drop sequence.

7. Write a SQL Query to-

1. Create an index employee_index depends on employee table using field name.
2. Create a view depends on employee table.
3. Display the records from the view where city as Delhi and Mumbai.
4. Update the view where employee id is ‘E006’.

8. Write a SQL query to illustrate numeric function.

1. Sqrt 2. Ceil 3. Power 4. Floor 5. Round
6. Mod 7. Abs 8. Exp 9. Greatest 10. Least

9. Write a SQL query to create tablespace datauser or data where size of file 100MB extend it by 10MB reach upto 250MB in size. Create user data1 with default tablespace and temporary tablespace. Create role acc_create with create session, create user, alter user and assign role to user. Assign profile to user where user should fail after 5 attempt and valid for 3 days. Destroy user data1 and tablespace from system.

10. Write a SQL query for join, inner join, outer join, self join and Cartesian join.

11. Write an algorithm, draw a flowchart and develop a PL/SQL program to check given number is odd or even.

12. Write an algorithm, draw a flowchart and develop a PL/SQL program to check number is reverse or not.

13. Write an algorithm, draw a flowchart and develop a PL/SQL program to check number is palindrome or not.

14. Write an algorithm, draw a flowchart and develop a PL/SQL program to find the number is Armstrong or not.

15. Write an algorithm, draw a flowchart and develop a PL/SQL program to find the addition of all the number in the given range.

16. Write an algorithm, draw a flowchart and develop a PL/SQL program to find the number is prime or not.

17. Write an algorithm, draw a flowchart and develop a PL/SQL program to calculate factorial of a given number.

18. Write an algorithm, draw a flowchart and develop a PL/SQL program to generate Fibonacci series.

19. Write an algorithm, draw a flowchart and develop a PL/SQL program to insert a new element in a given position in the array.

20. Write an algorithm, draw a flowchart and develop a PL/SQL program to delete the duplicate element from the array.

21. Write an algorithm, draw a flowchart and develop a PL/SQL program to sort the data in ascending order.

22. Write an algorithm, draw a flowchart and develop a PL/SQL program to find reverse of a string.

23. Write an algorithm, draw a flowchart and develop a PL/SQL program to find palindrome of a string.

24. Write an algorithm, draw a flowchart and develop a PL/SQL program to calculate number of char, spaces, words from given string.

25. Write an algorithm, draw a flowchart and develop a PL/SQL program to find largest and smallest element of given array using function concept.

26. Write an algorithm, draw a flowchart and develop a PL/SQL program to print ASCII table.

27. Write an algorithm, draw a flowchart and develop a PL/SQL program to change sale_price of product_master table where pro_no is ‘C001’ and insert records with date on which price was changed last in new_master table whose fields are prod_no, date, sale_price.

28. Write an algorithm, draw a flowchart and develop a PL/SQL program to accept the employee whose job is programmer and update the salary of the employee. Display how many rows are affected.

29. Write an algorithm, draw a flowchart and develop a PL/SQL program to display the name, dept, name and salary of first 10 employees getting the highest salary using explicit cursor.

30. Write an algorithm, draw a flowchart and develop a PL/SQL program to check whether emp_no of employees exists or not using procedure.

Paper - II: Principles & Techniques of Management

UNIT – I

Concepts And Nature of Management, Evolution of Management Thought, Management Process, Social Responsibilities of A Business, Coordination,

UNIT – II

Nature and Process Of Planning, Methods And Types Of Plans, Forecasting And Decision Making, Management Information System, Organizing Functions.

UNIT – III

Departmentation And Organization Structure, Nature And Scope Of Staffing, Training And Development, Performance Appraisal And Problem.

UNIT – IV

Direction and Supervision, SUPERVISION, Motivation and Moral, MOTIVATION, MORAL, Leadership, Communication, Techniques of managerial control.

Text Book:

1. R.S.N. Pillai & S. Kala, Principles & Practice of Management, S. Chand.

Reference Books:

1. Chandra Bose, Principles of Management & Administration, PHI.
2. P C Tripathy & P N Reddy, Principles of Management, McGraw-Hill.
3. V.P. Michel, Principles of Management.
4. Mohan, Developing of Communication Skills.
5. Philip Kotlar, Marketing Management.
6. C. B. Memoria, Personnel Management.
7. Asha Kaul, Business Communication, PHI.

Paper - III: Elective

Elective – I: PHP & My-SQL

UNIT - I

Introducing PHP- Why PHP and MySQL?**,** What Is PHP?, What Is MySQL?. **Server-Side Scripting Overview**- Static HTML,Client-Side Technologies, What Is Server-Side Scripting Good For? **Learning PHP Syntax and Variables -** PHP Is Forgiving, HTML Is Not PHP, PHP's Syntax Is C-Like, Comments, Variables, Types in PHP: Don't Worry, Be Happy, Type Summary, The Simple Types, Output. **Learning PHP Control Structures and Functions-** Boolean Expressions, Branching, Looping, Alternate Control Syntaxes, Terminating Execution, Using Functions, Function Documentation, Defining Your Own Functions, Functions and Variable Scope, Function Scope. **Passing Information with PHP -** HTTP Is Stateless, GET Arguments, A Better Use for GET-Style URLs, POST Arguments, Formatting Form Variables, PHP Superglobal Arrays. **Learning PHP String Handling -** Strings in PHP, String Functions. **Learning Arrays -** The Uses of Arrays, What Are PHP Arrays?, Creating Arrays, Retrieving Values, Multidimensional Arrays, Inspecting Arrays, Deleting from Arrays, Iteration. **Learning PHP Number Handling-** Numerical Types, Mathematical Operators, Simple Mathematical Functions, Randomness. **PHP Gotchas-** Installation-Related Problems, Rendering Problems, Failures to Load Page, Parse Errors, Missing Includes, Unbound Variables, Function Problems, Math Problems.

UNIT - II

Introducing Databases and MySQL- What Is a Database?, Why a Database?, PHP-Supported Databases. **Installing MySQL**- Obtaining MySQL, Installing MySQL on Linux, Installing MySQL on Microsoft Windows. **Learning Structured Query Language (SQL)-** Relational Databases and SQL, SQL Standards, The Workhorses of SQL, Database Design, Privileges and Security. **Learning Database Administration and Design -** Basic MySQL Client Commands, MySQL User Administration, Backups, Replication, Recovery. **Integrating PHP and MySQL-** Connecting to MySQL, Making MySQL Queries, Fetching Data Sets, Getting Data about Data, Multiple Connections, Building in Error Checking, Creating MySQL Databases with PHP, MySQL Functions. **Performing Database Queries -** HTML Tables and Database Tables, Complex Mappings, Creating the Sample Tables. **Integrating Web Forms and Databases-** HTML Forms, Basic Form Submission to a Database, Self-Submission, Editing Data with an HTML Form. **Improving Database Efficiency-** Connections — Reduce, Reuse, Recycle, Indexing and Table Design, Making the Database Work for You. **MySQL Gotchas-** No Connection, Problems with Privileges, Unescaped Quotes, Broken SQL Statements, Too Little Data, Too Much Data, Specific SQL Functions, Debugging and Sanity Checking.

UNIT - III

Introducing Object-Oriented PHP - What Is Object-Oriented Programming?, Basic PHP Constructs for OOP, Advanced OOP Features, Introspection Functions, Extended Example: HTML Forms, Gotchas and Troubleshooting, OOP Style in PHP. **Advanced Array Functions -** Transformations of Arrays, Stacks and Queues, Translating between Variables and Arrays, Sorting, Printing Functions for Visualizing Arrays. **Examining**

Regular Expressions - Tokenizing and Parsing Functions, Why Regular Expressions?, Perl-Compatible Regular Expressions, Example: A simple link-scraper, Advanced String Functions. **Working with the File system -** Understanding PHP File Permissions, File Reading and Writing Functions, Filesystem and Directory Functions, Network Functions, Date and Time Functions, Calendar Conversion Functions. **Working with Cookies and Sessions-** What's a Session?, Home-grown Alternatives, How Sessions Work in PHP, Sample Session Code, Session Functions, Configuration Issues, Cookies, Sending HTTP Headers, Gotchas and Troubleshooting. **Handing Exceptions with PHP -** Error Handling in PHP, Other Methods of Error Handling, Logging and Debugging. **Debugging PHP Programs -** General Troubleshooting Strategies, A Menagerie of Bugs, Using Web Server Logs, PHP Error Reporting and Logging, Error-Reporting Functions. **Learning PHP Style-** The Uses of Style, Readability, Maintainability, Robustness, Efficiency and Conciseness, HTML Mode or PHP Mode?, Separating Code from Design.

UNIT - IV

Sending E-Mail with PHP- Sending E-Mail with PHP, Sending Mail from a Form, **Integrating PHP and Java-** PHP for Java programmers, Integrating PHP and Java. **Integrating PHP and JavaScript**- Outputting JavaScript with PHP, PHP as a Backup for JavaScript, Static versus Dynamic JavaScript. **Integrating PHP and XML-** What Is XML?, Working with XML, Documents and DTDs, SAX versus DOM, DOM, SAX, SimpleXML API, A Sample XML Application, Gotchas and Troubleshooting. **Creating and Consuming Web Services with PHP**- The End of Programming as We Know It, REST, XML-RPC, SOAP, .NET, Current Issues with Web Services, Project: A REST Client. **Creating Graphics with PHP-** Your Options, HTML Graphic**s,** Creating images using gd, Gotchas and Troubleshooting.

Text Book:

1. Steve Suehring, Tim Converse & Joyce Park, PHP and MySQL, Wiely.

Reference Books:

1. Joel Murach & Ray Harris, murach's PHP and MySQL, Shroff Publishers.
2. Timothy Boronczyk, Elizabeth Naramore, Jason Gerner, Yann Le Scouarnec, Jeremy Stolz, Michael K. Glass, Beginning PHP6, Apache, MySQL Web Development, Wiley.
3. Jason Gilmore, Beginning PHP and MySQL.
4. Teach Yourself MySQL in 21 days – Techmedia.

Practical List of PHP & My-SQL

31. Write an algorithm, draw a flowchart and Write a PHP script to get the PHP version and configuration information.
32. Write an algorithm, draw a flowchart and Write a PHP script to print the Fibonacci series up to the entered range.
33. Write an algorithm, draw a flowchart and Write a PHP script to change the color of first character of a word.
34. Write an algorithm, draw a flowchart and Write a PHP script to test whether a number is greater than 30, 20 or 10 using ternary operator.
35. Write an algorithm, draw a flowchart and Write a PHP script to calculate the factorial of a number (non-negative integer) using function.
36. Write an algorithm, draw a flowchart and Write a PHP script to insert a new item in an array on any position.
37. Write an algorithm, draw a flowchart and Write a PHP script to sort an array of positive integers using the Sort function asort() and ksort().
38. Write an algorithm, draw a flowchart and Write a PHP script to
    a) Transform a string all uppercase letters.
    b) Transform a string all lowercase letters.
    c) Make a string's first character uppercase.
    d) Make a string's first character of all the words uppercase.
39. Write an algorithm, draw a flowchart and Write a PHP script to display all the numbers between 200 and 250 that are divisible by 4
40. Write an algorithm, draw a flowchart and Write a PHP class which displays an introductory message like "Hello All,Good Morning ", where "Morning" is an argument value of the method within the class.
41. Write an algorithm, draw a flowchart and Write a PHP Calculator class which will accept two values as arguments, then add them, subtract them, multiply them together, or divide them on request.
42. Write an algorithm, draw a flowchart and Write a PHP script to convert a date from yyyy - mm - dd to dd – mm - yyyy.
43. Write an algorithm, draw a flowchart and Write a PHP script to remove the whitespaces from a string.
44. Write an algorithm, draw a flowchart and Write a PHP function that checks if a string is all lower case.
45. Write an algorithm, draw a flowchart and Write a PHP script to check whether a entered string is palindrome or not
46. Write an algorithm, draw a flowchart and Write a PHP script to print Fibonacci series using recursion.
47. Write an algorithm, draw a flowchart and Write a PHP script using switch case and dropdown list display a - Hellol message depending on the language selected in drop down list.
48. Write an algorithm, draw a flowchart and Write a PHP script to replace the first 'the' of the following string with 'That' –
    Sample: 'the quick brown fox jumps over the lazy dog.'
    Expected Result: That quick brown fox jumps over the lazy dog.
49. Write an algorithm, draw a flowchart and Write a PHP script to check that email id is valid or not.
50. Write an algorithm, draw a flowchart and Write a PHP script to create a simple 'birthday countdown' script, the script will count the number of days between current day and birth day.
51. Write a SQL statement to create simple table countries including columns country_id, country_name and region_id.

52. Write a SQL statement to create table countries including columns country_id, country_name and region_id and make sure that the column country_id will be unique and store an auto incremented value.
53. Write a SQL statement to create a table named countries including columns country_id, country_name and region_id and make sure that no countries except Italy, India and China will be entered in the table.
54. Write a SQL statement to insert a record with your own value into the table countries against each columns region_id.
55. Write a SQL statement to rename the table countries to country_new.
56. Write an algorithm, draw a flowchart and Write a PHP script to which will receive the data captured by the HTML form, display the name of the form and also display the message Data Entered Successfully on the HTML form page after performing the validations.
57. Write an algorithm, draw a flowchart and Write a PHP script to creating, retrieving and deleting data from the cookie using POST Method.
58. Write an algorithm, draw a flowchart and Write a PHP script to create, retrieve and deleting the session data.
59. Write an algorithm, draw a flowchart and Write a PHP script to navigate the HTML Page with the use of JavaScript and PHP.
60. Write an algorithm, draw a flowchart and Write a PHP script to create login form with the fields' username and password with validation.
61. Write an algorithm, draw a flowchart and Write a PHP script to send e-mail from a form.
62. Write an algorithm, draw a flowchart and Write a PHP script to demonstrate the use of REST.
63. Write an algorithm, draw a flowchart and Write a PHP script to demonstrate the use of SOAP.
64. Create a table in MySQL named Programmer having the fields' id, sex, age, Language, OS, and Country with constraint, insert up to 20 values and write a PHP Script to generate a Bar Graph according to specific column the user selected.
65. Write an algorithm, draw a flowchart and Write a PHP script to create a registration form having two buttons Submit and Reset with validations. The form data should be submitted in MySQL databasewith coding to integrate the MySQL with PHP.

Paper - III: Elective

Elective – II: VB. Net

UNIT - I

Visual Basic .NET and the .NET Framework: The Common Language Runtime, Undestanding Assemblies, The .NET Security Model. **The Visual Basic .NET Devlopment Environment:** Working with the Visual Studio IDE, Creating a Visual Basic .NET Solution. **The Elements of Visual Basic .NET:** Visual Baisc .NET: The Foundation, Getting Started, Classes, Types, and Objects. **Visual Basic .NET Operators. Software Design, Conditional Structures, and Control Flow:** Control Flow, Conditional Statements, Loops, Pausing , Resuming, and Exiting Iteration.

UNIT - II

Methods: What is Method, Method Data, Method Access Characteristics, Properties, Introduction to Exception Handling, Design and Construction of Method. **Classes:** Class characteristics, Inheritance. **Exception Handling and Classes:** Structured Exception Handling, Exception Statements, Creating your own Exception Class. **Collections, Arrays, and Other Data Structures:** Stacks, Queues, Arrays, Jagged Arrays, Programming against Arrays, Array Exceptions.

UNIT – III

Advanced Interface Patterns:Adapter, Delegates, and Events : Adapters and Wrappers, Delegates, sorting Data with Delegates, Mulicast Delegates. **Data Processing and I/O :** Data Processing, Working with Strings, Members of the String Class, Classic Visual Basic String Functions, String Formatting, Building Strings with String builder. Files and Directories, Streams.

UNIT – IV

Interfacing with the End User: Windows Form, Introduction to Threading, MDI Application, Components and Controls, Menus and Toolbars, Response to User Input, Collecting User Input, Presentation and Informational Controls, Drag and Drop. **Getting Ready to Release:** The System.Diagnostics Namespace, Enabling Debugging, Run-time Configuration Files, Working with the Debug Class, Tracing and Trace Class, Debugging with Visual Studio .NET, The Visual Studio .NET Compiler.

Text Book:

1. Jeffry R. Shapiro, The Complete Reference, Visual Basic .NET McGraw- Hill.

Reference Books:

1. Thearon Willis, Jonathan Crossland, Richard Blair, Beginning CB.Net 2003, Dreamtech Press, Wiley.
2. Francesco Balena, Programming Microsoft Visual Basic.net, Microsoft Press.
3. Jeffrey Kent, Visual basic.Net – A Beginner's Guide, McGraw- Hill.

Practical List of VB. Net

1. Write an algorithm, draw a flowchart and develop a VB.NET console application to calculate the sum of all digits of a number.
2. Write an algorithm, draw a flowchart and develop a VB.NET console application to implement the sine series.
3. Write an algorithm, draw a flowchart and develop a VB.NET console application to remove all duplicate elements from an array.
4. Write an algorithm, draw a flowchart and develop a VB.NET console application to create all possible sets from given set {1, 2, 3 }.
5. Write an algorithm, draw a flowchart and develop a VB.NET console application to display the following pattern –

```
    *
   * * *
  * * * * *
 * * * * * * *
  * * * * *
   * * *
    *
```

6. Write an algorithm, draw a flowchart and develop a VB.NET console application to check a number is Armstrong or not.
7. Write an algorithm, draw a flowchart and develop a VB.NET console application to calculate the decimal number from binary number.
8. Write an algorithm, draw a flowchart and develop a VB.NET console application to calculate the first 50 prime and unprimed numbers.
9. Write an algorithm, draw a flowchart and develop a VB.NET console application to calculate the reverse of a string and check the string is palindrome or not.
10. Write an algorithm, draw a flowchart and develop a VB.NET console application to Search an element from characters and as well as from numbers using binary search method.
11. Write an algorithm, draw a flowchart and develop a VB.NET console application to sort a given string in the order of alphabets, digits & symbol.
12. Write an algorithm, draw a flowchart and develop a VB.NET console application to input array element, sorting them and remove duplicate element.
13. Write an algorithm, draw a flowchart and develop a VB.NET console application to create jagged array and arrange data in ascending order.
14. Write an algorithm, draw a flowchart and develop a VB.NET console application to calculate day of the week from a date without using any in build function.
15. Write an algorithm, draw a flowchart and develop a VB.NET console application to demonstrate exception handling.
16. Write an algorithm, draw a flowchart and develop a VB.NET windows application to check the user id and password is valid or not.
17. Write an algorithm, draw a flowchart and develop a VB.NET windows application to create a scientific calculator.
18. Write an algorithm, draw a flowchart and develop a VB.NET windows application to create text editor.
19. Write an algorithm, draw a flowchart and develop a VB.NET windows application to generate stopwatch.
20. Write an algorithm, draw a flowchart and develop a VB.NET windows application to create a start menu using status bar.
21. Write an algorithm, draw a flowchart and develop a VB.NET windows application to load the images & run Executable files using the file control.
22. Write an algorithm, draw a flowchart and develop a VB.NET windows application to create trial version DLL.

