

S.Y.B.Sc. (CBCS – 2018 Course)
SEM. - III
P – 31: MATHEMATICAL METHODS FOR PHYSICS

Total Credits: 04

Total Lectures: 60

Course Learning Outcomes:

By the end of this course student will be able to have following learning outcomes,

- Understanding of how partial differentiation works and different types of coordinates systems
- Ability to explain complex algebra using their different forms, associated theorems and trigonometric functions
- Explain the vector algebra and vector analysis
- Understanding of different vector identities and their physical significance

Course Content:

1. Partial Differentiation: (16)

Introduction, Idea, Definition and notation of partial differentiation, rules for obtaining partial derivative, total differential, exact differential, chain rule, Theorems of differentiation, change variables from the Cartesian to Spherical polar co-ordinates, problems based on change of variables, maxima and minima (Qualitative treatment), Problems, Frequently occurring differential equations (Cartesian coordinates), Degree, order, linearity and homogeneity of differential equation.

2. Complex Algebra: (16)

Complex Numbers, algebra of complex numbers, complex conjugate. Argand Diagram, Algebra of complex numbers by using Argand diagrams; Rectangular and polar form of complex numbers; Exponential form of complex numbers; Euler's relations De-Moivre's theorem (statement only), Trigonometric functions; exponential and hyperbolic functions, powers and roots of complex numbers; Applications of complex numbers to determine velocity and acceleration in Curved motion, Problems.

3. Vector Algebra (08)

Introduction to scalars and vectors, dot product and cross product of two vectors and its physical significance, Scalar triple product and its geometrical interpretation, Vector triple product and its proof, Problems.

4. Vector Analysis: (20)

Introduction, differentiation of a vector with respect to scalar, scalar and vector fields, Vector differential operator and Laplacian operator, gradient of a scalar, physical significance of a gradient of a scalar, physical significance of divergence of a vector field, curl of a vector field, its physical significances, del operator, some vector identities, Problems.

(a) $\nabla \times \nabla \phi = \mathbf{0}$, (b) $\nabla \cdot (\nabla \times \mathbf{V}) = \mathbf{0}$, (c) $\nabla \cdot (\nabla \phi) = (\nabla \cdot \nabla) \phi$, (d) $\nabla \cdot (\phi \mathbf{A}) = \nabla \phi \cdot \mathbf{A} + \phi \cdot (\nabla \cdot \mathbf{A})$,
(e) $\nabla \times (\nabla \mathbf{A}) = \phi (\nabla \times \mathbf{A}) + (\nabla \phi) \times \mathbf{A}$, (f) $\nabla \cdot (\mathbf{A} \times \mathbf{B}) = \mathbf{B} \cdot (\nabla \times \mathbf{A}) - \mathbf{A} \cdot (\nabla \times \mathbf{B})$

Reference books:

1. A Course in Mathematics - Laud and Takawale
2. Mathematical Methods in Physical Science - Mary Boas.
3. Mathematical Physics - B.D. Gupta and Gupta
4. Vector Analysis - Spiegel (Schaum Series)
5. Mathematical Physics - B.S. Rajput (Pragati prakashan)
6. Advanced Engineering Mathematics - Krezick (8th Edition)
7. Introduction to Classical Mechanics - R.G.Takwale and P. S. Puranic, Tata McGraw-Hill Publishing Company Ltd; New Delhi

S.Y.B.Sc. (CBCS – 2018 Course)
SEM. - III
P – 32: OPTICS

Total Credits: 04

Total Lectures: 60

Course Learning Outcomes:

By the end of this course student will be able to have following learning outcomes,

- Understanding the basics of optics
- Properties of light such as interference, diffraction and polarization
- Applications of properties of light in modern world

Course Content:

1. Geometrical Optics: (10)

Introduction, thin and thick Lenses, Sign convention, lens equation for thin lenses, Lens maker equation, Magnification of thin lens, Deviation by thin lens, Power of thin lens, Equivalent focal length of two thin lenses, Cardinal points, Optical instruments: Simple Microscope, Compound Microscope, Eyepieces - Ramsden and Huygen's Eyepieces, their merits and demerits, Problems.

2. Interference: (20)

Introduction - (Revision of Idea of coherence, Analytical treatment of interference - Intensity distribution in interference pattern, classification of interference), phase change on reflection (Stoke's treatment). Interference by parallel sided thin films, fringes of equal thickness (conditions for maxima and minima only), interference in thin wedge shaped films (normal incidence), Newton's rings. Theory and its application to determine wavelength of light, refractive index of liquid and flatness testing (Brief description)

3. Diffraction: (20)

Concept of diffractions, Fresnel and Fraunhofer diffractions - Fraunhofer diffraction at a single slit. Theory of plane transmission grating, intensity distribution in diffraction pattern, Fresnel diffraction - rectilinear propagation of light, simple theory of zone plate, Rayleigh's criteria of resolution, Resolving power, R.P of prism and transmission grating, crystal as a diffraction grating, Bragg's diffraction condition, Problems.