23. Write an algorithm, draw a flowchart and develop a VB.NET windows application to create a menu and perform any operation.
24. Write an algorithm, draw a flowchart and develop a VB.NET windows application to create MDI and arrange all forms as tiles and cascade form.
25. Write an algorithm, draw a flowchart and develop a VB.NET windows application to create popup menu.
26. Write an algorithm, draw a flowchart and develop a VB.NET windows application to create your own delegates.
27. Write an algorithm, draw a flowchart and develop a VB.NET windows application to create data bound control for retrieving the data from database.
28. Write an algorithm, draw a flowchart and develop a VB.NET windows application to create crystal report.
29. Write an algorithm, draw a flowchart and develop a VB.NET windows application to create different dialog box and perform any operation.
30. Write an algorithm, draw a flowchart and develop a VB.NET windows application to enter an e-mail ID into a textbox and check the e-mail ID is valid or not.

Paper - III: Elective

Elective – III: C#. Net

UNIT - I

Introducing C# - What is C#?**,** Evaluation of C#**,** Characteristics of C#**,** Application of C#**,** How does C# Differ from C++?**,** How does C# Differ from Java?. **Understanding .NET: The C# Environment –** The .NET Strategy, The Origin of .NET Technology, The .NET Framework, The Common Langue Runtime, Framework Base Class, User and Program Interface, Visual Studio .NET, .NET Languages, Benefits of the .NET Approach, C# and .NET. **Overview of C#** - Introduction, A Simple C# Program, Namespaces, Adding Comments, Main Running Value, Using Aliases for Namespaces Classes, Passing String Objects to WriteLine Method, Command Line Argument, Main with Class, Providing Interactive Input, Using Mathematical Function, Multiple Main Methods, Compile Time Error, Program Structure, Program Coding Style. **Literals, Variables and Data Types** – Introduction, Literals, Variables, Data Types, Value Types, Reference Type, Declaration Types, Initialization of Variables, Default Value, Constant Variable, Scope of Variables, Boxing and Unboxing. **Operators and Expressions** – Introduction, Arithmetic Operators, Relational Operators, Logical Operators, Assignment Operators, Increment and Decrement Operators, Conditional Operators, Bitwise Operators, Special Operators, Arithmetic Expressions, Evaluation of Expressions, Precedence of Arithmetic Operators, Type Conversion, Operator Precedence and Associativity, Mathematical Function. **Decision Making and Branching** – Introduction, Decision Making with if Statement, Simple if Statement, The if…else Statement, The else if Ladder, The Switch Statement, The ? : Operator, Decision Making and Looping – Introduction, The while Statement, The do Statement, The for Statement, The foreach Statement, Jumps in Loops

UNIT - II

Methods in C# - Introduction, Declaring Methods, The Main Method, Invoking Methods, Nesting of Methods, Method Parameters, Pass by Value, Pass by Reference, The Output Parameters, Variables Argument List, Methods Overloading. **Handling Arrays** – Introduction, One-Dimensional Array, Creating an Array, Two-Dimensional Array, Variable-Size Arrays, The System.Array Class, ArrayList Class. Manipulating Strings – Introduction, Creating String, String Methods, Inserting String, Comparing String, Finding String, Mutable String Arrays of String, Regular Expressions. **Structures and Enumerations** – Introduction, Structurs, Structs with Methods, Nested Structs, Difference between Classes and Structs, Enumerations, Enumerator Base Type, Enumerator type Conversion.

UNIT - III

Classes and Objects - Introduction, Basic Principle of OOP, Defining a Class, Adding Variables, Adding Methods, Member Access Modifiers, Creating Objects, Accessing Class Members, Constructors, Overloaded Constructors, Static Members, Static Constructors, Private Constructors, Copy Constructors, Destructors, Member Initialization, The This Reference, Nesting of Members, Constant Members, Read-only Members, Properties, Indexers. **Inheritance and Polymorphism** – Introduction, Classical Inheritance, Containment Inheritance, Defining a Subclass, Visibility Control, Defining Subclass Constructors, Multilevel Inheritance, Hierarchical Inheritance,

Overriding Methods, Hiding Methods, Abstract method, Sealed Class: Preventing Inheritance, Sealed Methods, Polymorphism. **Interface: Multiple Inheritance** – Introduction, Defining an Interface, Extending Interface, Implementing Interface, Interface and Inheritance, Explicit Interface Implementation, Abstract Class and Interface. **Operator Overloading** – Introduction, Overloadable Operators, Need for Operator Overloading, Defining Operator Overloading, Overloading Unary Operator, Overloading Binary Operator, Overloading Comparison Operator.

UNIT - IV

Delegates and Events – Introduction, Delegates, Delegates Declaration, Delegates Methods, Delegates Instantiation, Using Delegates, Multicast Delegates, Events. **Managing Errors and Exceptions** – Introduction, What is Debugging?, Types of Errors, Exceptions, Syntax of Exception Handling Code, Multiple Catch Statements, The Exception Hierarchy, General Catch Handler, Using Finally Statement, Nested Try Blocks, Throwing Our Own Exceptions, Checked and Unchecked Operators, Using Exceptions for Debugging. **Multithreading in C#** - Introduction, Understanding the System.Threading Namespace, Creating and Starting a Thread, Scheduling a Thread, Synchronizing Threads, Threading Pooling. **Window Form and Web-based Application Development on .NET** – Introduction, Creating Window Form, Customizing a Form, Understanding Microsoft Visual Studio 2005, Creating and Running a SimpleWinApp Windows Application, Overview of Design Patterns, Creating and Running a SimpleWinApp2 Windows Application, Web-based Application Errors.

Text Book:

1. E. Balagurusamy, Programming in C#, McGraw-Hill.

Reference Books:

1. Rod Stephens, C# 5.0 – Programmer's Reference, Wrox A Wiley Brand.
2. Rod Stephens, C# - 24 –Hour Trainer, Wrox A Wiley Brand.
3. Herbert Schildt, The Complete Reference C# 4.0, McGraw-Hill.

Practical List of C#.NET

1. Write an algorithm, draw a flowchart and develop a C#.Net console application to check whether the entered year is a leap year or not.
2. Write an algorithm, draw a flowchart and develop a C#.Net console application to develop Boxing and Unboxing concept.
3. Write an algorithm, draw a flowchart and develop a C#.Net console application to calculate the reverse of a number, To check the given number is palindrome or not, To check the given number is Armstrong or not, To calculate the sum of all the digits of a number.
4. Write an algorithm, draw a flowchart and develop a C#.Net console application to print the Following Pattern:

```
      1
    2   2
  3   3   3
4   4   4   4
```

5. Write an algorithm, draw a flowchart and develop a C#.Net console application to display the following pattern-

    Computer
    Compute
    Comput
    Compu
    Comp
    Com
    Co
    C

6. Write an algorithm, draw a flowchart and develop a C#.Net console application to print the Pascal Triangle.
7. Write an algorithm, draw a flowchart and develop a C#.Net console application to perform ascending order sorting using Jagged Array.
8. Write an algorithm, draw a flowchart and develop a C#.Net console application to find out the largest and second largest number from an array using jagged array.
9. Write an algorithm, draw a flowchart and develop a C#.Net console application to print abbreviation form of Name.
10. Write an algorithm, draw a flowchart and develop a C#.Net console application to separate character, digit and special symbols from an alpha numeric string and display them in ascending order sorting.
11. Write an algorithm, draw a flowchart and develop a C#.Net console application to count number of characters, words and blank spaces of given sentence.
12. Write an algorithm, draw a flowchart and develop a C#.Net console application to withdraw, deposit & transfer money to the account using method overloading.
13. Write an algorithm, draw a flowchart and develop a C#.Net console application to overload unary operator '-' and perform subtraction operation.
14. Write an algorithm, draw a flowchart and develop a C#.Net console application to overload binary operator '+' and perform addition operation between two complex numbers.
15. Write an algorithm, draw a flowchart and develop a C#.Net console application to implement the concept of constructor overloading.
16. Write an algorithm, draw a flowchart and develop a C#.Net console application to implement the concept of hierarchical inheritance.
17. Write an algorithm, draw a flowchart and develop a C#.Net console application to implement the concept of interface.
18. Write an algorithm, draw a flowchart and develop a C#.Net console application to combine two delegates.
19. Write an algorithm, draw a flowchart and develop a C#.Net console application to display the priority of the thread.
20. Write an algorithm, draw a flowchart and develop a C#.Net console application to convert feet to inches using Delegates.
21. Write an algorithm, draw a flowchart and develop a C#.Net console application to copy the contents from one file to another file.
22. Develop a C#.Net windows application to design and develop a simple calculator.
23. Develop a C#.Net windows application to design and develop a simple Notepad.
24. Develop a C#.Net windows application to develop a Birthday Reminder programme.
25. Develop a C#.Net windows application to develop a Database Connectivity with all controls.

Paper - IV: Compulsory Foundation

Compulsory Foundation: Research Methodology

UNIT – I

Research process, Problem and Hypothesis:

About Research - Introduction, Application of research, Definitions of research, Characteristics/Features of a good research, Types of research, Research Methods and Methodology, Research/Scientific Methods/Discovery, Research approaches, Application of research in management (Research applications in marketing management, Production management, Financial management, Human resource management, Current status of research in India), Limitations of research. **Research Process** - Defining and Formulating the Research Problem, Extensive Literature Survey, Development of the Working Hypothesis, Preparing the Research Designs, Determining the Sample Designs, Collecting the Data (Data Collection), Execution of the Project, Analysis of the Data, Hypothesis Testing and Verification, Generalization, Interpretation and drawing conclusions, Preparation of the report or writing the thesis. **Research Problem -** What is Research Problem?, Components of a research problem, Selection of a research problem, Technique involve in defining a research problem, Sources of problem, Research Proposal or Synopsis, Preparing synopsis for the research, Preparing research Plan. **Hypothesis -** Sources of hypothesis, Origin of hypothesis, Characteristics of a good hypothesis.

UNIT – II

Research Design and Sampling Design:

About Research Design - Introduction, Definition, Components of a research designs, Concepts related to research designs, Types of research designs. **Sampling Design –** Definition of sampling?, Features of the sampling technique, Essentials of an ideal sample, Types of sampling, Selecting/Calculating the sample size, Determination of sample size *n* When estimating the population mean, Some basic technologies of sampling, Common sampling distribution, Sampling theory.

UNIT – III

Data Collection, Preparation of Questionnaire and Schedule:

About Data Collection – Introduction, Primary data, Secondary data, Collection of primary data, Sources of secondary data, Creating a mechanism for gathering secondary data. **Questionnaire and Schedule –** Merits, Demerits, Formulation of Questionnaire, Various Method/ Technique for getting the Response, Construction of Questionnaire, Schedule, Types of Schedules, Difference between Questionnaire and Schedules, Types of Questions, Case Study Method.

UNIT – IV

Analysis of Data, Hypothesis Testing, Role of SPSS and Excel:

Analysis of Data -Introduction, Processing of data, Diagrammatic presentation in research, Scaling. **Role of Statistics -**Relational Statistics, Inferential Statistics(Inductive Statistics), Measures of Central Tendency, Types of central tendency or Average, Standard Deviation, Skewers, Correlation , Z-Test, t-Test or t-Distribution. **Research Hypothesis –** Introduction of Research hypothesis, The Rationale for Hypothesis

Testing, A General Procedure for Hypothesis Testing, Steps Involved in Hypothesis Testing, Procedure for Testing Hypothesis, Two-Sides and One-Sided Tests. **Role of SPSS –** Introduction, The Variables view, Statistical Types in SPSS, The SPSS Interface, Running procedures from the Menus, SPSS output files. **Role of MS Excel -** Excel and Research, The Excel spreadsheet, The Spreadsheet - The Container, Parts of the Spreadsheet, Create a new File, Save a new file, Open an existing file, Close a file, Navigating the spreadsheet, A simple spreadsheet, Simple formulas, Insert row and columns, Sorting, Chart wizard, Using Excel to determine a confidence interval, Using Excel for t-test of hypothesis, The t-test for Dependent(and Matched-Pair) Samples, Using Excel for ANOVA, Using Excel for Correlation, Using Excel for Linear Regression, Using Excel for Chi-Square Tests.

Text Book:

1. Mukul Gupta , Deepa Gupta, Research Methodology, PHI.

Reference Books:

1. Dr. C. R. Kothari, Research Methodology, New Age International (P Ltd) Publishers.
2. Dr. J. Y. Khan, Research Methodology, A. T. H. Publishing Corporation.
3. Dr. Prasant Sarangi, Research Methodology, Taxmann‘s.
4. Briony J Oates, Researching Information Systems and Computing, SAGE Publications.
5. Uma Sekaran & Roger Bougie, Research Methods for Business, Wiley.
6. Dr. Vijay Upagade & Dr. Arvind Shende, Research Methodology, S. Chand.

MCM Part-II

Semester - IV

Paper - I: ASP.Net

UNIT – I

An introduction to ASP.NET programming: An introduction to web applications, An introduction to ASP.NET development. **How to develop a one-page web application:** How to work with ASP.NET web sites, How to use Visual Studio to build a web form, How to add validation controls to a form, How to add C# code to a form, How to test a web application. **How to use HTML5 and CSS3 with ASP.NET applications:** The Future Value application with CSS formatting, The HTML and CSS skills that you need. **How to develop a multi-page web application:** How to work with multi-page web sites, How to use session state. **How to test and debug ASP.NET applications:** How to test an ASP.NET web site, How to use the debugger, How to use the trace feature.

UNIT –II

How to use the standard server controls: How to use the common server controls, How to use the button controls, How to use the list controls. **How to use the validation controls:** Introduction to the validation controls, How to use the validators, Validation techniques. **How to work with state, cookies, and URL encoding:** How to use view state, How to use session state, How to use application state and caching, How to use cookies and URL encoding. **How to use master pages:** How to create master pages , How to create and develop content pages, How to customize content pages. **How to use themes:** An introduction to themes, How to work with themes and skins. **How to use site navigation and ASP.NET routing:** How to use the navigation controls, How to use ASP.NET routing, How to use the navigation controls with ASP.NET routing.

UNIT – III

An introduction to database programming: An introduction to relational databases, An introduction to ADO.NET 4.5, How to use the DataList control, How to use data binding, How to customize the GridView control, How to use the DetailsView control , How to use the FormView control. **How to use object data sources with ADO.NET:** An introduction to object data sources, How to create a data access class, A Category Maintenance application . **How to secure a web site:** An introduction to SSL, How to use a secure connection**. How to authenticate and authorize users:** An introduction to authentication, How to set up authentication and authorization, How to use the login controls. **How to use email, custom error pages, and back-button control:** How to send email, How to use custom error handling, How to handle the back-button problem.

UNIT – IV

How to configure and deploy ASP.NET applications: How to use the Web Site Administration Tool, An introduction to deployment, How to use one-click deployment, How to create and use a Setup program. **How to use ASP.NET Ajax:** An introduction to Ajax, An introduction to ASP.NET Ajax, How to use the ASP.NET Ajax server controls,

An application that uses ASP.NET Ajax. **How to create and use WCF and Web API services:** An introduction to web services, How to create a WCF service, How to create a web site that consumes a WCF service, How to create a Web API service, How to create a web site that consumes a Web API service. **An introduction to ASP.NET MVC:** An introduction to MVC, An introduction to ASP.NET MVC, How to work with views, How to work with controls and postbacks.

Text Book:

1. Mary Delamater & Anne Boehm, murach's ASP.Net Web Programming with C#, Shroff Publishers.

Reference Books:

1. ASP.Net Black Book, Kogent Learning Solutions Inc, Dreamtech Press.
2. Jason Gaylord, Christian Wenz, Pranav Rastogi, Todd Miranda, Scott Hanselman, Professional ASP.Net in C# & VB, Wrox A Wiley Brand.
3. ASP.Net with C#, Kogent Learning Solutions Inc, Dreamtech Press.

Practical List of ASP.NET

1. Create a page in ASP.NET using VB.NET or C# to display the following Web Controls:
   1. A button with text "click me". The button control must be in the center of the form.
   2. A label with a text hello
   3. A checkbox. The form name must be Web Controls.
2. Create a page in ASP.NET using VB.NET or C# that displays a button in green color and it should change into yellow when the mouse moves over it.
3. Create a page in ASP.NET using VB.NET or C# containing the following controls:
   1. A ListBox
   2. A Button
   3. An Image
   4. A Label

   The listbox is used to list items available in a store. When the user clicks on an item in the listbox, its image is displayed in the image control. When the user clicks the button, the cost of the selected item is displayed in the control.
4. Create a page in ASP.NET using VB.NET or C# that take a student name from the user, add that name in list-box control. And delete the chosen name from the list-box.
5. Create a page in ASP.NET using VB.NET or C# for book sales. Enter the quantity, title and price of the book. Calculate the extended price, discount (15%) and after discount, the actual price of the book. Show the summery of book sales. (Like total no of books, total discount given, total discounted amount and average discount.) You will need command buttons- calculate, clear sale.
6. Create a page in ASP.NET using VB.NET or C# using HTML Server controls that take user name, address, and city, state and country name from the user and display it.
7. Create a page in ASP.NET using VB.NET or C# using HTML Server controls that convert given currency into another selected currency. For that you need a drop-down-list.
8. Create a page in ASP.NET using VB.NET or C# to get a user input such as the boiling point of water and test it to the appropriate value using Compare Validator.

9. Create a page in ASP.NET using VB.NET or C# that uses a textbox for a user input name and validate it for RequiredField Validation.
10. Create a page in ASP.NET using VB.NET or C# that gets user input such as the user name, mode of payment, appropriate credit card. After the user enters the appropriate values the Validation button must validates the values entered.
11. Create a page in ASP.NET using VB.NET or C# to declare one TextBox control, one Button control, one Label control, and one RegularExpressionValidator control in an .aspx file. The submit() function checks if the page is valid. If it is valid, it returns "The page is valid!" in the Label control. If it is not valid, it returns "The page is not valid!" in the Label control. If validation fails, the text "The zip code must be 5 numeric digits!" will be displayed in the RegularExpressionValidator control.
12. Create a page in ASP.NET using VB.NET or C# to the database with ADO.NET for Inserting Data.
13. Create a page in ASP.NET using VB.NET or C# to the database with ADO.NET for Updating Data.
14. Create a page in ASP.NET using VB.NET or C# to the database with ADO.NET for Deleting Data.
15. Create a page in ASP.NET using VB.NET or C# to the database with ADO.NET for Search Data.
16. Create a page in ASP.NET using VB.NET or C# that contains a list of following technologies:
    - ASP.NET, ADO.NET, C#.
    - It also contains a textbox in which the user has to enter a name and a textarea in which the user has to enter his comments. When the Submit is clicked, the output should display the name entered in the textbox and the user-selection from the listbox. All the above should be displayed with the tracing for the page being enabled.
17. Create a page in ASP.NET using VB.NET or C# that generates the “IndexOutOfRange” exception when a button is clicked. Instead of displaying the above exception, it redirects the user to a custom error page. All the above should be done with the trace for the page being enabled.
18. Create a page in ASP.NET using VB.NET or C# to create a simple Web Service that converts the temperature from Fahrenheit to Celsius, and vice versa create a simple Web Service that converts the temperature from Fahrenheit to Celsius, and vice versa. Also write an ASP program to consume this web service.
19. Create a page in ASP.NET using VB.NET or C# to create a proxy.
20. Create a page in ASP.NET using VB.NET or C# that has a form taking the user‟s name as input. Store this name in a permanent cookie & whenever the page is opened again, then value of the name field should be attached with the cookie‟s content.
21. Create a page in ASP.NET using VB.NET or C# to create a Session dictionary using object tag. In session-on start add keys for Time, UserAgent, RemoteIP& add appropriate values. Create a simple page to display the values.
22. Create a page in ASP.NET using VB.NET or C# to implement Session tracking using user authentication.
23. Create a page in ASP.NET using VB.NET or C# to delete all cookies of your web site that has created on the client’s computer.
24. Create a page in ASP.NET using VB.NET or C# to run video.
25. Create a page in ASP.NET using VB.NET or C# for 23. Dynamic images uploading by the user using FileUpload control and setting the profile image by the user in a website.

Paper - II: Elective

Elective – I: Advance Java

UNIT - I

Introducing Swing – JFC, The MVC Architecture, Applet, Window Panes, Important Classes of the javax.swing Package, Setting the Look and Feel of Components, An Applet with Swing Components. **Working with JDBC** - Introducing JDBC, Exploring JDBC Drivers, Exploring the Features of JDBC, Describing JDBC APIs, Exploring Major Classes and Interfaces, Exploring JDBC Processes with the java.sql Package, Working with Transactions. **Network Programming -** Networking Basics, Network Programming in Java Using the java.net Package, Establishing the two-way Communication between Server and Client, Retrieving a file at server, Learning the DatagramSocket and DatagramPacket Classes, Understanding the Content and Protocol Handlers.

UNIT - II

RMI, Naming Service, Serialization, and Internationalization - RMI Architecture, RMI Registry, Dynamic Code Loading in RMI, RMI API, Creating a Distributed Application, using RMI, Naming Services, Directory and Naming Services, Overview of JNDI, Object Serialization, Internationalization, Java and Internationalization, Internationalizing Web Applications. **Introducing the Java EE Platform** - Enterprise Application Concepts, Introducing the Java EE 6 Platform, HTTP Protocol, Exploring Web Application, Introducing Web and Application Servers. **Working with Servlets** - Exploring the Features of Java Servlet, Exploring New Features in Servlet 3.0, Exploring the Servlet API, Explaining the Servlet Life Cycle, Understanding Servlet Configuration, Creating a Sample Servlet, Creating a Servlet by using Annotation, Working with ServletConfig and ServletContext Objects, Working with the HttpServletRequest and HttpServletResponse Interfaces, Exploring Request Delegation and Request Scope, Describing a Session, Introducing Session Tracking, Exploring the Session Tracking Mechanisms, Using the Java Servlet API for Session Tracking.

UNIT - III

Introducing Event Handling and Filters - Introducing Events, Intoducing Event Handling, Working with the Types of Servlet Events, Introducing Filters, Exploring Filter API, Configuring a Filter, Creating a Web Application Using Filters, Using Initializing Parameter in Filters, Manipulating Responses, Discussing Issues in Using Threads with Filters. **Working with JavaServer Pages (JSP)** - Introducing JSP Technology, Exploring New Features of JSP 2.1, Listing Advantages of JSP over Java Servlet, Exploring the Architecture of a JSP Page, Describing the Life Cycle of a JSP Page, Working with JSP Basic Tags and Implicit Objects, Working with Action Tags in JSP, Exploring the JSP Unified EL, Using Functions with EL.

UNIT - IV

JSP Tag Extensions and Standard Tag Library - Exploring the Elements of Tag Extensions, Exploring the Tag Extension API, Working with Classic Tag Handlers, Working with Simple Tag Handlers, Working with JSP Fragments, Working with Tag Files, Introducing JSTL, Working with the Core Tag Library, Working with the XML Tag

Library, Working with the Internationalization Tag Library, Working with the SQL Tag Library, Working with the Functions Tag Library. **Introducing Hibernate** - Introducing Hibernate, Exploring the Architecture of Hibernate, Downloading Hibernate, Exploring HQL, Understanding Hibernate O/R Mapping, Working with Hibernate, Implementing O/R Mapping with Hibernate.

Text Book:

1. Prof. M. T. Savaliya, Advance java Technology, Dreamtech Press.

Reference Books:

1. Dr. Ashwin Mehta, Sarika Shah, Advance Java for Students, Shroff Publishers.
2. Patrick Naughton & Herbert Schildt, The Complete Reference: Java 2, McGraw-Hill.
3. Joseph Weber, Using Java 2 Platform, Prentice Hall of India.
4. Uttam K. Roy, Advance Java Programming, Oxford University.
5. Kanika Lakhani, Advance Java Programming, Katson Books.

Practical List of Advance Java

1. Write a Java program to develop an applet that draws a circle. The dimension of the applet should be 500 x 300 pixels. The circle should be centered in the applet and have a radius of 100 pixels. Display your name centered in a circle.(using drawOval() method).
2. Write a Java program to draw ten red circles in a vertical column in the center of the applet.
3. Write a Java program to develop calculator using Swing and also add image on Button.
4. Write a Java program to find the IP address or computer name of local machine.
5. Write a Java program with class GreetingClient is a client program that connects to a server by using a socket and sends a greeting, and then waits for a response.
6. Write a Java program that implements a simple client/server application. The client sends data to a server the server receives the data, uses it to produce a result and then sends the result back to the client. The client displays the result on the console. For ex the data send from the client is a numbers and the result produce by the server is the addition of that number.
7. Write a Java program to create an application that displays a frame with a menu bar. When a user selects any menu or menu item, display that selection on a text area in the center of the frame.
8. Write RMI application where client supplies data to withdraw and server response with new account balance. Provide your custom security policy for this application.
9. Write a Java program to develop database application that allows user to Insert, Update, Delete values in a Table and manages appropriate exception handling when wrong values are entered.
10. Write a Java program to present a set of choice for user to select a product and display the price of product.
11. Write a Java program to show validation of user using servlet.
12. Write a Java program to develop a simple servlet question answer application
13. Write a Java program to pass any URL string and display all 4 elements of URL string.

14. Write a Java program to trap all the events of mouse listener interface.
15. Write a Java program to show validation of user using JSP.
16. Write a Java program to display message on browser using JSP.
17. Write a Java program to connect with the google.com and retrieve the html code of default web page.
18. Write a Java program to present a set of choices for a user to select stationary products and display the price of product after selection from the list.
19. Write a Java program to demonstrate typical editable table, describing employee details for a software company.
20. Write a Java program to trap all the events of key listener interface.
21. Write a Java program of calling one servlet by another servlet.
22. Write a Java program to develop a simple servlet calculator application.
23. Write a Java program to set scope of beans.
24. Write a Java program to create a JSP application that accepts registration details from the student and stores the details into the database table.
25. Write a Java program to develop a JSP application that authenticate user login as per the registration details. If login success then forward user to the index page otherwise show login failure message.
26. Write a Java program using split pane to demonstrate a screen divided into two parts contains a name of planets and another display the image of planet. When user selects the planet name from the left screen appropriate image of display in right screen.
27. Write a Java program to develop a web application to add items in the inventory using JSP.
28. Write a Java program to create a web form which processes servlet and demonstrates use of cookies and sessions.
29. Write a Java program to develop a simple JSP program for user login form with static and dynamic database.
30. Write a Java program to develop a JSP program to display the grade of a student by accepting the marks of five subjects.

Paper - II: Elective

Elective – II: Android Programming

UNIT - I

Getting an Overview of Android Introducing Android - Listing the Version History of Android Platform, Discussing Android APIs, Describing the Android Architecture Application Framework, Exploring the Features of Android, Discussing about Android Applications, The Application Components, The Manifest File, The Command-Line Tools, Developing and Executing the First Android Application, Using Eclipse IDE to Create an Application, Running Your Application, Exploring the Application, Using Command-Line Tools. **Using Activities, Fragments and Intents in Android -** Working with Activities, Creating an Activity, Starting an Activity, Managing the Lifecycle of an Activity, Applying Themes and Styles to an Activity, Displaying a Dialog in the Activity, Hiding the Title of the Activity, Using Intents, Exploring Intent Objects, Exploring Intent Resolution, Exploring Intent Filters, Resolving Intent Filter Collision, Linking the Activities Using Intent, Fragments, Fragment Implementation, Finding Fragments, Adding, Removing, and Replacing Fragments, Finding Activity Using Fragment, Using the Intent Object to Invoke Built-in Application. **Working with the User Interface Using Views and ViewGroups -** Working with View Groups, The LinearLayout Layout, The RelativeLayout Layout, The ScrollView Layout, The TableLayout Layout, The FrameLayout Layout, The TabLayout Using the Action Bar, Working with Views, Using the TextView, Using the EditText View, Using the Button View, Using the RadioButton View, Using the CheckBox View, Using the ImageButton View, Using the ToggleButton View, Using the RatingBar View, Binding Data with the AdapterView Class, Using the ListView Class, Spinner, Using the Gallery View, Designing the AutoTextCompleteView, Implementing Screen Orientation, Anchoring the Views of the Current Activity, Customizing the Size and Position of the Views, Designing the Views Programmatically, Handling UI Events, Handling User Interaction with Activities, Handling User Interaction with the Views, Specialized Fragments, ListFragment, DialogFragment, PreferenceFragment, Creating Menus The Options Menu The Context Menu The SubMenus.

UNIT - II

Handling Pictures and Menus with Views - Working with Image Views, Displaying Images in the Gallery View, Displaying Images in the Grid View, Using the ImageSwitcher View, Designing Context Menu for Image View, Using the AnalogClock and DigitalClock Views, Embedding Web Browser in an Activity, Notifying the User Creating the Toast Notification, Creating the Status Bar Notification, Creating the Dialog Notification. **Storing the Data Persistently -** Introducing the Data Storage Options, Using Preferences, Using the Internal Storage Exploring the Methods Used for Internal Storage, Developing an Application to Save User Data Persistently in File, Using the External Storage Exploring the Methods Used for External Storage, Developing Application to Save File in SD Card, Using the SQLite Database Creating the Database Helper Class, Creating the Layout and Main Activity Class, Creating the Layout and Activity for the Insert Operation, Creating the Layout and Activity to Search a Record, Creating the Activity Class to Fetch All Records, Creating the Layout and Activity for the Update Operation, Creating the Layout and Activity for the Delete Operation, Executing the Database Operations, Working with Content Providers, Exploring the android.provider Package, Creating User-Defined Content Provider, Consuming User-Defined Content Provider. **Emailing and Networking in Android -** Building an Application to Send Email, Networking in Android, Getting an Overview of Networking Fundamentals, Checking Network Availability, Accessing Web Services Using HTTP

Post, Accessing Web Services Using the GET Method, Working with Binary Data and Text Files, Consuming JSON Services, Sockets Programming.

UNIT - III

Working with Location Services and Maps - Working with Google Maps, Exploring Google Maps External Library, Creating an Application Using Google Maps Android API, Disabling the Zoom Control Button, Changing the Map Type, Displaying the Specific Location and Adding Markers, Handling Map Gestures Interaction, Getting the Current Location of a User, Working with Geocoding and Reverse Geocoding. **Working with Graphics and Animation -** Working with Graphics, Drawing Graphics to Canvas, Using the Drawable Object, Referencing an Image File, Defining Drawable in XML, Using the Shape Drawable Object, Working with the Nine Patch Drawable Graphics, Understanding the Concept of Hardware Acceleration, Working with Animations, The Property Animation, View Animation Drawable Animation. Audio, Video and Camera - Role of Media Playback Using Media Player Media Formats Supported by Media Player, Preparing Audio for Playback, Preparing Video for Playback, Creating Application to Play Audio and Video Using MediaPlayer, Recording and Playing Sound, Use of Media Store Audio Recording Application, Creating a Sound Pool Using Camera for Taking Pictures, Creating Video Recording Application.

UNIT - IV

Threads and Services - Introducing Threads Worker Threads Using AsyncTask, Introducing Services Exploring Services Essentials, Understanding the Lifecycle of a Service, Exploring the Service Class, Introducing the Service Class, Creating a Bound Service. **Bluetooth, NFC and Wi-Fi -** Working with Bluetooth Exploring the Android Bluetooth APIs, Permissions Required to Access Bluetooth, Setting Up the Bluetooth for an Application, Identifying the Bluetooth-Enabled Devices, Querying the Paired Devices, Discovering Devices Creating an Application Using Bluetooth Functionality, Connecting the Devices Using Bluetooth for Data Transfer, Connecting as a Server Connecting as a Client Working with Bluetooth Low Energy, Working with NFC, Exploring the Basics of NFC, Developing an Application Using NFC, Working with Wi-Fi, Exploring the Wi-Fi APIs, Creating an Application Using Wi-Fi. **Telephony and SMS -** Handling Telephony Displaying Phone Information Application Receiving Phone Calls Application, Making Outgoing Phone Calls Application, Handling SMS Sending SMS Using SmsManager, Sending SMS Using Intent, Receiving SMS Using the BroadcastReceiver Object, Role of Default SMS Providers. Hardware Sensors - Introducing Sensors Exploring the Sensor Framework, Managing Various Sensor Configurations, Understanding the Sensor Coordinate System.

Text Book:

1. Rradeep Kothari, Android Application Development – Black Book, Dreamtech Press.

Reference Books:

1. Prasanna Kumar Dixit, Android, Vikas Publishing.
2. Dawn Griffiths & David Griffiths, Head First Android Development, Shroff Publishers.
3. Ed Burnette, Hello Android, Shroff Publishers.
4. Jerome DiMarzio, Android – A Programmer's Guide, McGraw-Hill.
5. Dave MacLean, Satya Komatineni, Grant Allen, Pro Android 5, Apress.
6. Reto Meier, Professional Android Application Development, Wiley.

Practical List of Android Programming

1. Create “Hello World” android application. That will display “Hello World” in the middle of the screen in the red color with white background.
2. Write an android application to understand Activity, Intenta. Create sample application with login module. (Check username and password) and on successful login, go to next screen. And on failing login, alert user using Toast. Also pass username to next screen.
3. Create an android application that will change color of the screen and change the font size of text view using xml.
4. Create login android application where you will have to validate EmailID (UserName). Till the username and password is not validated, login button should remain disabled.
5. Create and login android application as above. On successful login, open browser with any URL.
6. Create an android application that will pass some number to the next screen, and on the next screen that number of items should be display in the list.
7. Create an android application that will change color of the screen, based on selected options from the menu.
8. Create an android application that will display toast (Message) on specific interval of time.
9. Create a android background application that will open activity on specific time.
10. Create an android application that will have spinner with list of animation names. On selecting animation name, that animation should affect on the images displayed below.
11. Create an android UI such that, one screen have list of all the types of cars. and on selecting of any car name, next screen should show Car details like : name , launched date ,company name, images(using gallery) if available, show different colors in which it is available.
12. Write an android application to read phonebook contacts using content providers and display in list.
13. Write an android application to read messages from the mobile and display it on the screen.
14. Create an android application to call specific entered number by user in the EditText
15. Create an android application that will create database with table of User credential.
16. Create an android application to read file from asset folder and copy it in memory card.
17. Create an android application that will play a media file from the memory card.
18. Create an android application to make Insert, update, Delete and retrieve operation on the database.
19. Create an android application to read file from the sdcard and display that file content to the screen.
20. Create an android application to draw line on the screen as user drag his finger.
21. Create an android application to send message between two emulators.
22. Create an android application to take picture using native application.
23. Create an android application to pick up any image from the native application gallery and display it on the screen.
24. Create an android application to open any URL inside the application and clicking on any link from that URl should not open Native browser but that URL should open the same screen.
25. Create an android application that will create database with table of User credential.

Paper - II: Elective

Elective – III: Python

UNIT - I

The Way of the Program - The Python Programming Language, What Is a Program?, What Is Debugging?, Syntax Errors, Runtime Errors, Semantic Errors, Experimental Debugging, Formal and Natural Languages, The First Program. **Variables, Expressions, and Statements -** Values and Types, Variables, Variable Names and Keywords, Operators and Operands, Expressions and Statements, Interactive Mode and Script Mode, Order of Operations, String Operations, Comments. **Functions -** Function Calls, Type Conversion Functions, Math Functions, Composition, Adding New Functions, Definitions and Uses, Flow of Execution, Parameters and Arguments, Variables and Parameters Are Local, Stack Diagrams, Fruitful Functions and Void Functions, Why Functions?, Importing with from.

UNIT - II

Conditionals and Recursion - Modulus Operator, Boolean Expressions, Logical Operators, Conditional Execution, Alternative Execution, Chained Conditionals, Nested Conditionals, Recursion, Stack Diagrams for Recursive Functions, Infinite Recursion, Keyboard Input. **Fruitful Functions -** Return Values, Incremental Development, Composition, Boolean Functions, More Recursion, Leap of Faith, One More Example, Checking Types. **Iteration -** Multiple Assignment, Updating Variables, The while Statement, break, Square Roots, Algorithms, Debugging. **Strings -** A String Is a Sequence, len, Traversal with a for Loop, String Slices, Strings Are Immutable, Searching, Looping and Counting, String Methods, The in Operator, String Comparison.

UNIT - III

Lists - A List Is a Sequence, Lists Are Mutable, Traversing a List, List Operations, List Slices, List Methods, Map, Filter, and Reduce, Deleting Elements, Lists and Strings, Objects and Values, Aliasing, List Arguments. **Dictionaries -** Dictionary as a Set of Counters, Looping and Dictionaries, Reverse Lookup, Dictionaries and Lists, Memos, Global Variables, Long Integers. **Tuples -** Tuples Are Immutable, Tuple Assignment, Tuples as Return Values, Variable-Length Argument Tuples, Lists and Tuples, Dictionaries and Tuples, Comparing Tuples, Sequences of Sequences.

UNIT - IV

Files – Persistence, Reading and Writing, Format Operator, Filenames and Paths, Catching Exceptions, Databases, Pickling, Pipes, Writing Modules. **Classes and Objects -** User-Defined Types, Attributes, Rectangles, Instances as Return Values, Objects Are Mutable, Copying. **Classes and Functions –** Time, Pure Functions, Modifiers, Prototyping Versus Planning. **Classes and Methods -** Object-Oriented Features, Printing Objects, Another Example, A More Complicated Example, The init Method, The __str__ Method, Operator Overloading, Type-Based Dispatch, Polymorphism, Debugging, Interface and Implementation. **Inheritance -** Card Objects, Class Attributes, Comparing Cards, Decks, Printing the Deck, Add, Remove, Shuffle, and Sort, Inheritance, Class Diagrams, Debugging, Data Encapsulation.