4. Polarization: (10)

Introduction to polarization, Methods to produce polarized light, Brewster's law, polarization by refraction/pile of plates, Law of Malus polarization by reflection, detection of polarized light, polarized by selective absorption, Double refraction in uniaxial crystals, Construction of polarizer, Quarter and Half Wave plates, Nicol prism, Problems

Reference Books

1. Geometrical and Physical Optics - Jenkins and White
2. Optics - Ajay Ghatak 2nd edition
3. Principles of optics - D.S. Mathur, Gopal Press, Kanpur
4. Optics - Brijlal and Subramanyam
5. Optics - Ghatak Loknathan.
6. A Text book of Optics - N.Subhramanyam, Brijlal, M. N. Avadhanulu, S. Chand publication
7. Lasers and Non-linear light - Dr. B.B. Laud
8. Laser Applications - Mont Ross (Academic Press).

S.Y.B.Sc. (CBCS – 2018 Course)

SEM. - III

P – 33: PRACTICAL COURSE - III

Total Credits: 02

Total Lectures : 60

Learning Outcome :

1. Study of acceleration due to gravity 'g' by resonance pendulum
2. Study of coupled oscillators
3. Measurement of Young's modulus and modulus of rigidity
4. To understand Zener stabilized power supply.
5. To know diode as rectifier and calculation of ripple factor

Course Content:

1. 'g' by resonance pendulum - change in length of simple pendulum for two different amplitudes of compound pendulum.
2. Log decrement - Determination of Log decrement in air
3. Study of coupled oscillators comprising two simple pendulum (Mechanical) and determination of coupling coefficient.
4. Study of musical scales using a signal generator and musical instruments.
5. Determination of frequency of AC mains using sonometer.
6. Measurement of coefficient of absorption of sound for different materials (cork, thermocol, mica, paper etc.)
7. Measurement of Y and η of given wire by Searle's method.
8. Y by vibration of wooden bar.
9. Velocity of Sound by phase shift method.
10. Study of acoustic resonance by using bottle as a resonator.
11. Newton's Ring: Determination of wavelength of monochromatic light source
12. Dispersive power of glass prism
13. Measurement of beam divergence / beam size of a LASER beam
14. Diffraction at the edge of a razor blade.
15. Optical activity of sugar solution (polarimeter)
16. Wavelengths of any three colors in the Hg spectrum using Diffraction Grating.
17. Zener stabilized power supply, load and line regulation and % ripple factor
18. Study of rectifiers & calculation of ripple factor with & without filter

Note: At least 8 experiments should be performed from the course

REFERENCE BOOKS:

1. Advanced Practical Physics - Worsnop and Flint
2. Advanced Practical Physics Vol I and 2, - Chauhan and Singh
3. Experimental Physics - Rajopadhye and Purohit
4. B.Sc. Practical Physics - C. N. Arora
5. Physics through Experiments Vol. 1, Mechanical System - B. Saraf
6. A Lab. Manual of Physics for undergraduate Students - D. P. Khandelwal
7. World Wide View of Physics - A. W. Joshi & others.

S.Y.B.Sc (CBCS-2018 Course)
SEMESTER – III
C - 31 : PHYSICAL & ANALYTICAL CHEMISTRY-I

Credits: 04

Total Lectures: 60

Course Learning Outcomes:

After completion of this course students should be able to:

1. Know the meaning of conductance ,specific conductance, molecular conductance etc.
2. Understand the efficiency of Carnot cycle.
3. Solve numerical based on entropy.
4. Study the real meaning of sampling.
5. Realize the actual calculations of significant figures.
1. 6.Analyse qualitative and quantitative estimation of C,H,(O)

Course Content:

SECTION - I (PHYSICAL CHEMISTRY)

1. Electrochemistry

[18]

Introduction, Conduction of electricity, Types of conductors: electronic and electrolytic, Explanation of the Terms: Specific, equivalent and molecular conductance's, relation between specific and equivalent conductance, variation of conductance with dilution, equivalent conductance at infinite dilution, Measurement of Conductance by Wheatstone Bridge, Types of Conductivity cells, Cell constant and its determination, Migration of Ions, Hittorf's Rule (Migration), Transport number, Determination of transport number by moving boundary method, Factors influencing transport number: Concentration, Temperature, Complex formation, Abnormal transport number, Degree of hydration, Kohlrausch Law: i)Relation between ionic conductance, ionic mobility and transport number ii) Determination of equivalence conductance at infinite dilution for weak electrolytes iii) Determination of degree of dissociation iv) Determination of ionic product of water v) Determination of solubility and solubility product of sparingly soluble salts.

Conductometric Titrations: Theory, general procedure, different types of conductometric titrations and applications of conductometric titrations.

Ref.7 Page no. 339-464.

2. Thermodynamics - I

[06]

Spontaneous and non-spontaneous process, Second law of thermodynamics and its different statements, Carnot's Theorem (Heat engine), Carnot cycle and its efficiency. Numerical.

Ref.1 and 2.

3. Thermodynamics - II

[06]

Entropy: Introduction, Concept of entropy, Entropy as a state function, Definition mathematical expression, unit, physical significance of entropy, Entropy changes for reversible and irreversible processes in isolated system, Entropy changes for an ideal gas as a function of V and T and as a function of P and T, Entropy change in mixing of gases. Entropy change in Physical transformations: (i) Fusion of a solid.(ii) Vaporization of a liquid. (iii) Transition from one crystalline form to another.

Third law of thermodynamics, Absolute entropy and Evaluation of absolute entropy, Use of absolute entropies: Determination of entropy changes in chemical reactions.

Ref.1 and 2.