Text Book:

1. Allen B. Downey, Think Python, Shroff Publishers, O'Reilly.

Reference Books:

1. Charles Dierbach, Introduction to Computer Science using Python, Wiley.
2. Laura Cassell & Alan Gauld, Python Projects, Wrox A Wiley Brand.
3. Paul Greis, Jennifer Campbell, Jason Montojo, Practical Programming – An Introduction to Computer Science using Python, Shroff Publishers.

Practical List of Python

1. Write a Python program to convert the given temperature from Fahrenheit to Celsius and vice versa depending upon users choice.
2. Write a Python program that allows the user to enter any integer base and integer exponent, and displays the value of the base raised to that exponent.
3. Write a Python program that prompts the user for a certain number of cities for the Travelling salesman Problem, and displays the total number of possible routes that can be taken.
4. Write a Python program that prompts the user to enter an upper or lower case letter and displays the corresponding Unicode encoding.
5. Write a Python program to calculate total marks, percentage and grade of a student. Marks obtained in each of the three subjects are to be input by the user. Assign grades according to the following criteria:
   Grade A: Percentage >=80
   Grade B: Percentage>=70 and <80
   Grade C: Percentage>=60 and <70
   Grade D: Percentage>=40 and <60
   Grade E: Percentage<40
6. Write a Python program to find the area of rectangle, square, circle and triangle by accepting suitable input parameters from user using user-defined function.
7. Write a Python program find factorial of the given number.
8. Write a Python program to find sum of the following series for n terms: 1 – 2/2! + 3/3! - - - - - n/n!
9. Write a Python program to calculate the sum and product of two compatible matrices.
10. Write a Python program to calculate the transpose of a matrix.
11. Write a Python program to determine how many times a given letter occurs in a provided string using recursion.
12. Write a Python program to calculate Fibonacci series using recursion.

Visual Python

13. Write a Python program to create mathematical 3D objects –
    I. curve
    II. sphere
    III. cone
    IV. arrow
    V. ring
    VI. cylinder.
14. Write a Python program to read n integers and display them as a histogram.
15. Write a Python program to display sine, cosine, polynomial and exponential curves.
16. Write a Python program to plot a graph of people with pulse rate p vs. height h. The values of p and h are to be entered by the user.

17. Write a Python program to calculate the mass m in a chemical reaction. The mass m (in gms) disintegrates according to the formula m=60/(t+2), where t is the time in hours. Sketch a graph for t vs. m, where t>=0.
18. A population of 1000 bacteria is introduced into a nutrient medium. The population p grows as follows:
    P(t) = (15000(1+t))/(15+ e)
    where the time t is measured in hours. Write a Python program to determine the size of the population at given time t and plot a graph for P vs t for the specified time interval.
19. Input initial velocity and acceleration, and plot the following graphs depicting equations of motion:
    I. velocity wrt time (v=u+at)
    II. distance wrt time (s=u*t+0.5*a*t*t)
    III. distance wrt velocity (s=(v*v-u*u)/2*a)
20. Write a Python program show a ball bouncing between 2 walls.

Paper - III: Elective Foundation

Elective Foundation – I: Big Data & Hadoop

UNIT - I

Types of Digital Data - Classification of Digital Data. **Introduction to Big Data -** Characteristics of Data, Evolution of Big Data, Definition of Big Data, Challenges with Big Data, What is Big Data?, Other Characteristics of Data Which are not Definitional Traits of Big Data, Why Big Data?, Are We Just an Information Consumer or Do we also Produce Information?, Traditional Business Intelligence (BI) versus Big Data, A Typical Data Warehouse Environment, A Typical Hadoop Environment, What is New Today?, What is changing in the Realms of Big Data?. **Big Data Analytics -** Where do we Begin?, What is Big Data Analytics?, What Big Data Analytics Isn't?, Why this Sudden Hype Around Big Data Analytics?, Classification of Analytics, Greatest Challenges that Prevent Businesses from Capitalizing on Big Data, Top Challenges Facing Big Data, Why is Big Data Analytics Important?, What Kind of Technologies are we looking Toward to Help Meet the Challenges Posed by Big Data?, Data Science, Data Scientist…Your New Best Friend!!!, Terminologies Used in Big Data Environments, Basically Available Soft State Eventual Consistency (BASE), Few Top Analytics Tools.

UNIT - II

The Big Data Technology Landscape - NoSQL (Not Only SQL), Hadoop. **Introduction to Hadoop -** Introducing Hadoop, Why Hadoop?, Why not RDBMS?, RDBMS versus Hadoop, Distributed Computing Challenges, History of Hadoop, Hadoop Overview, Use Case of Hadoop, Hadoop Distributors, HDFS (Hadoop Distributed File System), Processing Data with Hadoop, Managing Resources and Applications with Hadoop YARN (Yet another Resource Negotiator), Interacting with Hadoop Ecosystem. **Introduction to MongoDB -** What is MongoDB?, Why MongoDB?, Terms Used in RDBMS and MongoDB, Data Types in MongoDB, MongoDB Query Language.

UNIT - III

Introduction to Cassandra - Apache Cassandra - An Introduction, Features of Cassandra, CQL Data Types, CQLSH, Keyspaces, CRUD (Create, Read, Update and Delete) Operations, Collections, Using a Counter, Time to Live (TTL), Alter Commands, Import and Export, Querying System Tables, Practice Examples. Introduction to MAPREDUCE Programming – Introduction, Mapper, Reducer, Combiner, Partitioner, Searching, Sorting, Compression. Introduction to Hive - What is Hive?, Hive Architecture, Hive Data Types, Hive File Format, Hive Query Language (HQL), RCFile Implementation, SerDe, User-Defined Function (UDF).

UNIT - IV

Introduction to Pig - What is Pig?, The Anatomy of Pig, Pig on Hadoop, Pig Philosophy, Use Case for Pig: ETL Processing, Pig Latin Overview, Data Types in Pig, Running Pig 10.9 Execution Modes of Pig, HDFS Commands, Relational Operators, Eval Function, Complex Data Types, Piggy Bank, User-Defined Functions (UDF), Parameter Substitution, Diagnostic Operator, Word Count Example using Pig, When to use Pig?,

When not to use Pig?, Pig at Yahoo!, Pig versus Hive. Jasper Report using Jasper soft - Introduction to Jasper Reports, Connecting to MongoDB NoSQL Database, Connecting to Cassandra NoSQL Database. Introduction to Machine Learning - Introduction to Machine Learning, Machine Learning Algorithms.

Text Book:

1. Seema Acharya & Subhashini Chellappan, Big data and Analytics, Wiley.

Reference Books:

1. Radha Shankarmani & M. Vijayalakshmi, Big data Analytics, Wiley.
2. Chuck Lam, Hadoop in Action, Dreamtech Press.
3. Philip Kromer & Russell Jurney, Big Data for Chimps, Shroff Publishers, O'Reilly.
4. Chandrakant Naikodi, Managing Big Data, Vikas publishing.
5. Chriss Eaton, Dirik Deroos, Tom Deutsch, George Lapis, Paul Zikopoulos, Understanding Big Data, McGraw-Hill.

Paper - III: Elective Foundation

Elective Foundation – II: Software Engineering

UNIT - I

Introduction- The software engineering discipline evolution and impact, Programs Vs. software product, Why study software engineering?, Emergence of software engineering, Notable changes in software development practices, Computer systems engineering. **Software Life Cycle-** Why use a life cycle model?, Classical waterfall model, Interactive waterfall model, Prototyping model, Evolutionary model, Spiral model, Comparison of different life cycle models. **Software Product Management**- Responsibilities of a software project manager, Project planning, Matrices for project size estimation, Project estimation techniques, Empirical project techniques, COCOMO- A heuristic estimation technique, Halstead's software science- An analytical technique, Staffing level estimation, Scheduling, Organization and team structures, Staffing, Risk management, Software configuration management, Miscellaneous plans.

UNIT - II

Requirement Analysis and Specifications - Requirement gathering and specifications, Software requirement specification, Formal system development techniques, Axiomatic specification, Algebraic specification, Executable specification and 4GLs. **Software Design**- What is a software design?, Cohesion and coupling, Neat arrangement, Software design approaches, Object oriented Vs. function oriented design. **Function Oriented Software Design**- Overview of SA/SD methodology, Structured analysis, Data flow diagrams (DFDs), Extending DFD techniques to real-time systems, Structured design, Detailed design, Design review.

UNIT - III

Object Modeling Using UML - Overview of object oriented concept, Unified modeling language (UML), UML diagrams, Use case models, Class diagrams, Interaction diagrams, Activity diagrams, State chart diagrams. **Object Oriented Software Development-** Design pattern, A generalized object oriented analysis and design process, Odd goodness criteria.

UNIT - IV

Computer Aided Software Engineering- Case and its scope, Case environment, Case support in software life cycle, Other characteristics of case tools, Towards second generation case tools, Architecture of a case environment. **Software Maintenance-** Characteristics of software maintenance, Software reverse engineering, Software maintenance process model, Estimation of maintenance cost. **Software Reuse**- What can be reused?, Why almost no reuse so far?, Basic issue in any reuse program, A reuse approach, Reuse at organization level.

Text Book:

1. Rajib Mall, Fundamentals of Software Engineering, PHI.

Reference Books:

1. Rajesh Narang, Software Engineering Principles & Practices, McGraw-Hill.
2. Roger Pressman, Software Engineering – A Practitioner Approach, McGraw-Hill.
3. Dr. Sajan Mathew, Software Engineering, S. Chand.
4. S. Thangasamy, Essentials of Software Engineering, Wiley-India.
5. Pankaj Jalote, Software Engineering – A Precise approach, Wiley.

Paper - III: Elective Foundation

Elective Foundation – III: Strategic Management

UNIT - I

Strategic Management - Introduction to strategic management, Strategic decision making, Strategic management process; Difference between Policy, Strategy and Tactics. Vision, Mission & goals, Preparation of Vision & Mission Statement; Organizational objectives, Hierarchy of objectives & strategies, setting of Objectives.

UNIT - II

Internal & Resource Analysis - SWOT analysis, Resource analysis- a) Organization capabilities & competitive advantage b) Value chain analysis; Concept of synergy – Core competency, Competitive analysis - Interpreting the five forces model, Competitors analysis. **External analysis -** Environment analysis a) Components of External environment b) Components of Internal environment c) Environmental scanning. Industry Analysis a) A Framework for industry analysis b) Michael Porter's Analysis c) Usefulness of industry analysis.

UNIT - III

Strategy Formulation - Corporate Level Strategy: A) Growth-Concentration, Horizontal, Vertical, B) Diversification- Concentric, conglomerate. C) Expansion through Cooperation; Merger, Acquisitions, Joint ventures & strategic alliances D) Stability - Pause/proceed with caution, No change, Profit strategies. E) Retrenchment – Turnaround, Captive Company Strategy, Selling out Bankruptcy, Liquidation. **Portfolio Approach & Analysis -** a) Portfolio analysis, advantages & disadvantages, b) BCG Matrix c) General Electric's Business Screen, d) Life cycle or Arthur D Little matrix, e) Balance scorecard. 7s Framework, Strategic Business Unit (SBUS), Merits & Demerits of SBU; Leadership, Power & organization culture.

UNIT - IV

Business Level Strategy & Functional Level Strategy - A) Business Level strategy- Competitive advantage, Low cost strategy, Differential strategy and Focus strategy, B) Functional level strategy - Operations strategy, Marketing strategy, Financial strategy, Human Resource strategy. Global strategy **-** Reasons for globalization, Global expansion strategy, International Portfolio Analysis; Market entry strategy, International strategy & competitive advantage.

Strategic Implementation Strategic Evaluation, Control & Continuous:

Improvement - Establishing strategic evaluation & control; The quality imperative: continuous Improvement to build customer value, Fundamentals of Six sigma approach for continuous improvement.

Text Book:

1. V. S. Ramaswami, S. Namaumari, Strategic Planning & Formulation of Corporate Strategy, Macmillan - Publication.

Reference Books:

1. Richard B Robinson, Strategic Management, McGraw-Hill.
2. Henry, Understanding Strategic Management, Oxford University Press.
3. R.M. Srivastava, Management Policy & Strategic Management, Himalaya Pub.
4. Chandrasekara, Anant Narayanan, Strategic Management, Oxford University Press.

APPENDIX – C

PGDCCA Part-I

Semester-I

Paper - I: Fundamental of Information Technology

Unit – I

Computers: Introduction to computers, Characteristics of computer, Evolution of computer, Generations of computer, Basic organization of computer system (Block Diagram), Functioning of computer, Concept of system. **Number system:** non-positional number systems, Positional number systems, Conversion from one number system to another, Fraction numbers. **Computer codes:** BCD, EBCDIC, ASCII, Unicode, Collating sequence. **Computer arithmetic:** Need of binary, Binary arithmetic.

Unit – II

Processor & memory: Central processing unit (CPU), Components of CPU (CU, ALU, Instruction set, Registers, Processor speed, Type of processor), Main memory, Types of memory. **Secondary storage devices:** Sequential & direct access devices, Magnetic tapes, Magnetic disks, Optical disks, Memory storage devices, Mass storage devices, Data backup, On-line, Near line and Off-line storage, Hierarchical storage devices(HSS), Input-output devices.

Unit – III

Computer software: Define software, Types of software, Logical system architecture, Firmware, Middleware, Acquiring software, Software development life cycle (SDLC), Software engineering, CASE tools. **System implementation & operation:** Software testing & debugging (Types of program errors, Testing a program, Debugging a program for syntax errors & logical errors, Difference between testing & debugging), Software documentation, Software deployment, System evaluation, Software maintenance. **Business data processing:** Meaning of data processing, Data storage hierarchy, Standard methods of organizing data, File management system, Database management system.

Unit – IV

Data communication and computer networks: Basic elements of a communication system, Data transmission modes, Data transmission speed, Data transmission media, Digital & analog data transmission, Data transmission services, Multiplexing techniques, Switching techniques, Routing techniques, Network topologies, Types of network, Communication protocols, Network interface card (NIC), OSI model, Ernet working tools,

Wireless Networks. **Multimedia:** What is multimedia, Multimedia components, Multimedia applications, and media center computer. **Classification of computers:** Notebook computers (Laptops), Personal computer (PCs), Workstations, Mainframe systems, Super computers, Client & server computers, Handheld computers (Tablet PC, PDA/Pocket PC, Smartphone).

Text Book:

1. P. K. Sinha & Priti Sinha, Computer Fundamentals, BPB Publication.

Reference Books:

1. Madhulika Jain, Shashank Jain, Satish Jain, Information Technology Concepts, BPB Publication.
2. B. Ram, Computer Fundamentals (Architecture & organization), New Age International Publisher.
3. Turban, Rainer, Potter, Introduction to Information Technology, Wiley India Edition.
4. Peter Norton, Introduction to Computers, McGraw-Hill Education.
5. S. Jaiswal, I.T. Today, Encyclopedia.

Practical List of Fundamental of Information Technology

A1. Use a contemporary letter template of MS-WORD and provide information about launching of new products of a company.
Also write down the steps to perform above in MS-WORD.

A2. Use a professional letter template of MS-WORD and write an application to the principal for two days leave.
Also write down the steps to perform above in MS-WORD.

A3. Using Mail Merge of MS-WORD, write a letter to the students of PGDCCA-I to submit their Original Documents (Mark Sheet, Migration Certificate, TC etc) along with their balance fees up to 10th March 2008 in the office of the college during office timings morning 8:00 AM to 5:00 PM.
Also write down the steps to perform above in MS-WORD.

A4. Using Mail Merge of MS-WORD, write a letter to your friends, invite them on your Birth Day Party on 10th March 2008 at the Venue- B04, Amar Apartment, Narendranagar, Nagpur-440021
Also write down the steps to perform above in MS-WORD.

A5. Using Mail Merge of MS-WORD, write a letter to all the selected candidate for their final interview on 10th March 2008 at the Centre Point College, 7 Nawab Layout, Tilaknagar, Nagpur-10 at 11:00 AM along with all original documents and 2 passport size photographs.
Also write down the steps to perform above in MS-WORD.

A6. Draw and Analyze the DFD of Book Issuing System of College Library in MS-PowerPoint.
Also write down the steps to perform above in MS-POWERPOINT.

A7. Draw and Analyze the DFD of Hotel Management System in MS-PowerPoint.
Also write down the steps to perform above in MS-POWERPOINT.

A8. Draw and Analyze the DFD of Examination Management System in MS-PowerPoint.
Also write down the steps to perform above in MS-POWERPOINT**.**

A9. Create a Mark-Sheet of PGDCCA-Part I using MS-Excel. Mark-Sheet format should be as per below. Fill the information about 10 students.

Roll No.	Name of Student	IT (100)	ICP (100)	IOS (100)	C (100)	MIS& SA (100)	Practical-I (100)	Practical-II (100)	Total Marks (Out of 700)	%age
1										

Draw a pie chart for above Mark-sheet
Also write down the steps to perform above operation in MS-EXCEL.

A10. Create a Employee Payment Sheet using MS-Excel. Employee Payment Slip format should be as per below. Fill the information about 10 employees.

Sr.No.	Name of Employee	Basic Salary	HRA 5%	TA 7%	DA 9%	Gross_Salary
1						
Total salary						

Draw a bar chart for above Employee Payment Sheet
Also write down the steps to perform above operation in MS-EXCEL.

A11. Create the following Product sheet in MS-EXCEL and perform the operation given below:

Sr.No.	Product Name	Company Name	Country	Quantity	Rate
1	Butter	Amul India ltd	India	20	Rs.19.00
2	Milkmaid	Amul India ltd	India	10	Rs.35.00
3	Tea	Hindustan Lever ltd	Malaysia	15	Rs.40.00
4	Biscuits	Parle ltd	India	32	Rs.12.00
5	Papad	Haldiram ltd	India	12	Rs.10.00
6	Chocolate	Cadbury ltd	Australia	150	Rs.15.00
7	Paneer	Amul India ltd	India	23	Rs.25.00
8	Bournvita	Cadbury ltd	Australia	20	Rs.45.00
9	Poppins	Parle ltd	India	27	Rs.6.00
10	Sauce	Amul India ltd	India	16	Rs.21.00

a) Sort by Product Name, by company name, by country in ascending order.
b) Sort by Country in descending order.
Also write down the steps to perform above operation in MS-EXCEL.