REFERENCE BOOKS:

1. Essentials of Physical Chemistry (2012), S Chand & Co. Ltd., ArunBahl, B. S. Bahl & G. D. Tuli.
2. Advanced Physical Chemistry (2011), S Chand & Co. Ltd., D. N. Bajpai.
3. Physical Chemistry, G.M.Barrow, International Student Edition, McGraw Hill.
4. Physical Chemistry, R.A.Alberty, Wiley Eastern Ltd.
5. University General Chemistry, C.N.Rao, Macmillan.
6. Physical Chemistry Through Problems, S.K.Dogra, Wiley Eastern Ltd.
7. Principles of Physical Chemistry, Samuel H. Maron, Carl F. Prutton, Fourth Edn.

SECTION – II (ANALYTICAL CHEMISTRY)

1) Importance of Analytical Chemistry and Sampling [04]

The analytical process, types of analytical techniques and their comparison. Sampling, storage of samples, sampling of solids, liquids and gases,.

2) Errors in Quantitative Analysis. [06]

Accuracy, precision, mean deviation, standard deviation, classification of errors, minimization of errors, significant figures and computations, reliability of results, Numericals.

3) Theory of Qualitative Analysis [10]

Basic principle, common ion effect, solubility, solubility product, preparation of original solution, classification of basic radicals in groups, separation of basic radicals, removal of interfering anions (Phosphate and borate), detection of acidic radicals.

4) Analysis of Organic Compounds (Qualitative & Quantitative) [10]

I. Qualitative

A. Types of organic compounds, Characteristic tests and classifications, reactions of different functional groups, analysis of binary mixtures.

II Quantitative

B. Estimation of C, H, (O) by combustion tube, detection of nitrogen, sulfur, halogen and phosphorous by Lassigen's test.

C. Estimation of nitrogen by Dumas's Kjeldahl's flask method, estimation of halogen, sulphur and phosphate by Carious tube method.

D. Determination of empirical and molecular formula and numerical problems.

REFERENCE BOOKS:

- 1) The Quantitative Inorganic Chemistry - by A.I. Vogel
- 2) Fundamentals of Analytical Chemistry - by S.M.Khopkar
- 3) Quantitative Analysis - by Day and Underwood
- 4) Analytical Chemistry - by G.D.Christian

S.Y.B.Sc (CBCS-2018 Course)
SEMESTER – III

C-32 : ORGANIC & INORGANIC CHEMISTRY-III

Credits: 04

Total Lectures: 60

Course Learning Outcomes:

After completion of this course students should be able to:

1. Understand the types of organic reaction and mechanism of some name reactions.
2. Write stereochemistry of cycloalkanes.
3. Study of ethers and epoxides.
1. 4. Know synthesis and reactions of pyridine, quinoline & isoquinoline.
2. 5. Explain study of chemistry of d-block elements.
6. Describe the role metals in bioinorganic compounds.
7. Specify principles in metallurgy and its applications

Course Content:

SECTION – I (ORGANIC CHEMISTRY)

1. Organic reaction Mechanism [10]

- a) Introduction, types of reagents—electrophile, nucleophile and free radical.
- b) Types of organic reactions: Addition, Elimination (β -elimination and Hofmann elimination), substitution (aliphatic electrophilic and nucleophilic, aromatic electrophilic) and rearrangement.
- c) Mechanism: (i) Aldol condensation (ii) Markovnikov and anti-Markovnikov addition reaction (iii) SN^1 and SN^2 reactions

Ref. 1 & 4

2. Stereochemistry of Cycloalkanes [08]

- a) Baeyer's strain theory, Heat of combustion,
- b) cycloalkanes, factors affecting the stability of conformation,
- c) Conformation of cyclohexane - equatorial and axial bonds,
- d) Monosubstituted cyclohexane stability with $-CH_3$ and $-C(CH_3)_3$
- e) substitutes.

Ref. 3

3. Ethers and Epoxides [06]

- a) Ether linkage, classification, Nomenclature, Physical properties.
- b) Industrial source.
 - i) Williamson's synthesis.
 - ii) Diazomethane method.
 - iii) Alkoxy mercuration demercuration.
 - iv) Reactions of ethers with cold HI, hot HI and dil H_2SO_4 .
 - v) Synthesis of epoxides, Acid base catalyzed ring opening of epoxides, Reactions with Grignard reagent

(Ref.1, Pages 699 - 708, 713 - 719)

4. Heterocyclic Chemistry

[06]

- a) Introduction.
- b) Structure.
- c) Nomenclature.
- d) Synthesis and reactions of:- (i) Pyridine (ii) Quinoline (iii) Isoquinoline.
(Ref. 5 :- Sections 7 & 8, Pages :- 223-232, 273-293).

Reference Books:

1. Organic Chemistry-6h Ed. Morrison and Boyd Prentice Hall of India Pvt Ltd, New Delhi-2001.
2. Outline of Biochemistry 5h Ed., Conn, Stumpf Bruening and Roy Doi John Wiley 1987.
3. Stereochemistry of carbon compounds - E. L. Eliel
4. Reactions, rearrangements and reagents – S N Sanyal
5. Principles of modern Heterocyclic Chemistry By L.A. Paquette.