A12. Create the following Product sheet in MS-EXCEL and perform the operation given below:

Sr.No.	Product Name	Company Name	Country	Quantity	Rate
1	Butter	Amul India ltd	India	20	Rs.19.00
2	Milkmaid	Amul India ltd	India	10	Rs.35.00
3	Tea	Hindustan	Malaysia	15	Rs.40.00

		Lever ltd			
4	Biscuits	Parle ltd	India	32	Rs.12.00
5	Papad	Haldiram ltd	India	12	Rs.10.00
6	Chocolate	Cadbury ltd	Australia	150	Rs.15.00
7	Paneer	Amul India ltd	India	23	Rs.25.00
8	Bournvita	Cadbury ltd	Australia	20	Rs.45.00
9	Poppins	Parle ltd	India	27	Rs.6.00
10	Sauce	Amul India ltd	India	16	Rs.21.00

a) List only those records whose country =”India”.
b) List only those records whose company name=”Amul”.
Also write down the steps to perform above operation in MS-EXCEL.

A13. Create the following Product sheet in MS-EXCEL and perform the operation given below:

Sr.No.	Product Name	Company Name	Country	Quantity	Rate
1	Butter	Amul India ltd	India	20	Rs.19.00
2	Milkmaid	Amul India ltd	India	10	Rs.35.00
3	Tea	Hindustan Lever ltd	Malaysia	15	Rs.40.00
4	Biscuits	Parle ltd	India	32	Rs.12.00
5	Papad	Haldiram ltd	India	12	Rs.10.00
6	Chocolate	Cadbury ltd	Australia	150	Rs.15.00
7	Paneer	Amul India ltd	India	23	Rs.25.00
8	Bournvita	Cadbury ltd	Australia	20	Rs.45.00
9	Poppins	Parle ltd	India	27	Rs.6.00
10	Sauce	Amul India ltd	India	16	Rs.21.00

a) List the records whose quantity is >= 10 and <= 100.
b) List the records whose rate is >= Rs. 35.00.
Also write down the steps to perform above operation in MS-EXCEL.

A14. By the help of following information prepare cost sheet for the month of March 1980:

	Rs.
1. Stock (1-3-1980)	
a) Raw Materials	25,000
b) Finished goods	17,360
2. Stock (31-3-1980)	
a) Raw Materials	26,250
b) Finished goods	15,750
3. Raw material purchased	21,900
4. Work-in-progress (1-3-80)	8,220
5. Work-in-progress (31-3-80)	9,100
6. Sale of finished goods	72,310
7. Direct wages	17,150
8. Unproductive Wages	830
9. Factory Expenses	8,340
10. Office and management expenses	3,160
11. Selling and distribution expenses	4,210

Prepare cost sheet and find out following information:
1) Total Cost 2) Cost of goods sold 3) Profit on sold out goods
Also write down the steps to perform above operation in MS-EXCEL.

A15. Following information is received from the books of a factory:

1. Closing stock of raw materials	25,150
2. Closing stock of finished goods	14,650
3. Raw materials purchased	20,800
4. Work in progress (1-1-78)	8,220
5. Work in progress (31-12-78)	8,000
6. Opening stock of raw material	24,000
7. Opening stock of finished goods	16,200
8. Sale of finished goods	62,800
9. Office expenses	2,150
10. Selling and Distribution expenses	4,000
11. Direct wages	16,000
12. Factory expenses	9,000

Prepare cost sheet and find out the following items:
1) Cost of materials consumed 2) Production Cost 3) Cost of goods sold 4) Net profit.
Also write down the steps to perform above operation in MS-EXCEL.

A16. By the help of following information prepare a statement of cost and in that statement indicate prime cost, works cost, office cost (production cost) and cost of goods sold, for the half year ending 30th June, 1978. Production 500 units.

1. Material consumed	30,000
2. Direct Wages	40,000
3. Direct Expenses	4,000
4. Works on Cost Expenses	
a) Unproductive wages	9,000
b) Factory lighting and heating	11,000
c) Factory rent, rates and insurance	3,000
d) Factory Director's fees	
e) Depreciation of machinery	1,500
f) Factory stationery	375
g) Factory cleaning	400
h) Depreciation of loose tools	900
i) Indirect material	500
j) Estimating expenses	500
5. Office expenses (Office overhead)	
a) Director fees	3,000
b) Office printing and stationery	750
c) Legal Expenses	500
d) Depreciation of office building	800
e) Bank fee	75
f) Salary of office employees	5,000
6. Selling and Distribution expenses	
a) Selling commission	1,000
b) Rent of warehouse	1,800
c) Bad debt	150
d) Advertisement	500
e) Depreciation and maintenance of delivery vans	700

Also write down the steps to perform above operation in MS-EXCEL.

A17. Prepare cost sheet by the help of following information and find out (i) Prime cost (ii) Factory cost (iii) Total Cost; (iv) Net Profit.

1.Raw Material purchased	66,000
2.Direct wages	52,500

3.Indirect wages	2,750
4.Stock of Raw Materials (1-9-83)	75,000
5.Stock of Raw material (30-9-83)	91,500
6.Stock of finished goods (1-9-83)	54,000
7.Stock of finished goods (30-9-83)	31,000
8.Stock of work in progress (1st Sep.83)	28,000
9.Stock of work in progress (30th sept.83)	35,000
10.Sales	2,11,000
11.Rent, rates and electric of factory	15,000
12.Depreciation of machinery	3,500
13.Carriage inward	1,500
14.Sundry factory exp.	10,000
15.Travelling wages and commission	6,500
16.Office rent and rates	2,500
17.Sundry Office expenses	6,500
18.Advertisement	3,500
19.Carriage outward exp.(exp. on sale)	2,500

Also write down the steps to perform above operation in MS-EXCEL.

A18. By the help of following information prepare cost sheet for the year 1976.

1.Opening Stock (1-1-1976)	
a) of Raw Materials	22,000
b) of Unfinished goods	5,000
c) of Finished goods	10,000
2.Closing Stock: (31-12-76)	
a) of Raw Materials	2,350
b) of Unfinished goods	3,000
c) of Finished goods	2,000
3.Direct Wages	30,000
4.Direct Expenses	10,000
5.Material Purchased	70,500
6.Carriage Inward	2,000
7.Factory on cost	70,000
8.Factory Supervision	8,800
9.Office Rent	6,000
10.Factory Rent	9,000
11.Rent of sales department	6,000
12.Lighting bill (out of this 30% of factory, 20% of sales dept. and balance for office)	10,000
13.Advertisement	6,000
14.Salary of Manager (30% of Factory, 40% of Sales dept. and balance for office)	37,000
15.Profit 10% on total cost.	

Also write down the steps to perform above operation in MS-EXCEL.

A19. Following information is available from the books of Zenith manufacturing company as on 31st Dec. 1974.

1.Salary of Drawing room staff	6,500
2.Salary of distribution department	12,600
3.Outward carriage expenses	4,300
4.Cash discount	2,900
5.Inward carriage exp. on purchase	7,150
6.Bad debts written off	6,500
7.Machine repairing	4,450
8.Rent, taxes and insurance (Factory)	8,500

9.Rent, taxes and insurance (office)	2,000
10.Sales	4,61,100
11.Stock of Raw material (31-12-73)	62,800
12.Stock of Raw material (31-12-74)	48,000
13.Material Purchased	1,85,000
14.Travelling Expenses	2,100
15.Salary and Commission of travelling agent	7,700
16.Productive wages	1,26,000
17.Depreciation of machinery & equipment	6,500
18.Depreciation of office furniture	300
19.Director fee	6,000
20.Gas and Water (Factory)	1,200
21.Gas and Water (Office)	400
22.Salary of manager (3/4 for factory & 1/4 for office)	10,000
23.General Expenses	3,400
24.Income tax	1,500
25.Dividend	1,000

Prepare cost sheet and indicate the following items:-
1) Materials Consumed (2) Prime cost (3) Factory on cost and factory cost(4) General and selling overhead (5) Total cost (6) Net profit (7) Percentage of factory on cost to wages (8) percentage of general overhead to factory cost.
Also write down the steps to perform above operation in MS-EXCEL.

A20. From the given information prepare Flexible budget for the capacity 70%, 80% & 100 % & show the results.
The sales for the above capacity would be 50,00,000/-, 60,00,000/-, 85,00,000 respectively. Fixed expenses will be constant at all capacities. Semi variable will be constant between 55% to 75% capacity.
It will be increased by 10% between the capacity 75% to 90% & will be increased by 20% between the capacity 90% & 100%. Following exp are on the capcity of 60%.

Particulars	Rs.
Semi variable exp:	
Maintenance & repairs	1,25,000
Labour	5,00,000
Sales dept. Expenses	1,50,000
Other overheads	1,25,000
	9,00,000
Variable Cost :	
Material	12,00,000
Labour	13,00,000
Other Expenses	2,00,000
	27,00,000
Fixed Cost :	
Wages & salaries	4,20,000
Rent & Taxes	2,80,000
Depreciation	3,50,000
Other overheads	4,50,000
	15,00,000
Total Cost	51,00,000

Also write down the steps to perform above operation in MS-EXCEL.

A21. The following data is taken from the manufacturing record of a company for 1/2 year period.

Fixed expenses:	
Wages & salaries	84,000
Rent, rates & taxes	56,000
Depreciation	70,000
Sundry administration Exp.	89,000
	2,99,000
Semi-variable exp : (at 50% capacity)	
Maintenance & Repairs	25,000
Indirect Labour	99,000
Sales Department salaries	29,000
Sundry administration exp.	26,000
	1,79,000
Variable Exp. (at 50% capacities)	
Materials	2,40,000
Labour	2,56,000
Other expenses	38,000
	5,34,000

Assume that the fixed expenses remain constant for all levels of production. Semi- Variable expenses remain constant between 45% & 65% of capacity. Increasing by 10% between 65% & 80% capacity & by 20% between 80% & 100% of capacity. Sales at various levels are :-

Capacity	Rs.
60%	10,00,000
75%	12,00,000
90%	15,00,000
100%	17,00,000.

Prepare Flexible budget for the above capacity.
Also write down the steps to perform above operation in MS-EXCEL.

A22. The following budget is prepared for 10,000 units. Per unit cost will be as under :-

Particualrs	P.U. (Rs.)
Material	60
Wages	55
Fixed cost (2,00,000)	20
Variable expenses	5
Selling expenses (10% fixed)	15
Administration exp. (90,000)	9
Distribution exp. (20% fixed)	15

Prepare budget for 7,500 & 6,500 units.
Also write down the steps to perform above operation in MS-EXCEL.

A23. The following figures are available from sales & cost forecast of M/s ALANKAR & Co. for the year ended 31st.Dec. 1990 at 50% (5,000 units) capacity. Prepare a profit forecast statement through flexible budget at 60%, 75%, 90% & 100% capacity assuming that

1) The fixed expenses remain constant for all levels of production & sales.
2) Selling price between 50% & 75% capacity is Rs. 25/- per unit.
3) Semi variable expenses will remain unchanged at 50% & 65% capacity but will increase by 10% between 65% to 80% capacity & by 30% between 80% & 100% capacity.
4) At 90% level (capacity) material Cost increase by 5% & Selling Price is reduced by 5%.

5) At 100% level both material & labour cost increase by 10% & selling Price is reduced by 8%.
6) Semi variable expenses are Rs. 50,000 /-
7) Fixed expenses are Rs. 50,000/-
8) Variable expenses are : Material Rs. 5 p.u.
Labour Rs. 2 p.u.
Direct Exp. Rs. 1 p.u.
Also write down the steps to perform above operation in MS-EXCEL.

A24. Prepare Flexible budget & find out overhead rate.

Particulars	50% Rs.	60% Rs.	70% Rs.
Variable Overheads			
A) Material	---	60,000	---
B) Labour	---	24,000	---
Semi-Variable Exp.			
1) Electric (20% fixed)	---	15,000	---
2) Repairs & Maint. (20% variable)	---	7,500	---
Fixed Expenses			
a) Depreciation	---	20,000	---
b) Rent & tax	---	2,250	---
c) Insurance	---	2,500	---
d) Salary	---	15,000	---
e) Indirect wages	---	8,000	---
Budgeted Direct labour hours	---	30,000	---

Also write down the steps to perform above operation in MS-EXCEL.

A25. Estimated cash balance on 1st may 1990 Rs. 2,50,000 From the following information Prepare Cash budget for the month of may, June, July 90.

Month	Sales	Purchase	Wages	Manu. Exp.	Office Exp.	Selling Exp.
March	50,000	30,000	6,000	5,000	4,000	3,000
April	56,000	32,000	6,500	5,500	4,000	3,000
May	60,000	35,000	7,000	6,000	4,000	3,500
June	80,000	40,000	9,000	7,500	4,000	4,500
July	90,000	40,000	9,500	8,000	4,000	4,500

Adjustments :-
a) Out of total sale 20% sales in cash & balance will be collected in the next month.
b) Suppliers allowed the credit period of 2 months.
c) Wages and all other exp. will be paid in the following months.
d) Dividends to share holders & Bonus to employees will be paid in the month of may Rs. 10,000 & Rs. 15,000 Respectively.
e) An order of machine is given, the cost of which is Rs. 80,000, Machine will be received in the month of June & payment will be done in same month.
f) Income tax will be paid Rs. 25,000/- in the month of July.
Also write down the steps to perform above operation in MS-EXCEL.

A26. From the following information Prepare Cash budget for the 3 months ending 30th June.

Month	Sales	Materials	Wages	Overheads	
Jan		60,000	40,000	11,000	6,200

Feb.	56,000	48,000	11,600	6,600
Mar.	64,000	50,000	12,000	6,800
Apr.	80,000	56,000	12,400	7,200
May	84,000	62,000	13,000	8,600
June	76,000	50,000	14,000	8,000

a) Payment of material & overheads will be done in the following month.
b) Payment of wages will be done in the same month.
c) Terms & conditions of sales as under :- Half amount of credit sales will be recovered in following months & balance amount will be recovered in the next month of the following month.
d) Dividend on Preference shares Rs. 30,000/- will be paid on 1st may.
e) The amount of share call each Rs. 25,000/- will be received on 1st April & of 1st June each.
f) Machines costing Rs. 10,000/- will be established in the month of January but payment will be done in the month of June.
g) The selling commission 5% will be paid in the following months of actual sales.
h) On 1st April Expected Cash balances Rs. 20,000/-
Also write down the steps to perform above operation in MS-EXCEL.

A27. From the following information Prepare Cash budget for 3 months commencing from 1st June. On 1st June Cash balance is Rs. 1,00,000/-

Month	Sales	Purchase	Wages	Manu. Exp	Selling & Admn. exp.
April	80,000	41,000	5,600	3,900	10,000
May	76,500	40,500	5,400	4200	1400
June	78500	38500	5400	5100	15000
July	90,000	37,000	4,800	5,100	17000
Aug.	95,500	35,000	4,700	6,000	13000

Additional Information :-
1) Commission on sales 5% will be paid after 2 months of the sales. (This commission is in addition of Selling Exp.)
2) Machine Costing Rs. 65,000/- will be purchased in the month of April but payment will be done in the month of August.
3) Dividend of last year Rs. 15,000/- will be paid in the month of July.
4) Lag time allowed to customers for the payment is 2 months, and 2 months credit period allowed from suppliers.
Also write down the steps to perform above operation in MS-EXCEL.

A28. Budgeted information given as under :-

Month	Sales	Purchases	Wages	Manu. Exp.	Office Exp.	Selling
Mar.	50,000	30,000	5,000	1,000	1,000	6,000
April	60,000	35,000	6,000	4,000	2,000	7,000
May	70,000	37,000	7,000	2,000	3,000	8,000
June	80,000	42,000	8,000	4,000	3,000	9,000
July	90,000	60,000	9,000	3,000	2,000	15,000
Aug	1,00,000	70,000	11,000	4,000	1,000	20,000

Additional Information :-
1) Cash balance on 1st may Rs. 80,000/-
2) 20% sales in cash & out of total Credit sales 50% amount Recovered in the following month & balances 50% in the next month of the following month.
3) Suppliers allowed a credit period of 2 months.

4) Lag time for wages 1/2 month.

5) Delay in payment of office expenses 1 month.

6) Delay in payment of manufacturing exp. 1 month.

7)Amount of shares call money willbe received in the months of may Rs. 50,000/-

8) Payment of tax will be done in July Rs. 80,000/-.

9) Machine will be purchased in June Rs. 20,000/-.

Prepare Cash Budget for May, June, & July.

Also write down the steps to perform above operation in MS-EXCEL.

A29. A newly established Company wants to prepare Cash budget for four months ending on 30th June.

Month	Sales	Materials	Wages	Overheads	Selling&Admn. Exp
Jan	20,000	20,000	4,000	3,200	800
Feb.	22,000	14,000	4,400	3,300	900
Mar.	24,000	14,000	4,600	3,300	800
Apr.	26,000	12,000	4,600	3,400	900
May	28,000	12,000	4,800	3,500	900
June	30,000	16,000	4,800	3,600	1,000

Adjustment :-

1) Expected Cash balance on 1st March Rs. 10,000/-.

2) A machinery is Purchased for Rs. 30,000/- payment will be done in two equal instalments March & April.

3) Selling Commission 5% on total sales & this commission will be paid in the following months of actual sales.

4) Amount of 2nd call will be received in the month of march Rs. 10,000/- & Amount of share premium Rs. 2,000/- will be received with 2nd call.

5) Period allowed to customer for payment is1 month.

6) Remaining all other exp. will be paid in the following months.

7) The delay in the payment of wages 1/2 month.

8) You may presume that 50% sales are in cash.

9) Suppliers allowed period of 2 months for payment.

Also write down the steps to perform above operation in MS-EXCEL.

A30.By the help of following information prepare cost sheet for the month of March 1980:

1. Stock (1-3-1980)	
a) Raw Materials	25,000
b) Finished goods	17,360
2. Stock (31-3-1980)	
a) Raw Materials	26,250
b) Finished goods	15,750
3. Raw material purchased	21,900
4. Work-in-progress (1-3-80)	8,220
5. Work-in-progress (31-3-80)	9,100
6. Sale of finished goods	72,310
7. Direct wages	17,150
8. Unproductive Wages	830
9. Factory Expenses	8,340
10. Office and management expenses	3,160
11. Selling and distribution expenses	4,210

Prepare cost sheet and find out following information:

1) Total Cost 2) Cost of goods sold 3) Profit on sold out goods

Also write down the steps to perform above operation in MS-EXCEL.

Paper - II: Programming in C& OOP's Concepts

UNIT – I

Design methods, Programming language, Translators, Introduction to C, C character set and keywords, Escape sequence, Constants and variables, Data types, Conversion specification, Input and output statements in C, Operators and expressions (Arithmetic, Relational, Logical, Assignment, Ternary, Bit Wise and Increment & Decrement Operator). **Storage class:** Automatic, Static, External, Register. **Control statement:** If-else, Looping statements (while, do- while and for loop), Switch, Go-to, Use of break and continue statements.

UNIT – II

Function: Arithmetic and string library function, User defined functions, Function definition & declaration, Function call, Return statement, Function arguments, use of void, Types of function, Function with call by value and call by reference, Recursion.
Arrays: Declaration, Referring individual elements, Entering data in to an array, Reading data from array, Array initialization, Printing of array, Searching, Sorting and merging of array. **Pointer:** Introduction to pointer, Pointer and function, pointer and structure, Pointer and array, Pointer and string. **Dynamic memory allocation:** Sizeof ( ), malloc (), calloc ( ), realloc(), free().

UNIT – III

String: String manipulation using string library function, **Structure:** Declaration structure, initializing structure, Structure variables, accessing structure elements, Arrays of structure, Array within structure. **Unions:** Concept and applications. **Files:** Concept of file, Modes of files, Open and close, Creation and reading of files, Character input/output function, Formatted input/output function, String input and output: sscanf, sprint, gets, puts. **File input/output:** fprintf, facanf, getc, putc, and **Block read/write:** fread, fwrite, random access to files, Other file function, command line argument.

UNIT – IV

Introduction to OOP, Characteristics of OOP's, Advantages & disadvantages of OOP's, Steps in developing the OOP Program, Object Oriented Languages, Importance of C++, Classes and objects, Member function, Concept of overloading, Inheritance & types of inheritance, Data abstraction, Data encapsulation, Concept of polymorphism and virtual function, Namespace and exception handling.

Text Books:

1. S. K. Shrivastava & Dipali Srivastava, C in Depth, BPB Publication.
2. D. Ravichandran, Programming with C++, McGraw-Hill.

Reference Books:

1. Steve Oualline, Practical C Programming, SPD, O'Reilly.

2. Harshal Arolkar, Simplifying C, Dreamtech Press.
3. Dr. S. Dey & Mridul Ghosh, Computer Fundamentals and C Programming, SPD.
4. Yashwant Kanetkar, Let Us C, BPB Publication.
5. Veugopal Prasad, Mastering C, McGraw-Hill.
6. Balguruswamy, Programming in ANSI C, McGraw-Hill.
7. E. Balguruswamy, Object Oriented Programming with C++, McGraw-Hill.

Practical List of Programming in C& OOP's Concepts

1. Write an algorithm, draw a flowchart and develop 'C' program to compute the factors of a given number.
2. Write an algorithm, draw a flowchart and develop 'C' program to interchange the values of two numbers without using any temporary variable.
3. Write an algorithm, draw a flowchart and develop 'C' program to calculate and find the nature of roots of given quadratic equation.
4. Write an algorithm, draw a flowchart and develop 'C' program to check given number is prime number.
5. Write an algorithm, draw a flowchart and develop 'C' program to calculate LCM & HCF of two numbers.
6. Write an algorithm, draw a flowchart and develop 'C' program to reverse an n digit number.
7. Write an algorithm, draw a flowchart and develop 'C' program to calculate sum of odd digits and product of even digits of a given n digit number.
8. Write an algorithm, draw a flowchart and develop 'C' program to check a given number is an Armstrong number.
9. Write an algorithm, draw a flowchart and develop 'C' program to convert a decimal number into its equivalent binary number.
10. Write an algorithm, draw a flowchart and develop 'C' program to display the Fibonacci series of n terms.
11. Write an algorithm, draw a flowchart and develop 'C' program to print the following output:-

    1
    1 2
    1 2 3
    1 2 3 4
    1 2 3 4 5
    1 2 3 4
    1 2 3
    1 2
    1

12. Write an algorithm, draw a flowchart and develop 'C' program to display the following pattern;-

    1 1
    1 2 2 1
    1 2 3 3 2 1
    1 2 3 4 3 2 1

13. Write an algorithm, draw a flowchart and develop 'C' program to calculate the series of n terms foe x as;-

$S = x + x^2 + x^3 + x^4 + \ldots\ldots\ldots$

14. Write an algorithm, draw a flowchart and develop ‘C’ program to calculate the sum of the n terms of the series;-
    S= 1/2!+2/3!+3/4!+4/5!.....
15. Write an algorithm, draw a flowchart and develop ‘C’ program to display the following pattern:-

```
        1
      2 3 2
    3 4 5 4 3
  4 5 6 7 6 5 4
5 6 7 8 9 8 7 6 5
```

16. Write an algorithm, draw a flowchart and develop ‘C’ program to insert an element in an array at appropriate position.
17. Write an algorithm, draw a flowchart and develop ‘C’ program to sort the given array using bubble sort.
18. Write an algorithm, draw a flowchart and develop ‘C’ program to find the transpose of a given matrix.
19. Write an algorithm, draw a flowchart and develop ‘C’ program to check whether the given word is palindrome or not.
20. Write an algorithm, draw a flowchart and develop ‘C’ program to count vowels in given word using switch statement.
21. Write an algorithm, draw a flowchart and develop ‘C’ program to count number of letters, words and blank spaces in a given line.
22. Write an algorithm, draw a flowchart and develop ‘C’ program to find largest and smallest element of given array using function concept.
23. Write an algorithm, draw a flowchart and develop ‘C’ program to find factorial of given number using recursion function.
24. Write an algorithm, draw a flowchart and develop ‘C’ program to find reverse of digits of given number using recursion concept.
25. Write an algorithm, draw a flowchart and develop ‘C’ program to swap the values of two array using user defined function. Use the concept “Call by Value” and “Call by Reference”.
26. Write an algorithm, draw a flowchart and develop ‘C’ program to find and replace a numeric value from an array using function and pointer.
27. Write an algorithm, draw a flowchart and develop ‘C’ program to Create a structure Student containing fields for Roll No., Name, Class, Year and Total Marks. Create 10 students and store them in a file.
28. Write an algorithm, draw a flowchart and develop ‘C’ program to create a file “abc.txt” and store the text. Copy the content from “abc.txt” to another file “xyz.txt” using putc() and getc() function. Also read the content of both files.
29. Write an algorithm, draw a flowchart and develop ‘C’ program to write and read the ‘n’ records as an entire block (structure) on a file using fwrite() and fread(). The block structure contains Roll Number and Name of the Students.
30. Write an algorithm, draw a flowchart and develop ‘C’ program to copy the content of one file to another file by using command line argument.

Paper-III: Introduction to Operating Systems

UNIT – I

Introduction – What operating systems do, Computer system organization, Computer system architecture, Operating system architecture, Operating system operations, Process management, Memory management, Storage management, Protection & Security, Kernel data structures, Computing environments, Open source operating systems. **System Structures –** Operating system services, User and operating system interface, system calls, types of system calls.

UNIT – II

Process Management – Process concept, Process Scheduling, Operations on processes, Interprocess Communication. Deadlocks – Deadlock characterization, Deadlock prevention, Deadlock Avoidance. **Memory Management Strategies –** Background, Swapping, Contiguous memory Allocation, Segmentation, Paging. **File System –** File concept, File system mounting, File sharing.

UNIT – III

Introduction to Disk Operating System (DOS)

- File types, Directory Structure
- Booting - Warm and Cold Booting
- Types of DOS commands (Internal and External)
- Introduction of Autoexe and Config files.
- Directory commands: DIR, MD, RD, TREE, PATH, SUBST ETC.
- Wild card Definitions
- Commands related to file management: COPY, DEL, ERASE, REN, ATTRIB, XCOPY, BACKUP and RESTORE .
- General commands: TYPE DATE, TIME, PROMPT etc.
- batch commands, wild card characters & its use.

UNIT – IV

Introduction to Unix overview

- File systems and structure of directories and file
- File Oriented Commands – Cat, op, In mv, rm etc.
- File Permissions
- Directory Oriented commands – ls, mkdir, rmdir, cd, pwd etc.
- Inter user connection commands – write, mail, used, at, wall etc.
- Common commands – skill, date, wo, sleep, who ps.
- Unix Utility Commands – grep, pr, cut, paste, sort, lp shutdown, halt, sys, tar, find etc.
- Basics of shell scripts

- Writing shell scripts, running scripts, using variables, controlling the flow of statement
- Introduction of Linux.

Text Books:

1. Abraham Silberschatz, Peter Galvin, Gerg Gagne, Operating System Concepts, Wiley.
2. Robert M. Thomas, DOS 6 & 6.2, BPB Publications.
3. Yashavant Kanetkar, Unix Shell Programming, BPB Publications.

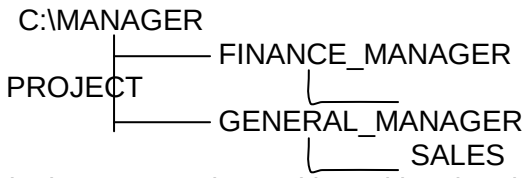
Reference Books:

1. Tanenbaum, Modern Operating Systems, PHI.
2. Stuart E. Madnick, John J. Donovan, Operating Systems, McGraw-Hill.
3. Dhananjay M. Dhamdhere, Operating Systems, McGraw-Hill
4. Sumitabha Das, Unix Concepts & Applications, McGraw-Hill.
5. Kernighan & Pike, The Unix Programming Environment, PHI.
6. Christopher Negus, Ubuntu Linux Toolbox, Wiley.
7. S. Jaiswal, DOS / Unix & Windows: IT Today, Encyclopedia.
8. Burnett, Using Linux: Tackett, PHI.
9. MS-DOS Manual.

Practical List of Introduction to Operating Systems

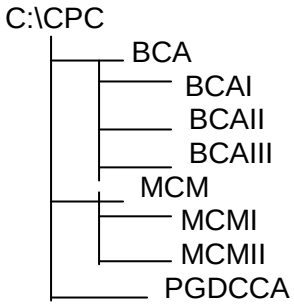
1. Make a directory naming VMV in DOS. Under that make three sub directories BCAI, BCA II, BCAIII. Also explain the commands used in making the directories and subdirectories in DOS.

2. Using Tree Command in DOS make the following tree diagram



   Also explain the commands used in making the above tree diagram.

3. Using tree command in DOS makes the following tree diagram



   Also explain the commands used in making the above tree diagram.

4. Make a file named "compute.txt" in DOS and write the definition and characteristics of computer in that file. Rename the file compute.txt to computer.txt.
   Also explain the commands used in making the file and renaming file. Explain the difference between copy and ren Command.

5. Make a file named "compute.txt" in DOS and write the definition and characteristics of computer in that file. Copy the contents of file compute.txt to computer.txt. Also explain the commands used in making the file and copying the contents of one file to another file.

6. Make a file named file1.txt in DOS and enter the following text in that file.
   WWW can be defined as a set of standards for storing, retrieving, formatting and displaying information using client/server architecture, graphical user interfaces and a hypertext language that enables dynamic link to documents. World Wide Web is a repository of information spread all over the world and linked together.

7. Write a shell script in UNIX to calculate area of a triangle.
8. Write a shell script in UNIX to calculate area and circumference of a circle.
9. Write a shell script in UNIX to calculate the simple interest.
10. Write a shell script in UNIX to calculate the total marks and percentage of five subjects.
11. Write a shell script in UNIX to calculate largest and smallest number among three numbers.
12. Write a shell script in UNIX to calculate the gross salary of an employee. The salary includes – Basic Salary, HRA (20% of Basic Salary), DA (20% of Basic Salary) and CCA (10% of Basic Salary).
13. Write a shell script in UNIX to enter the two strings and then compare the two strings. If strings are equal then display the message "Strings are Equal" else "Strings are not Equal".
14. Write a shell script in UNIX to check whether the given file is directory or ordinary file.
15. Write a shell script in UNIX to check entered character is in uppercase or in lowercase.
16. Write a shell script in UNIX to check whether the entered number is EVEN or ODD.
17. Write a shell script in UNIX to check whether the entered number is prime or not.
18. Write a shell script in UNIX to print the Fibonacci series.
19. Write a shell script in UNIX to calculate the factorial of a given number.
20. Write a shell script in UNIX to calculate reverse a number.
21. Write a shell script in UNIX to find sum of digits of a number.
22. Write a shell script in UNIX to implement Break statement.
23. Write a shell script in UNIX to search whether element is present is in the list or not.
24. Write a shell script in UNIX to copy contents of one file to another.
25. Write a shell script in UNIX to count number of files in a directory.
26. Write a shell script in UNIX to implement FCFS Algorithm.

Paper - IV: Computerized Accounting (TALLY ERP 9)

UNIT - I

Accounting Basics - Defining the need for accounting, Defining accounting, Exploring the branches of accounting, Describing the functions of accounting, Listing the advantages of accounting, Listing the limitations of accounting, Explaining important terms in accounting, Exploring the concepts of accounting, Understanding the conversions of accounting, Describing an account and its types, Explaining the rules of debit and credit, Describing a journal, Describing a ledger, Describing trial balance, Describing a financial entries, Understanding adjustment entries.

Introduction to Tally.ERP 9 – Features of Tally, Enhancement in Tally.ERP 9, Installation procedure of Tally.ERP 9, Opening Tally.ERP 9, Components of the Tally.ERP 9 window, Creating a Company.

UNIT - II

Stock and Godown in Tally.ERP 9 – Stock groups, Stock categories, Stock items, Units of measure, Godowns. **Group, Ledgers, Vouchers and Orders –** Introducing groups, Introducing ledgers, Introducing vouchers, Introducing purchase orders, Introducing a sales order, Introducing invoices.

UNIT - III

Reports in Tally.ERP 9 – Working with balance sheet, Working with profit & loss A/c report, Working with stock summary report, Understanding ratio analysis, Working with trial balance report, Working with day book report. **Payroll –** Exploring payroll in Tally.ERP 9, Required features to create a pay slip, Description of payroll info, Working with payroll vouchers, Defining payroll reports, working with statements of payroll report, Describing salary discursement.

UNIT - IV

Taxation – Indian Tax Structure, Tax deducted at source in tally.ERP 9, Create a Tax Ledger, TDS Vouchers, Printing a TDS Challan, Tax collected at source in Tally.ERP 9, TCS reports in Tally.ERP 9, Calculating VAT in Tally.ERP 9, VAT Classification, VAT Vouchers, VAT Reports in Tally.ERP 9, Service Tax.

Text Book:

1. Vikas Gupta, Business Accounting with MS Excel and Tally.ERP 9 Course Kit, Dreamtech Press.

Reference Books:

1. Computerized Accounting using Tally ERP 9, Sahaj Enterprise, Tally Education Private Ltd (TEPL).

2. Vishnu Priya Singh, Tally 9.
3. K. K. Nadhani, Accounting with Tally, BPB Publication.
4. K. K. Nadhani and A.K. Nadhani, Tally Tutorial, BPB Publication.
5. Anthony R. N. and J. S. Richard, Accounting Principles, Irwin Inc.

Practical List of Computerized Accounting (TALLY ERP 9)

1. Create a company in Tally ERP 9 with the following details:

Name of company	Universal Company Ltd.
Address	1804, world Tower, AB road, Baner, Pune _411080
Country	India
State	Maharashtra
Contact number	7894561230
Mobile number	7741258963
Email-Id	info@universalmfg.co.in
Books beginning from	01-04-2015
Financial year Beginning from	01-04-2015

2. Create a company in Tally ERP 9 with the following details:

Name of company	Sambhav trading Company
Address	a/512, palm court, girgaam chaupaty, charni road, Mumbai-400007
Country	India
State	Maharashtra
Contact number	022-22886512
Mobile number	9898745555
Email-Id	enquiry@sambhav.com
Books beginning from	01-04-2014
Financial year Beginning from	01-04-2014

3. Create the following ledgers in the books of universal company ltd in Tally ERP 9.

Name of ledger	Under (group)	Bill wise details set to	Opening balance
Share capital	Capital account	No	15,00,000
Purchase account	Purchase account	No	Nil
Sales accounts	Sales accounts	No	Nil
Ultra tech cement ltd	Sundry creditors	yes	270000
Building	Fixed assets	No	1200000
Computers	Fixed assets	No	50000
Office furniture	Fixed assets	No	175000

Cash in hand	Cash accounts	No	20000
Civic centre association	Sundry debtors	yes	290000
Bank of india	Bank accounts	No	80000
Petty cash	Cash in hand	No	50000

4. Create the following ledgers in the books of universal company ltd in Tally ERP 9.

Name of ledger	Under (group)	Bill wise details set to	Opening balance
Proprietors Capital	Capital Account	No	10,00,000
Purchase Account	Purchase Account	No	Nil
Sales Accounts	Sales Accounts	No	Nil
Hindustan Lever Ltd	Sundry creditors	yes	355000
Land and Building	Fixed Assets	No	850000
Computers and Peripheral	Fixed Assets	No	30000
Office Furniture	Fixed Assets	No	75000
Cash in hand	Cash Accounts	No	18000
Tahuraa Traders Pvt Ltd	Sundry Debtors	yes	310000
Bank of Baroda	Bank Accounts	No	102000

5. Record the following vouchers in the books of Universal company ltd.

a. 04-04-2014 withdrawn Rs. 20000 from bank of india and transferred to petty cash book.
b. 08-04-2014 paid 2000 from petty cash for buying stationery for office.
c. 15-04-2014 made purchase from ultra tech cement ltd. Worth Rs. 45000
d. 19-04-2014 issued cheque to ultra tech cement ltd for Rs. 45000
e. 21-04-2014 sold goods worth of Rs. 75000 to civic centre association
f. 25-04-2014 received a cheque from civic center association for Rs. 75000. The same was deposited in the bank on the same date.
g. 30-04-2014 paid staff salary of Rs. 9800 from petty cash

6. Record the following vouchers in the books of Sambhav Trading Co. Pvt. ltd.

a. 02-04-2014 withdrawn RS. 10000 From bank of baroda and transeferred to petty cash book.
b. 05-04-2014 paid 1000 from petty cash for office expences.
c. 11-04-2014 made purchase from Hindustan unilever ltd. Worth Rs. 33000
d. 13-04-2014 Issued cheque to Hindustan Unilever Ltd. For Rs. 20000
e. 14-04-2014 Made purchase from Hindustan Unilever Ltd. Worth Rs. 26000
f. 18-04-2014 Issued cheque of Rs. 38000 to Hindustan Unilever Ltd.
g. 21-04-2014 sold goods worth of Rs. 90000 to Tahuraa Traders Pvt Ltd.
h. 22-04-2014 received a cheque from Tahuraa Traders Pvt Ltd. For Rs. 75000 . The same was deposited in the bank on the same date.
i. 23-04-2014 sold goods worth of rs. 85000 to Tahuraa Traders Pvt Ltd.
j. 25-04-2014 received cheque from Tahuraa Traders Pvt Ltd. From Rs.75000. The same was deposited in the bank on the same date.

k. 30-04-2014 Paid staff salary of Rs. 7200 from petty cash.