SECTION – II (INORGANIC CHEMISTRY)

1. Chemistry of d-block elements

[08]

Position of d-block in periodic table, electronic configuration, trends in properties of these elements w.r.t.(a) Size of atoms & ions (b) Reactivity (c) Catalytic activity (d) Oxidation states (e) Complex formation ability (f) Colour (g) Magnetic properties (h) Nonstoichiometry (i) Density (j) Melting & Boiling points.

Ref.1 Page no. 651-675 and

2 Page no. relevant pages.

2. Bioinorganic chemistry

[08]

Role of metals in bioinorganic compounds, Biological role of some alkali metals and transition metals: compounds of Ca, Mg, Fe and Co, Bioinorganic chemistry of iron, Haemoglobin and myoglobin, Functions of oxygen transfer, oxyhaemoglobin and deoxyhaemoglobin, photosynthesis; photosystem-I and photosystem-II, Vitamin B-12, Structure and Applications.

Ref.3. page no. 851-921

4. page no. 645-655.

3. General Principles of Metallurgy:

[08]

Introduction, occurrence of metals, ores and minerals, types of ores, operations involved in metallurgy, Crushing, Pulverisation, Methods of concentration such as Hand picking, Gravity separation, Magnetic separation. Froth flotation, Calcinations, Roasting etc.

Reduction, Various methods of reduction such as smelting, Aluminothermic process and Electrolytic reduction, Refining of metals, Various methods of refining such as poling, liquation, electrolytic and vapour phase refining (Van Arkel Process).

Ref. 5. page no. 262-271.

6. page no. 2.3-2.8, 2.13-2.17.

4. Metallurgy of Aluminium (Electrometallurgy):

[06]

Occurrence, Physiochemical principles, Extraction of Aluminium, Purification of bauxite by Baeyer's process, Electrolysis of alumina, Application of aluminum and its alloys.

Ref. 5 page no. 458-463. 6 page no. 2.209 to 2.211.

References:

1. Concise Inorganic Chemistry by J. D. Lee.
2. General Chemistry-Raymond Chang.
3. Inorganic Chemistry-James Huheey, Third Edⁿ
4. Inorganic Chemistry-Shriver and Atkins, Third Edⁿ.
5. Advanced Inorganic Chemistry, Satyaprakash, Tuli, Basu,
6. Text book of Inorganic Chemistry, P.L. Soni.

S.Y.B.Sc (CBCS-2018 Course)
SEMESTER – III

C-33 : PRACTICAL COURSE - III

Credits: 02

Course Learning Outcomes:

After completion of this course students should be able to:

1. Study the reaction between $K_2S_2O_8$ and KI.
2. Determine the normality of strong acid conductometrically.
3. Find out the CST of phenol-water system.
4. Analyse binary mixture of organic compound.
5. Estimate the Vitamin C and Acetamide.

Course Content:

A. PHYSICAL CHEMISTRY EXPERIMENTS (Any 5)

- 1 To study the reaction between $K_2S_2O_8$ and KI (Equal concentrations).
- 2 To determine the normality of the given strong acid by titrating it against strong alkali conductometrically.
- 3 Determination of solubility of benzoic acid at different temperature and to determine ΔH of dissociation process.
- 4 To determine critical solution temperature of phenol water system
- 5 To determine molecular weight of given organic liquid by steam distillation
- 6 To study neutralization of acid (HCl) base (NaOH) and CH_3COOH by NaOH and H_2SO_4 by NaOH.
- 7 To determine the rate constant of base catalyzed ester hydrolysis.
- 8 To determine the specific and molar refractions of benzene, toluene and xylene by Abbe's refractometer and hence determination of the refraction of $-CH_2-$ group (Methylene group). (Densities should be determined by students.)

B. ORGANIC CHEMISTRY EXPERIMENTS

Organic qualitative analysis: (3 Mixtures)

a) Separation of binary mixtures (without ether) followed by Type determination, Recrystallization, M.P./B.P. of separated organic components from mixture.

Type determination, Recrystallization, M.P./B.P.

The following compounds should be selected:-

Acids:- Benzoic, salicylic, phthalic, cinnamic and oxalic acid.

Phenols:- α -Naphthol, β -Naphthol & Resorcinol

Bases:- Aniline, p-Toluidine, o-Nitroaniline, p-Nitroaniline, mNitroaniline, and N-N dimethyl aniline.

Neutrals:- Acetone, Ethylmethyl ketone, Ethyl acetate, Naphthalene, m-Dinitrobenzene, Nitrobenzene, Acetanilide, Thiourea

Volumetric analysis : (Any two)

- (i) Estimation of Acetamide.
- (ii) Estimation of Carboxylic acid.
- (iii) Estimation of Vitamin C

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SEMESTER-III

B - 3 1 : ANGIOSPERM TAXONOMY

Core Course – Theory; Credits- 04

Total lectures- 60 L

Course Learning Outcomes :

On Completion of this course, students are able to:

1. Know the vegetative characteristics of the plant.
2. Know the scope and importance of the discipline.
3. Learn about the reproductive characteristics of the plant.
4. Understand the plant morphology and the diversity of angiosperms.
5. Understand the comparative account among the families of angiosperms.
6. Know the economic importance of the angiosperm plants.
7. Understand plant communities and ecological adaptations in plants.

Course content

TAXONOMY

- 1. Introduction to plant taxonomy: 09 L**
Definition, objectives, importance, concept of systematics and taxonomy.
- 2. Aspects of plant systematic: 09 L**
System of classification: Natural, Artificial and Phylogenetic.
- 3. System of classification: 09 L**
Salient features of Bentham & Hooker's and Engler&Prantle's system of classification with merits & demerits.
- 4. Botanical nomenclature: 11 L**
Salient features of ICBN; concept of binomial nomenclature, taxonomic ranks and concept of species.
- 5. Study of plant families: 22 L**
Study of following flowering plant families according to Bentham & Hooker's system distribution, distinguishing character, floral formula, floral diagram and economic importance.
 - Annonaceae
 - Brassicaceae
 - Meliaceae
 - Caesalpinaceae
 - Apiaceae
 - Asteraceae
 - Solanaceae
 - Acanthaceae
 - Euphorbiaceae
 - Amaryllidaceae

Reference Books:

1. Cronquist, A. 1968. The evolution and classification of flowering plants. Thomas Nelson (Printers) Ltd., London & Edinburgh.
2. Delevoryas Th. 1965. Plant Diversification. modern biology series, Halt, Rinehart & Winston, New York.
3. Foster, A.S. and Gifford, A.E.M., Jr. 1967. Comparative Morphology of Vascular Plants. Vakils. Peffer& Simons Pvt. Ltd.
4. Spome, K.R. 1977. The Morphology of Angiosperms. B.I. Publication, Bombay.
5. Bhowani. S.S. and Bhatnagar, S.P. 2000. The Embryology of Angiosperms, 4th revised and enlarged edition. Vikas publishing house, Deihi.
6. Johri B.M.1984, Embryology of Angiosperms. Springer-Verlag, Berlin.
7. V.N.Naik, 1985. Taxonomy of Angiosperms.
8. P.Shukla and S.Mishra, 1979. An Introduction to taxonomy of Angiasperms.
9. A text book of Botany – K.N.Dhumal *et al* Nirali Prakashan

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SEMESTER-III

B-32: DEVELOPMENTAL BOTANY & EMBRYOLOGY

Core Course – Theory; Credits- 04

Total lectures- 60 L

Course Learning Outcomes :

On Completion of this course, students are able to:

1. Understand the various components of stem and wood during its secondary growth.
2. Enlighten about the mechanism of pollination and basic structure of the embryo.
3. Understand the scope & importance of anatomy and embryology.
4. Know various tissue systems, normal and anomalous secondary growth in plants and their causes. Perform the techniques in anatomy.
5. Understand structure and development of microsporangium and megasporangium.
6. Understand male and female gametophytes.
7. Know fertilization, endosperm and embryogeny.

Course content

DEVELOPMENTAL BOTANY:

1. **Organization of higher plant body:-** **06 L**
Primary structure of root and shoot systems, tissue systems in plants.
Meristematic tissues: general characters, theories-Histogen theory, apical cell theory and Tunica corpus theory; shoot apical meristem, root apical meristem, lateral meristems and their functions, Permanent tissues.
2. **Epidermal tissue system-** **05L**
Epidermal cells, structure of typical stoma, types & functions, Epidermal outgrowths - trichomes and their functions.
3. **Mechanical tissues system-** **04L**
Types of mechanical tissues, distribution of mechanical tissues in
 - *Coleus, Zea maize.*
 - Leaf - *Eucalyptus, Cycas*
 - Root- *Zea maize* -Functions of the mechanical tissue system.
4. **Secondary growth:** **05L**
Normal secondary growth in dicotyledon root, stem and leaf root, monocotyledon root stem, and leaf; their tissues and their function
5. **Anomalous Secondary Growth:** **05L**
Definition, causes, anomalous secondary growth in *Bignonia, Borrhaevia, Dracena.*

EMBRYOLOGY

1. **Introduction to plant Embryology, definition and scope.** **03L**
2. **Microsporangium** **08L**
structure of tetrasporangiate anther, tapetum types, sporogenous tissue.
Microsporogenesis: Process, cytokinesis and its types. Types of microspore tetrad.
Male gametophyte: structure of pollen grain, development of male gametophyte.
3. **Megasporangium** **10L**
Structure and types of ovules – anatropous, orthotropous, amphitropous, campylotropous, circinotropous.
Megasporogenesis: Tenuinucellate and crassinucellate ovules, types of megaspore tetrads.

Female gametophyte: structure of typical 8-nucleate embryo sac, types and development of embryo sacs – monosporic, bisporic and tetrasporic.

4. **Fertilization** **08 L**
Pollen stigma interaction, self compatibility, entry of pollen tube, discharge of pollen tube content, fusion of gametes, syngamy, triple fusion, significance of double fertilization.
5. **Endosperm types:** nuclear, helobial, cellular. **03L**
6. **Embryo** - structure of dicot and monocot embryo (development not expected) **03L**

Reference books:

1. Carlquist, S, 1988, Comparative wood Anatomy: Systematic, Ecological and Evolutionary Aspects of Dicotyledonous wood, Spring-Verlag, Berlin.
2. Cutter, E.G. 1969. Part I. Cells and Tissues. Edward Arnold, London.
3. Cutter, E.G. 1971. Plant Anatomy; Experiment and Interpretation. Part II. Organs. Edward Arnold, London.
4. Esau, K. 1977. Anatomy of seed Plants, 2nd edition. John Wiley and Sons. New York.
5. Fahn, A. 1974. Plant Anatomy, 2nd edition. Pergamon Press, Oxford.
6. Fuller, K.W. and Gallon, J.R. 1985. Plant Products and New Technology. Clarendon Press, Oxford, New York.
7. Lyndon, R.F. 1990. Plant Development; The Cellular Basis Unwin Hyman, London .
8. Mauseth, J.D. 1988. Plant Anatomy. The Benjamin/Cummings Publishing Company Inc. Menlo Park, California. USA.
9. Nair. M.N.B. 1998. Wood Anatomy and Major Uses of Wood. Faculty of Forestry, Universiti Putra Malaysia, 43400 Serdang, Selangor D.E/. Malaysia.
10. Raghavan, V. 2000. Developmental Biology of Flowering Plants. Springer-Verlag, New York.
11. Raven P.H., Evert, R.E. and Eichhorn, S.E. 1999. Biology of Plants 6th edition W.H. Freeman and Co. Worslem Publishers, New York.
12. Steeves, T.A. and Sussex, I.M. 1989. Patterns in Plant Development, 2nd edition. Cambridge University Press, Cambridge.
13. Thomas, P. 2000. Trees: Their Natural History. Cambridge University Press, Cambridge.
14. Tippo, O. and Stern, W.L. 1977. Ornamental Horticulture, Macmillan India Ltd. New Delhi.
15. P. Maheshwary: Plant Embryology.

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SEMESTER- III

B 33 - Botany Practical course

Core Course – Practical; Credits- 02

Contact hours per practical – 04h

(ANY-10)

Course Learning Outcomes :

On Completion of this course, students are able to:

- Understand the plant morphology and the diversity of angiosperms.
- Understand the comparative account among the families of angiosperms.
- Know the economic importance of the angiosperm plants.
- Understand the scope & importance of Anatomy and Embryology.
- Know various tissue systems, normal and anomalous secondary growth in plants and their causes. Perform the techniques in anatomy.

Course content

ANGIOSPERM TAXONOMY

1.- 6 Study of plant families (according to Bentham & Hooker's system of classification) with the help of locally available specimen. E

- Annoniaceae
- Brassicaceae
- Meliaceae
- Caesalpinaceae
- Apiaceae
- Asteraceae
- Solanaceae
- Acanthaceae
- Euphorbiaceae
- Amaryllidaceae

7. Study hydrophytic and xerophytic plants and their adaptations. E

8. Methods of sampling plant communities. E

9. Determination of rain fall, temperature, light intensity and humidity of atmosphere. D

DEVELOPMENTAL BOTANY & EMBRYOLOGY

10. Study of epidermal structures - E

- i) Stomata - types with suitable examples.
- ii) Multilayered epidermis in *Nerium* and *Opuntia*.
- iii) Trichomes - types with suitable examples.

11. Study of mechanical tissues in E

- i) Stem - *Coleus*, maize.
- ii) Leaf - *Eucalyptus*, *Cycas*. Root - Maize.

12. Study of vascular cambium in stem and root. Secondary growth in dicot stem and root. E

13. Study of anomalous secondary growth in *Bignonia*, *Borrhaevia* and *Dracena* by hand sectioning method. E

14. Study of types of ovules. E

15. Study of dicoylidons and embryo E

16. A)Study of pollen grains by acetolysis method. E

B)Study of pollen grains by NPC observation. E

Reference books:

1. Copeland, R.A 1996, Enzymes: A Practical introduction to Structure, Mechanism, and Data Analysis. VCH Publisher, New York.
2. Dryer, R.L. and Lata, G.F. 1989, Experimental Biochemistry. Oxford, University Press, New York .
3. Moore, T.C. 1974. Research Experience in plant Physiology. A Laboratory Manual. Springe-Verlag, Berlin.
4. Wilson, K. and Goulding , K.H. (Eds)1986. A Biologists Guide to Principles and Techniques of Practical Biochemistry. Edward Arnold, London, Uk.
5. Practical Botany-S. B. Agarwal
6. A Mannual in Plant Physiology Practical –Vaidya&Kulkarni
7. Practical Botany- By S C Santra, Vol. 1, Vol. 2, New Central Book Agency (P) Ltd., Kolkata.

S. Y. B.Sc. (CBCS - 2018 Course)
SEMESTER III

Z 3 1 : Functional Anatomy of Non-Chordates II and Biodiversity

Total Credits: 04

Total lectures: 60

Course Outcomes:

On completion of the course, students are able to:

1. Understand the systematic position and external morphology of Starfish.
2. Understand and study the various systems like structure and types of pedicellariae, digestive system, respiratory system, nervous system, sense organs, autotomy and regeneration in starfish.
3. Understand the classification and diversity of various classes of phylum Arthropoda, Mollusca, Echinodermata, Hemichordata.
4. Understand and study classification and general characters of Nematoda, Nematode development.
5. Study and understand various types of shell and foot modification in Mollusca.
6. Explain, study and understand concept of mimicry in insects.
7. Study and understand metamorphosis in insects.
8. Gain knowledge about Bioluminescence.

Course Content

UNIT I

15L

Study of starfish (*Asterias rubens*)

- i) Systematic position, Habits and habitat.
- ii) External characters.
- iii) Structure and types of pedicellariae.
- iv) Digestive system – Alimentary canal, food, feeding mechanism and physiology of digestion.
- v) Water vascular system.
- vi) Nervous system and sense organs.
- vii) Reproductive system, Larval development and metamorphosis.
- viii) Autotomy and regeneration.