7. Create cost centers Project A and Project B under primary cost category and record the following transaction in the books of sambhav trading company

a. On 07-09-2014, purchased Cement worth Rs. 1, 50,000/- from Ultratech cement Ltd. That will be shared equally between Project A and Project B . A credit period of 30 days was provided.
b. Record transaction on 09-09-2014 for the purchase of Steel worth Rs. 450000 from Embee Enterprises. Allocate Rs. 50000 to Project A and the the rest to Project B . a credit period of 45 days was allowed .

8. Create cost centers Mumbai and Pune under primary cost category and record the following transaction in the books of Universal co. Limited

a. On 05-10-2014, purchases done worth Rs. 2, 50,000/- from Hindustan Unilever Ltd. That will be shared equally between Mumbai and Pune.
b. Record transaction on 09-10-2014 for the purchase worth Rs. 600000 from Hindustan Unilever Ltd. Allocate Rs. 250000 to Mumbai and the rest to Pune. . a credit period of 45 days was allowed.
c. On 18-10-2014 record a transaction for the sale on Super technologies for Rs. 1575000/- of which 1200000 would be allocated to Mumbai branch and the rest to Pune.
d. On 22-10-2014 one more sales entry was made for 1600000 to Super technologies of which 10,00,000 was allocated to pune branch and the rest to Mumbai.

9. Record the following transaction in the books of Universal Co. Ltd.

a. On May 11, 2014 they received a bill no. May /005/2014 for a sum of Rs. 125000/- from M/s. Rajesh shah and Co., architects for consultancy towards designing their office and training centre.
b. Universal company Ltd. Made the payment after deducting the TDS amount.
c. On 27th May 2014, company received bills no May/015/2014 for a sum of Rs. 75000 from M/s Rajesh shah and co., architects for consultancy.
d. On 28th May, company made the payment after deducting TDS.

10. Journalize the following Transaction in the books of Mr. Anil for the month of March 2012 and prepare Trial balance

March 2010	Particular	Amt
1	Start business with cash	80000
3	Purchase goods for cash	5000
4	Purchase goods from Akash	9000
6	Sold goods to Vikas	7000
7	Return goods to Akash	700
9	Goods return by Vikash	400
11	Cash paid to Raman	4000
17	Withdrew from Bank	10000
20	Wage paid	1000

11. Akhilesh started his business on 1st Jan. 2012 with Rs.5000, his transaction for the month were as following, prepare Cash A/C.

January 2012	Particular	Amt
1	Bought goods on credit from Sachine & Sons	5000
5	Paid salary	500
10	Sold to Roy	2000
15	Cash sales	2200
19	Cash Purchase	3000
25	Deposit in Bank	1000
27	Goods returned to Sachine & Sons	500
31	Cash Withdrawn by Akhilesh for personal use	500

12. Journalize the following transactions in the books of Sudhir Kumar 2003 and prepare a Trial Balance :

Jan 2003	Particular	Amt
1	Sudhir Commenced business with cash	40000
3	Purchased goods for cash	500
5	Sold goods for cash	300
6	Purchased one Motor Car for cash	15000
9	Sold Machinery for cash	9000
11	Purchased a Building on credit from Narendra	20000
15	Sold Furniture on credit to Randhir Kappor	9500
17	Paid Cartage	110
22	Received Commission	50
27	Cash Sales	1200
29	Cash Purchase	600
30	Received on account from Ahmed	350
31	Paid cash to Sunitkumar on account	190

13. **Journalize the following transactions in the books of Royal & Co. and prepare a Trial Balance :**

Nov. 2003	Particular	Amt
1	Cash invested in Business	150000
2	Cash deposited In to SBI Current A/C	30000
3	Goods Purchased in cash	20000
4	Goods Sold in cash	12000
5	Commission received Rs. 500 from Sushma Traders	
6	Goods Sold on credit to Roshan	25000
7	Goods return from Roshan	5000
8	Depreciation charged on Machine @ 12% for four month Machine Cost	45000
10	Cheque received from Roshan	10000
11	Salary Paid	1500

14. Journalize the following transaction in the books of Sanjay Potdar for the month of March 2012.

1. Ashok starts business with Rs. 100000/-
2. Purchase machinery for Rs. 50000/ and furniture for Rs. 10000
3. Paid amount for rent Rs. 1000/
4. Deposits Rs,. 10000/- in Bank
5. Purchase of goods for Rs. 20000/ from Mr. Ram on credit.
6. Sold goods to Mr. Rakesh for Rs. 10000/
7. Rs. 5000/ withdraws from bank for personal use.
8. Withdraws Rs. 1000/ for office use.

9. Received cash from Mr. Rakesh.
10. Paid to Mr. Ram.

15. Record the following transaction in the books of Raj enterprises.

1. Goods purchase from “Kirti sales” on credit Bill no. 115 Rs. 62000
   a. Color tv (lg) 4% 3qty Rs. 30000
   b. Washing machine (samsung) 4% 4 qty Rs. 32000
2. Cash received from sangam enterprizes Rs. 15000
3. Goods purchase in cash bill no. 69 Rs. 35000
   a. B/W tv (sony) 4% 4 qty Rs. 20000
   b. Audio (onida) 4% 5 qty Rs. 15000
4. Goods sale on cash rs, 19000
   a. Color tv (lg) 4% 1 qty Rs. 15500
   b. Audeo (onida) 4% 1 qty Rs. 3500
5. Goods purchase in cash from vikram enterprises bill no. 45 Rs. 40000
   a. Color tv (lg) 4% 2 qty Rs. 20000
   b. Refregerator (vedeocon) 4% 2qty Rs. 20000
6. Cheaque no. received from ravi agency Rs. 10000 and deposited in state bank.
7. Credit sale to vijay enterprises bill no. 93 Rs.17200
   a. Washing machine (samsung) 4% 1qty Rs. 8000
   b. B/W tv (sony) 4% 1 Qty Rs. 5700
   c. Audio (onida) 4% 1 qty Rs. 3500
8. Cash paid to ravi kulkarni rs. 1500
9. Cheque no. 159 paid to central engineering co. Rs 15000
10. Refregerator purchase on cash Rs. 30000 fom k k agency 3 qty (videocon) 4%
11. Office rent paid in cash Rs. 1700
12. Received cheque from vijay enterprises Rs. 10000 & deposited in canara bank.
13. Bill received from lokmat Rs. 1500 bill no.5
14. Amount received from vaishali agency in cash rs. 5000 & cheque no. 336791 Rs. 10000 only. Cheque deposited in state bank.
15. Cash sale to telco ltd. Rs. 29900
    a. Color tv (Lg) 4% 1 qty Rs. 10000
    b. Washing machine (samsung) 4% 1 qty Rs. 9100
    c. Refregerator (vedeocon) 4% 1qty Rs. 10800
16. Cheque deposited in canara bank Rs.5000
17. Cash withdrawn from bank Rs. 34000

16. Record the following transaction in the books of Maharashtra Traders.

1. Opening stock for Wadi Godown
   a. Akai color Tv 4% 10 qty Rs.10500 each.
   b. Refregerator (videocon) 7qty 12000 each.
   c. Washing machine (samsung) 5 qty 8000 each
   d. Audio (Philips) 4% 2Qty 2000
   e. Onida color tv 4% 5 qty 12000 each
   f. B/W tv (akai) 4% 5 qty 18000

2. Opening stock for nandanwan godown
    a. Akai color tv 2 qty 10500 each
    b. refrigerator (videocon) 3qty 12000 each
    c. Audio (Philips) 3 qty 1000 each.
3. Cash sale to Bhagwandas Co. Rs. 41500 in wadi godown.
    a. Color tv (akai) 4% 2 qty Rs.21000.
    b. Refrigerator (Vedeocon) 4% 1qty Rs. 11300
    c. Washing Machine (samsung) 4% 1 qty Rs. 9200.
4. Goods purchase in cash from national Trading co. & store Nandanwan godown.
    a. Audio (Philips) 2qty 4% Rs.6000
    b. W/M (Samsung) 1qty 4% Rs. 10000
5. Credit sales to Ravina traders Rs. 51800 wadi godown.
    a. Refrigerator (vedeocon) 2qty 4% Rs. 22000.
    b. W/M (Samsung) 1qty 4% Rs.8300
    c. Color tv (akai) 2qty 4% 21500
6. Cheque received from vikas enterprises Rs. 20000 & deposited in state bank.
7. Cash withdrawn from state bank cheque no. 16 Rs. 15000/-
8. Received loan from state bank Rs. 10,00,000/- invensted in business, interest 10%.
9. Cheque paid to kirti sales rs. 25000/-
10. Goods purchase on credit from rama & sons Rs. 44000 store nandanwan.
    a. W/M (Lg) 3 qty 4% Rs. 24000
    b. Refrigerator (videocon) 1qty 4% Rs. 10000.
    c. Color tv (onida) 1qty 45 Rs. 10000
11. Akai color TV purchase in cash Rs. 20000 2qty 4% Rao store in nandanwan.
12. Paid salary Rs. 10000
13. Paid bank loan Rs. 8,00,000
14. Cash sale on wadi godown Rs 42000\
    a. Audio 2 qty 4% Rs.7000
    b. w/m (s.s.) 2qty 4% Rs. 17000
    c. b/w tv (akai) 3qty 4% Rs. 18000
15. Paid to rama & sons by cheque rs. 18000 chq. No. 1152.
16. Paid electric bill Rs. 10000
17. Total cash sale after allowing discount Rs. 1000.
18. Paid total balance loan on state bank.
19. Advertisement exp. Rs.10000
20. Carriage exp. Rs. 5000
21. Purchase furniture for nandanwan godown Rs.28000 in cash.
22. Withdrawn for personal use Rs, 10000.

17. Record the following transaction in the books of Rathore Traders.

1. Goods purchase from sohan & sons Rs. 20000/-
    a. Gold 10gm (12.5%) rs. 10000/-
    b. Silver 1kg (12.5%) Rs.10000/-
2. Goods purchase from sagar computer Rs. 25000/-
    a. Monitor (compaq) 1qty 5000/- 4%
    b. Cpu (intel) 1qty 15000/- 4%

   c. Speaker (Logitex) 1qty 5000/- each
3. Goods sold on cash Rs. 22000/-
   a. Gold (12.5%) 10gm 12000/-
   b. Silver(12.5%) 1kg 10000/-
4. Withdrawn 400/- Rs. From canara bank.
5. Cash given to sagar computers Rs. 24000/- in full settlement.
6. Cheque given to mr. sohan & sons. Rs 20000.
7. Salary given to mr. sahil Rs. 2000/-
8. Withdrawn Rs. 4000/-
9. Paid insurance premium Rs. 200/-
10. Purchase table without vat Rs.2000/-

PGDCCA Part-I

Semester-II

Paper - I: Management Information Systems

UNIT - I

Strategic View of MIS:

Management information system in a digital firm: Management Information System (MIS): Concept, Definition, Role of MIS, Impact of the MIS, MIS and the user, Management as a control system, MIS: A support to the management, Management effectiveness and MIS, Organization as a System, MIS: Organization Effectiveness, MIS for a digital firm. **E-Business Enterprise:** A digital firm - Introduction, Organization of business in a digital firm, E-Business, E-Commerce, E-Communication, E-Collaboration, Real Time Enterprise.

Strategic Management Of Business Performance: Concept of corporate planning, Essentiality of strategic planning, Development of the business strategies, Types of strategies, Short range planning, Tools of planning, Strategic analysis of business, Balance score card, Score card and dash board, MIS: Strategic business planning.

Information security challenges in E-Enterprises: Introduction, Security threats and vulnerability, Controlling security threats and vulnerability, Managing security threat in E-Business, Disaster management, Information security.

UNIT - II

Basic of Management Information Systems:

Decision-Making: Concept, Process, Decision analysis by analytical modeling, **Behavioral concepts in Decision -** Making, Organizational Decision Making. **Information, Knowledge, Business Intelligence:** Information concepts, Information: A quality product, Classification of the information, Methods of data and information collection, Value of the information, General model of a human as an information processor, Summary of information concept and their implications, Knowledge and knowledge management systems, Business intelligence MIS and the information and knowledge. **System Engineering: Analysis And Design:** System concepts, System control, Types of system, Handling system complexity, Classes of systems, General model of MIS, The need for system analysis, System analysis of the existing system, System analysis of a new requirement, System development model, Structured system analysis and design (SSAD), Object oriented analysis (OOA), System development through OOT: A use case model, OOSAD development life cycle.

UNIT – III

Development process of MIS: Development of long range plans of the MIS, Ascertaining the class of information, Determining the information requirement, Development and implementation of the MIS, Management of information quality in MIS, Organization for development of MIS, MIS: Development Process Model. **Strategic Design of MIS:** Strategic management of the business, Why strategic design of MIS?, Balance score card, Score card, and dash board, Strategic design of MIS, Development process steps for strategic design(SD) of MIS, illustrating SD of MIS for Big Bazzar, Strategic management of business and SD of MIS, Business strategy determination, Business strategy implementation. **Business Process Re-Engineering (BPR):** Introduction, Business process, Process model of organization, Value stream model of the organization, What delays the Business Process? Relevance of information technology (IT), MIS and BPR.

UNIT - IV

Applications of Management Information Systems to E-Business:

Application in manufacturing sector: Introduction, Personnel management (PM), Financial management (FM), Production management (PM), Raw material management(RMM), Marketing management, Corporate overview. **Application in Service Sector:** Introduction to service sector, Creating a distinctive service, Service concept, Service process cycle and analysis, Customer service design, Service management system , MIS application in service industry, MIS: Service industry. **Decision support systems and knowledge management: Decision support systems (DSS):** Concept and philosophy, Group decision support system(GDSS), DSS application in E-Enterprise, Knowledge management , Knowledge management systems, Knowledge based expert system (KBES), MIS and the benefits of DSS. **Enterprise Management Systems:** Enterprise management systems(Ems), Enterprise resource planning (ERP) system, ERP models and modules, Benefits of the ERP, ERP product evaluation, ERP implementation, Supply chain management (SCM), Information management in SCM, Customer relationship management (CRM), EMS and MIS.

Text Book:

1. Waman S. Jawadekar, Management Information Systems, McGraw-Hill.

Reference Books:

1. D. P. Goyal, Management Information Systems, Vikas Publishing.
2. D. P. Nagpal, Management Information Systems, S. Chand.
3. S. Sadagopan, Management Information Systems, PHI.
4. A. K. Gupta, Management Information Systems, S. Chand.
5. Mahesh Halale, Management Information Systems, Himalaya publishing house.
6. Kanter, Managing with Information, PHI.

Paper - II: Core Java

UNIT - I

Java Evolution - Java history, Java features, How java differ from C and C++, Java and internet, Java and world wide web, Web browsers, Hardware and software requirements, Java support systems, Java environment. **Overview of Java Language** – Introduction, Simple Java programs, More of Java, An application with two classes, Java program structure, Java tokens, Java statements, Implementing a Java program, Java virtual machine, Command line arguments, Programming style. **Constants, Variables, and Data Types** – Introduction, Constants, Variables, Data Types, Declaration of variables, Giving value to variables, Scope of variables, Symbolic constants, Type casting, Getting values of variables, Standards default values. **Operators and Expressions** - Introduction, Arithmetic operators, Relational operators, Logical operators, Assignment operators, Increment and decrement operators, Conditional operators, Bitwise operators, Special operators, Arithmetic expression, Evaluation of expression, Precedence of arithmetic operators, Type conversion in expression, Operator precedence and associativity, Mathematical functions. **Decision Making and Branching** – Introduction, Decision making with If Statement, Simple If statement, The If…Else statement, Nesting of If...Else statement, The Else If ladder, The switch statement, The? : Operators. **Decision Making and Looping** – Introduction, The while statement, The do statement, The for statement, Jumps in loops, Labeled loops.

UNIT - II

Classes, Objects and Methods – Introduction, Defining a class, Fields declaration, Methods declaration, Creating objects, Accessing class members, Constructors, Method overloading, Static members, Nesting of methods, Inheritance: Extending a class, Overriding methods, Final variables and methods, Final classes, Finalizer methods, Abstract methods and classes, Methods with varargs, Visibility Controls. **Arrays, Strings and Vectors** – Introduction, One-Dimensional Array, Creating an array, Two-Dimensional Array, Strings, Vectors, Wrappers classes, Enumerated types, Annotations. **Interfaces: Multiple Inheritance** – Introduction, Defining interfaces, Extending interfaces, Implementing interfaces, Accessing interface variables.

UNIT - III

Packages: Putting Classes Together – Introduction, Java API Packages, Using system packages, Naming conventions, Creating packages, Accessing a package, Using a package, Adding a class to package, Hiding classes, Static import. **Multi Threaded Programming** – Introduction, Creating threads, Extending the thread class, Stopping and blocking a thread, Life cycle of thread, Using thread methods, Thread exception, Thread priority, Implementing the 'Runnable' interface, Inter-thread communication. **Managing Errors and Exceptions** – Introduction, Types of errors, Exceptions, Syntax of exceptions handling code, Multiple catch statements, Using finally statements, Throwing

our own exceptions, Improved exception handling in Java ES 7, Using exceptions for debugging.

UNIT - IV

Applet Programming – Introduction, How applet differ from application, Preparing to write applet, Building applet code, Applet life cycle, Creating an executable applet, Designing a web page, Applet tag, Adding applet to HTML file, Running the applet, More about applet tag, Passing parameters to applet, Aligning the display, More about HTML tags, Displaying numerical values, Getting input from the user, Event handling. **Graphics Programming** – Introduction, The graphics class, Lines and rectangles, Circles and ellipses, Drawing arcs, Drawing polygons, Line graphs, Using controls loops in applets, Drawing bar charts, Introduction to AWT packages, Introduction to swing. **Managing Input / Output Files in JAVA** – Introduction, Concepts of streams, Streams classes, Bytes streams classes, Character streams classes, Using streams, Other useful I/O classes, Using the file classes, Input / Output exception, Creation of files, Reading/Writing character, Reading/Writing bytes, Handling primitive data types, Concatenating and buffering files, Random access file, Interactive input and output, Other stream classes. **JAVA Collections** – Introduction, Overview of interfaces, Overview of classes, Overview of algorithm.

Text Book:

1. E. Balagurusamy, Programming with Java, McGraw-Hill.

Reference Books:

1. Dr. R. NageswaraRao, Core Java – An Integrated Approach, Dreamtech Press.
2. Rashmi Kanta Das, Core Java for Beginners, Vikas Publishing.
3. Joel Murach, Murach's Java Programming, Shroff Pubishers.
4. Sharanam Shah & Vaishali Shah, Core Java 8 for Begineers, Shroff Pubishers.
5. Patrick Naughton & Herbert Schildt, JAVA 2 – The Complete Reference 3/E, McGraw-Hill.
6. B. M. Harwani, Java for Professionals, Shroff Pubishers.