UNIT II

20L

Salient features and classification upto class of the following : (any two examples from each class)

- i) Arthropoda – Crustacea, Arachnida, Insecta, Myriapoda, Onychophora
- ii) Mollusca – Aplacophora, Gastropoda, Pelecypoda, Scaphopoda, Cephalopoda
- iii) Echinodermata - Asteroidea, Ophuroidea, Holothuria, Echinoidea, Crinoidea
- iv) Hemichordata – Enteropneusta, Pterobranchia

UNIT III

Study of following with reference to

20L

- i) Nematoda – Classification and general characters of Nematoda, Nematode development, Some common nematode parasites of man (Any Four)
- ii) Arthropoda – Metamorphosis in Insects, Mimicry in Insects
- iii) Mollusca – Shell and foot modification in mollusca

UNIT IV

05L

Bioluminescence in Firefly

Reference books :

1. The invertebrates – Hyman L. H.
2. Arthropoda, Mollusca and Echinodermata – Kotpal R.L.
3. Mollusca – Mortan J.E.
4. Echinodermata – Nicholas D.
5. Zoology, Non-chordates – Marathe, Agarkar and Joshi. Narendra Publication.
6. Invertebrate Zoology (1983). – E.L. Jordan and P.S. Verma
7. Biology of higher invertebrates – Russell- Hunter.
8. Invertebrates – Kotpal R.C.
9. A Text book of Invertebrate zoology – Prasad S. N.
10. A Text book of Invertebrate zoology – Srivastava M.
11. Modern text book of zoology – Invertebrates – Kotpal, Agarwal and Khetarpal.
12. Invertebrate structure and function – Barrington.
13. Biology of Non-chordates – Nigam
14. Invertebrate Zoology – Barnes.
15. Textbook of Zoology – Invertebrates Vol.1(1992) – Parker and Haswell.
16. A life of invertebrate – Russel Hunter.
17. College Zoology – Boolootin and stiles.
18. A manual of practical Zoology Invertebrates – P.S. Verm

S. Y. B.Sc. (CBCS - 2018 Course)
SEMESTER III
Z 3 2 : Histology of Mammals

Total Credits: 04

Total lectures: 60

Course Outcomes:

On completion of the course, students are able to:

1. Understand the term histology.
2. Understand how tissues are produced from cells.
3. Understand and study cell, various types of tissue- structure and function, organ and system.
4. Study and understand gross anatomical structure of various organs through vertical section, longitudinal section and transverse section.
5. Study and understand gross anatomical structure and function of endocrine glands.

Course Content

UNIT I

20L

Study of Tissues

Review of the following tissues with reference to structure and functions.

i) Epithelial Tissues

- a) Simple epithelial tissue
- b) Compound epithelial tissue
- c) Glandular epithelium

ii) Connective Tissues

- a) Loose connective tissue
- b) Reticular tissue
- c) Adipose tissue.
- d) Skeletal tissue – Cartilage and Bone
- e) Fluid connective tissue – Blood and Blood cells

iii) Muscular tissue

- a) Smooth muscle
- b) Striated muscle
- c) Cardiac muscle

iv) Nervous tissue

- a) Neuron
- b) Nerve fibre

UNIT II

25L

Study of gross histological structure of different system organs Part I.

- i) Skin
- ii) Tooth
- iii) Tongue
- iv) Alimentary canal
 - a) Oesophagus b) Stomach c) Duodenum. D) Ileum
- v) Associated glands
 - a) Salivary glands
 - b) Liver
 - c) Pancreas

- vi) Respiratory system
 - a) Lung
 - b) Trachea

UNIT III

15L

Study of gross histological structure of different system organs Part II.

- i) Kidney
- ii) Spinal cord
- iii) Reproductive organs
 - a) Testis
 - b) Ovary
- iv) Endocrine glands- General idea of endocrine glands
 - a) Pituitary gland
 - b) Thyroid gland
 - c) Adrenal gland

Reference books :

1. Histology of Mammals by : Athavale M.V. & Latery A.N.Narendra Prakashan,Pune.
2. Bailey's Text Book of Histology by : W.M.Copenhaver R.P. Bunge M.B.Bunge.
3. An Atlas of Histology by : W.H. Freeman B. Bracegirdle.
4. Histology by : A.W. Ham Lippincott.
5. A Text Book of Histology by : W. Bloom D.W. Fawcett(1975) Saunders,Philadelphia.
6. Histology: Greep, R. O. and Well L.

S. Y. B.Sc. (CBCS - 2018 Course)
SEMESTER III
Z 33 : Zoology Practical course
(Practical based on paper: Z-31, Z-32)

Total Credits: 02

Contact hours per practical – 04 h

Course Outcomes:

On completion of the course, students are able to:

1. Study of general and distinguishing characters and classification of non-chordates with the help of museum specimens.
2. Understand the systematic position and external characters of Starfish.
3. Understand digestive system, water vascular system in Starfish.
4. Understand structure of T. S. of arm of starfish, tube feet and gonads in starfish.
5. Understand shell and foot modification in Mollusca with some examples.
6. Impart the knowledge about mimicry in insects.
7. Students gain fundamental knowledge of various types of tissues with the help of permanent slides.
8. Gain knowledge and understand structure of various organs with the help of permanent slides.