Practical List of Core Java

1. Write an algorithm, draw a flowchart and develop a Java program to find the sum of any number of integers entered as command line arguments.
2. Write an algorithm, draw a flowchart and develop a Java program to perform addition, subtraction, multiplication and division using switch case statement.
3. Write an algorithm, draw a flowchart and develop a Java program to find the factorial of a given number.
4. Write an algorithm, draw a flowchart and develop a Java program to display the following pattern –

```
    *
  * * *
```

* * * * *
* * * * * * *

5. Write an algorithm, draw a flowchart and develop a Java program to learn use of single dimensional array by defining the array dynamically.
6. Write an algorithm, draw a flowchart and develop a Java program to convert a decimal number to binary number.
7. Write an algorithm, draw a flowchart and develop a Java program to find the sum of any number of integers interactively, i.e., entering every number from the keyboard, whereas the total number of integers is given as a command line argument.
8. Write an algorithm, draw a flowchart and develop a Java program to Write a program that show working of different functions of String and StringBufferclasss like setCharAt(, setLength(), append(), insert(), concat()and equals().
9. Write an algorithm, draw a flowchart and develop a Java program to create a - distance class with methods where distance is computed in terms of feet and inches, how to create objects of a class and to see the use of this pointer.
10. Write an algorithm, draw a flowchart and develop a Java program to show that during function overloading, if no matching argument is found, then java will apply automatic type conversions(from lower to higher data type).
11. Write an algorithm, draw a flowchart and develop a Java program to show the use of static functions and to pass variable length arguments in a function.
12. Write an algorithm, draw a flowchart and develop a Java program to demonstrate the concept of boxing and unboxing.
13. Write an algorithm, draw a flowchart and develop a Java program to find the area of rectangle using constructor.
14. Write an algorithm, draw a flowchart and develop a Java program to demonstrate the method overloading concept.
15. Write an algorithm, draw a flowchart and develop a Java program to find even, odd, factorial of a number using inheritance.
16. Write an algorithm, draw a flowchart and develop a Java program to demonstrate the Interfaces.
17. Write an algorithm, draw a flowchart and develop a Java program to create a multilevel package and also creates a reusable class to generate Fibonacci series, where the function to generate Fibonacci series is given in a different file belonging to the same package.
18. Write an algorithm, draw a flowchart and develop a Java program that creates illustrates different levels of protection in classes/subclasses belonging to same package or different packages.
19. Write an algorithm, draw a flowchart and develop a Java program to create your own exception types to handle situation specific to your application (Hint: Define a subclass of Exception which itself is a subclass of Throwable).
20. Write an algorithm, draw a flowchart and develop a Java program to implement the concept of loading & displaying images.
21. Write an algorithm, draw a flowchart and develop a Java program to demonstrate the animation.
22. Write an algorithm, draw a flowchart and develop a Java program to demonstrate multithread communication by implementing synchronization among threads (Hint: you can implement a simple producer and consumer problem).
23. Write an algorithm, draw a flowchart and develop a Java program to create URL object, create a URLConnection using the openConnection() method and then use it examine the different components of the URLand content.
24. Write an algorithm, draw a flowchart and develop a Java program to implement a simple datagram client and server in which a message that is typed into the server window is sent to the client side where it is displayed.

25. Write an algorithm, draw a flowchart and develop a Java program that creates a Banner and then creates a thread to scrolls the message in the banner from left to right across the applet‘s window.
26. Write an algorithm, draw a flowchart and develop a Java program to get the URL/location of code (i.e. java code) and document(i.e. html file).
27. Write an algorithm, draw a flowchart and develop a Java program to demonstrate different mouse handling events like mouseClicked(), mouseEntered(), mouseExited(), mousePressed, mouseReleased() and mouseDragged().
28. Write an algorithm, draw a flowchart and develop a Java program to demonstrate different keyboard handling events.
29. Write an algorithm, draw a flowchart and develop a Java program to generate a window without an applet window using main() function.
30. Write an algorithm, draw a flowchart and develop a Java program to display the following output using applet -

    A
    A P
    A P P
    A P P L
    A P P L E
    A P P L E T

Paper - III: Quantity Techniques & Operation Research

UNIT - I

Introduction to statistics - Origin and growth of statistics, meaning of statistics, Definitions of statistics, Characteristics of statistics, Main division of statistics, Nature of statistics: a Science or an Art, Scope of statistics , relation of statistics to other sciences, Function of statistics, Importance of statistics, Limitations of statistics, Distrust Misuse of statistics, Statistical thinking, statistical inferences. **Measures of central Tendency or Averages -** Definition and meaning of average, Qualities of good average, Types of averages, Arithmetic mean, median, Mode, geometric mean ,harmonic mean, Relation among mean ,median and mode, Relation among arithmetic mean, geometric mean and harmonic mean, Quartiles ,deciles, and percentiles. **Measures of dispersion -** Definition of dispersion , meaning of dispersion , purpose of dispersion, quartiles of a good Measures of dispersion, Measures of dispersion, range, quartile deviation or semi-inter quartile range, mean deviation or average deviation, standard deviation or root-mean square deviation, co-efficient of variation, variance, combined standard deviation, relation among quartile deviation, mean deviation and standard deviation, Lorenz curve—graphical presentation of dispersion.

UNIT - II

Correlation Analysis - Meaning of correlation, definition of correlation, usefulness of correlation analysis, types of correlation, co-efficient of correlation , measurement of correlation, probable error of co-efficient of correlation, standard error of co-efficient of correlation, co-efficient of determination, correlation ratio. **Regression Analysis -** Introduction, meaning of regression, definition of Regression, usefulness of Regression analysis, types of Regression, Regression lines, Regression equation, Regression co-efficients, standard erroe of estimate (SEE), ratio of variation, galton graph, limitations of Regression analysis, distinguish between correlation and Regression. **Probability Analysis -** Introduction, meaning of Probability, properties of Probability, importance of Probability, Probability related events, theorems of Probability, fundamental rules of Probability, calculation of Probability.

UNIT - III

Operation Research: An Introduction – Operation Research – Quantitative approach to decision making, The history of Operation Research, Definition of Operation Research, Characteristics of Operation Research approach, Applications of Operation Research, Computer software for Operation Research. **Linear Programming: Application & Model Formulation –** Introduction, Structure of linear programming model, Advantage of using linear programming, Limitations of linear programming,

Application areas of linear programming, General mathematical model of linear programming problem, Guidelines on linear programming model formulation, Example of linear programming model formulation. **Linear Programming: The Graphical Method –** Introduction, Important definitions, Graphical solution methods of LP problem. **Linear Programming: The Simplex Method –** Introduction, Standard form of an LP problem, Simplex algorithm (Maximization & Minimization Case), Types of linear programming solutions.

Transportation Problem – Introduction, Mathematical model of transportation problem, Methods of finding initial solution. **Assignment Problem –** Introduction, Mathematical model of statement assignment problem, Solution methods of assignment problem (Hungarian Method).

UNIT - IV

Decision Theory and Decision Trees – Introduction, Steps of decision making process, Types of decision making environments, Decision making under uncertainty, Decision making under risk, Decision trees analysis, Decision making with utilities. **Theory of Games -** Introduction, Two Person zero sum games, Pure strategies (Minimax and minimum principles): games with saddle point, Mixed strategies: game without saddle point, The rules of dominance, Solution methods for games without saddle point. **Project management: PERT and CPM –** Introduction, Basic difference between PERT and CPM, Phases of project management, PERT/CPM network components and precedence relationships, Critical path analysis, Project scheduling with uncertain activity times, Project time-cost trade-off, Updating of the project progress. **Replacement and Maintenance Models –** Introduction, Types of failure, Replacement of items whose efficiency deteriorates with time, Replacement of items that fail completely, Other replacement problems.

Text Book:

1. E. Narayanan Nadar, Statistics, PHI.
2. J. K. Sharma, Operation Research – Theory & applications, Macmillan.

Reference Books:

1. P. N. Arora, S. Arora, Statistics, S. Chand.
2. Richard A. Johnson & Gouri K. Bhattavharyya, Statistics – Principles and Methods, Wiley.
3. S. C. Gupta, V. K. kapoor, Fundamentas of Mathematical Statistics, S. Chad & Sons.
4. Ken Black, Applied Business Statistics, Wiley.
5. Ravindran, Phillips & Solberg, Operation Research – Principles & Practice, Wiley.
6. R. Panneerselvam, Operations Research, PHI.
7. Prem Kumar Gupta, D. S. Hira, Operations Research, S. Chand.

Paper - IV: E-Commerce & Web Designing

UNIT - I

Introduction- Electronic Commerce And Physical Commerce, The DIGITAL Phenomenon, Looking At E-Commerce From Different Perspectives, Different Types Of E-Commerce, Some E-Commerce Scenarios, Changes Brought By E-Commerce, Advantages Of E-Commerce, Myths About E-Commerce Development And Implementation, System Model And Road Map Of This Book. **Internet And World Wide Web-** An Overview Of The Internet, Brief History Of The Web, Web System Architecture, Uniform Resource Locator, Overview Of The Hypertext Transfer Protocol, Hypertext Transfer Protocol (HTTP), Generation Of Dynamic Web Pages, Cookies, HTTP/1.1, Example. **Client Side Programming**- Important Factors In Client-Side Or Web Programming, Web Page Design And Production, Overview Of HTML, Basic Structure Of An HTML Document, Basic Text Formatting, Links, Images, ImageMap, Tables, Frames, Form, Cascading Style Sheets, Javascript.

UNIT - II

Server-Side Programming I: Servlet Fundamentals- Revisiting The Tree-Tier Model, Common Gateways Interface (CGI), Active Server Page (ASP), Overview Of Java Servlet, Java Servlet Architecture, Overview Of Servlet API, Building The Virtual Bookstore- Step By Step, Your First Servlet- Welcome To VBS, Compilation And Execution Of Servlets, An Interactive Servlet Program Example: Topics Of Interest, Topics Of Interest: Cookie Approach.

Server-Side Programming II: Database Connectivity- Introduction, Relational Database Systems, JDBC Perspectives, A JDBC Program Example: Simple Servlet Book Query, An Advance Book Query: Servletbookquerymulti, Advanced JDBC Servlet: VBS Advance Book Search Engine. **Server-Side Programming III: Session Tracking-** Introduction, Traditional Session Tracking Techniques, The Servlet Session Tracking Techniques, The Servlet Session Tracking API, A Practical Case: VBS Shopping Cart. **Basic Cryptography Enabling E-Commerce-** Security Concern, Security Requirements, Encryption, Two Basic Principles For Private Key Encryption, The Key Distribution Problem, Diffie-Hellman Key Exchange Protocol, Public Key Encryption, RSA Encryption Algorithm, Hybrid Encryption, Other Public Key Encryption Methods, Stream Cipher And Block Cipher, Message Digest, Message Authentication Code, Digital Signature, Digital Signature Standard, Authentication.

UNIT - III

Internet Security- IPSec protocol, setting up associations, the authentication header (AH) service, the encapsulating security payload (ESP) service, preventing replay attack, application of IPSec: virtual private network, firewalls, different types of firewalls,

example of firewall system, secure socket layer (SSL), putting everything together. **Advanced techniques for e-commerce-** introduction to mobile agents, WAP: the enabling technology for mobile commerce, XML (eXtensible Markup Language), Data mining.

UNIT - IV

Internet Payment System- Characteristics Of Payment System, 4C Payment Methods, SET Protocol For Credit Card Payment, E-Cash, E-Check, Micropayment System, Overview Of Smart Card, Overview Of Mondex, Putting It All Together For Payment In The VBS. Consumer **Oriented E-Commerce**- Introduction, Traditional Retailing And E-Retailing, Benefits Of E-Retailing, Key Success Factors, Models Of E-Retailing, Features Of Retailing, Developing A Consumer-Oriented E-Commerce System, The PASS Model. **Business Oriented Commerce- Features** Of B2B E-Commerce, Business Model, Integration. **E-Services-** Categories Of E-Services, Web-Enabled Services, Matchmaking Services, Information-Selling On The Web, E-Entertainment, Auctions And Other Specialized Services, Traditional Versus Internet Advertising, Internet Advertising Techniques And Strategies, Business Models For Advertising And Their Revenue Streams, Pricing Models And Measurement Of The Effectiveness Of Advertisements, Web Publishing- Goals And Criteria, Web Site Development Methodologies, Logical Design Of The User Interface I- Abstract User Interface, Logical Design Of The User Interface II- Flow Of Interaction, Usability Testing And Quality Assurance, Web Presence And Visibility.

Text Book:

1. Henry Chan, Raymond Lee, Tharam Dillon, & Elizabeth Chang, E-Commerce – Fundamentals and Applications, Wiley.

Reference Books:

1. Eric van der Vlist, Danny Ayers, Erik Bruchez, Joe Fawcett, AlessandroVernet, Professional Web 2.0 Programming, Wiely.
2. Michael P. Papazoglou, Pieter M.A. Ribbers, e-Business, Wiely.
3. Brian P. Hogan, HTML5 and CSS3, Shroff Publishers.
4. Sandeep panda, AngularJS – Novice to Ninja, Shroff Publishers.

Practical List of E-Commerce & Web Designing

1. Write a program in HTML to illustrate the use of Formatting tags => BOLD, ITALIC, UNDERLINE, SUPERSCRIPT, SUBSCRIPT, AND STRIKETHROUGH.

2. Write a paragraph centrally aligned and change the color of text to BLUE and Background to YELLOW. The size of the font should be 6.

3. Write a program in HTML to illustrate the below given formats.
   a) The page should contain a paragraph which is centrally aligned.
   b) FIRST line of the paragraph should be BOLD and ITALIC.

c) STRIKEOUT the Second Line.
d) Underline and change the color to RED, of the third line.
e) Change the font size of the fourth Line to 5.
f) Change the color of the text to GREEN.
g) Two horizontal lines below the paragraph.

4. Write a program in HTML to link two files.
   a) The name of the first file is LINK1.HTML and that of second file is LINK2.HTML.
   b) LINK2.HTML should contain a Back link also.

5. Write a program in HTML to Design a Table containing 5 columns and 4 rows. The name of the columns should be ENO, NAME, DESIGNATION, SALARY and CITY.

6. Write a program in HTML to design a Table containing 5 columns and 4 rows. The name of the columns should be ENO, NAME, DESIGNATION, SALARY and CITY. The table should also contain the below given specifications.
   a) Table should contain BORDER.
   b) Background color of the Table should be GREEN.
   c) Color of the Text should be BLUE.
   d) Text should be centrally aligned in the cell.

7. Write a program in HTML to Design a Table containing 5 columns and 4 rows. The name of the columns should be ENO, NAME, DESIGNATION, SALARY and CITY. Illustrate the usage of cell padding and cell spacing. Also align the Table to the CENTRE of the page.

8. Write a program in HTML to illustrate the usage of ROWSPAN in the below given format.

CITY	TOWN
NAGPUR	SHANKAR NAGAR
	DHARAMPETH
	RAMDASPETH
BOMBAY	DADAR
	V.T.
	THANE

9. Write a program in HTML to illustrate the usage of COLUMN SPAN (COLSPAN) in the below given format.

NAME	LIVING CITY	COMPANY CITY
SUJEET	CHHINDWARA	
TAPAN	NAGPUR	BOMBAY
RAM	BOMBAY	
MOHAN	BANGALORE	
KRISHNA	PUNE	
MANGESH	BOMBAY	NAGPUR
AVINASH	DELHI	

10. Write a program in HTML to divide the screen horizontally into two sections.

11. Write a program in HTML to divide the screen vertically into two sections.

12. Write a program in HTML to divide the Screen into 4 sections.

13. Write a program in HTML to demonstrate the usage of Marquee text with the below given Specifications.
    Marquee text is INTERNATIONAL COLLEGE.
    Color of text is BLUE.
    Background color is YELLOW.
    Size of Text is 7.
    Direction is LEFT to RIGHT.

14. Write a program in HTML to demonstrate the use of the Marquee Text with the below given Specifications.
    a) Marquee Text is INTERNATIONAL COLLEGE.
    b) Text color is BLUE.
    c) Repeat the Marquee Text five Times.
    d) Make use of SCROLLAMOUNT.
    e) Make use of SCROLLDELAY.

15. Write a program in HTML to demonstrate the usage of Image file with the below
    a) given specification.
    b) Background color of page is GREEN.
    c) The size of Image is 400 x 400 pixels.
    d) The Image should contain a border.
    e) Alternate text is “IMAGE NOT FOUND”.
    f) Image should appear on the centre of the page.

16. Write a program in HTML to Demonstrate the usage of Image file with the below given specifications.
    a) Background color is RED.
    b) The size of Image is 300 x 300 pixels.
    c) The image should contain a BORDER.
    d) Alternate Text is “IMAGE is NOT FOUND”.
    e) Vertical space should be 100 pixels.
    f) Horizontal space should be 350 pixels.

17. Write a program in Java Script which should prompt the user to enter the result of Question-“What is the result of 10+10?”. The user will be given a chance to answer the question. If the answer is correct then the program should raise a message-“Congratulations”. If the answer is wrong then the program should again ask the same question. If the answer is correct then the message should be –“Cleared in the second round” else another message should be generated specifying –“ Sorry, try next time” and the program should exit. Note – Make use of If. Else.

18. Write a program in Java Script which should prompt the user to enter the result of question –“ What is the Result of 10 +10?. At the most the user will get 5 chances to answer the question. If the user gives the correct answer during the attempts then the program should exit the loop by raising a message-“Congratulations “. Otherwise, whenever the answer is wrong the program should alert the user that the answer is wrong. Even during the 5^{th} attempt, if the answer is wrong then it should raise another alert message also specifying- “Sorry- Try Next Time”. (Use Loop, Prompt and Alert).

19. Write a program in Java Script which prompt the user to enter the Result of Question- “ What is the Result of 10+10?.

The program should repeat the question in two cases-

a. If the user is wrong.
b. And he wants to continue.

The program should exit the loop in two cases-

b) If the answer is correct.
c) If the answer is wrong but the user doesn't want to continue.
d) (Use odd Looping, Prompt, Alert and Confirm Dialog Boxes).

20. Write a program in Java Script which raises a Message:"
"Welcome To Our Website" as soon as the Site is loaded. It should also display a message: -"Thank You " when the user switch over from the page.

21. Write a program in Java Script to check the username. If the user name is correct, the program should give an alert message-: "Welcome" along with user name else the program should alert the user specifying that the user name is wrong. Use DOM and onchange event.

22. Write a suitable program in Java Script which displays a message depending on the radio button being clicked using DOM and onclick event.

23. Write a program in Java Script to count the number of elements in a forms elements array. Check the number of elements returned against the number of form elements described between < Form> and </Form> tag in HTML page that is running in the browser. Recognize that number of elements in the array match the number of elements described between <FORM> and </FORM> tag in HTML page exactly.

24. Write a program in Java Script to check whether the form is filled or not. If one of the elements is not filled then display an alert message to fill the particular element using DOM and BUTTON.

25. Write a program in Java Script to check whether the form is completely filled or not. If one of the elements is not filled then display an alert message to fill the particular element using DOM and onsubmit event.