Course Content

Functional Anatomy of Non-Chordates II and Biodiversity

1. Study of general and distinguishing characters and classification of non-chordates upto class level with one example of each class. **D**
(Sketches/Photographs may be used)
 - a. Arthropoda
 - b. Mollusca
 - c. Echinodermata
 - d. Hemichordata
2. Study of systematic position, external features and digestive system of Starfish. **D**
3. A. Study of water vascular system of Starfish. **D**
B. Temporary preparation of gonads and tube feet from star fish. **E**
4. Study of permanent slides of T. S. of an arm of Starfish and bipinnaria larva. **D**
5. Study of shell in mollusca. **D**
6. Study of foot in mollusca. **D**
7. Study of Mimicry in insects. **D**

Histology of mammals

1. Study of permanent slides of tissues. **D**
 - a. Squamous epithelium
 - b. Columnar epithelium
 - c. Areolar connective tissue
 - d. Hyaline cartilage
 - e. Smooth muscle fibre
 - f. Striated muscle fibre

9. Study of permanent slides of following organs. **D**
- a. Skin – vertical section
 - b. Tooth – vertical section
 - c. Tongue – vertical section
 - d. Oesophagus – cross section
 - e. Stomach – cross section
 - f. Duodenum – cross section
 - g. Ileum – cross section
 - h. Salivary gland – parotid
 - i. Liver – cross section
 - j. Pancreas – cross section
 - k. Trachea – cross section
10. Study of permanent slides of following organs. **D**
- l. Kidney – longitudinal section
 - m. Spinal cord - cross section
 - n. Testis - cross section
 - o. Ovary - cross section
 - p. Thyroid gland - cross section
 - q. Adrenal gland - cross section
 - r. Pituitary gland - cross section

Reference books:

1. A Manual of Practical Zoology Invertebrate : P. S. Verma S.Chand and Co.,New Delhi.
2. A Manual of Practical Zoology Vol. I : Non- Chordata,1994: P. K. G. Nair and K. P. Aehar, Himalaya Publishing House,Bombay,Delhi,Nagpur.
3. A Manual of Practical Zoology Vol.II Non Chordata,1994: P. K. G. Nair and K. P. Aehar, Himalaya Publishing House,Bombay,Delhi,Nagpur.
4. Practical Zoology, Invertebrate/Vertebrate : S.S. Lal Rastogi Publications,Meerut.
5. Practical Invertebrate Zoology – 1972. V. S. Srivastava. Central Book Depot. Allahabad.
6. Kotpal, R.L., (All Series) Protozoa, Porifera, Coelenterata, Annelida, Arthropoda, Mollusca & Echinodermata - Rastogi Publications.
7. A Text Book of Histology : W. Bloom D.W. Fawcett(1975) Saunders, Philadelphia.

S. Y. B.Sc. (CBCS - 2018 Course)
Semester III
MB - 31 Microbial Metabolism

Total credits 04

Total 60 Lectures

Course Outcomes:

At the end of this course the students will be able to:

1. Understand different aspects of microbial metabolism needed for commercial exploitation of microorganisms.
2. Understand different properties of enzymes.
3. Know how to investigate the active site of enzymes
4. Understand different ways of transportation of nutrients
5. Know differential photosynthesis in bacteria, plants and algae.

Course Content

No. Of lectures

(I)	Enzymes	(15)
	<ul style="list-style-type: none">i) Physicochemical properties of enzymesii) Theories of enzyme catalysis<ul style="list-style-type: none">a) Proximation effectb) Pauling concept of strainc) Acid-Base Catalysisd) Covalent Catalysisiii) Nomenclature of enzymesiv) Factors affecting enzyme activity – pH & Temperaturev) Mechanism of enzyme action:<ul style="list-style-type: none">a) Lock and Key hypothesisb) Induced fit hypothesisvi) Enzyme specificity –<ul style="list-style-type: none">a) Absolute specificityb) Group specificityc) Optical specificityd) Geometrical specificityvii) Introduction to ‘Allosteric Enzymes’viii) Biological role of Enzymesix) Methods of investigation of active site<ul style="list-style-type: none">a) Trapping of ‘Enzyme substrate complex’b) Use of ‘substrate analogues’	
(II)	Bioenergetics	(12)
	<ul style="list-style-type: none">i) Principles of Bioenergeticsii) Role of ATP in bacterial metabolismiii) Reducing power and its significance in bacterial metabolismiv) Generation of ATP through substrate level phosphorylationv) Component's of Electron Transport chain (ETC)<ul style="list-style-type: none">a) Flavoproteins (FMN & FAD)b) Quinones (Ubiquinone & Menaquinone)c) Iron sulphur proteinsd) Cytochromesvi) Generation of ATP through ETC	

- (III) Energy Cycles (18)**
- i) Energy Production by Anaerobic Processes
 - a) EMP pathway
 - b) Pentose phosphate pathway
 - c) Entner Doudoroff pathway
 - ii) Energy Production by aerobic processes
 - a) Tricarboxylic Acid cycle
 - b) Anaplerotic reactions of 'Tricarboxylic Acid cycle'.
- (IV) Transport of Nutrients by Bacteria: (08)**
- i) Passive Diffusion
 - ii) Facilitated Diffusion
 - iii) Group Translocation
 - iv) Active Transport
- (V) Photosynthesis (07)**
- i) Bacterial Photosynthesis
 - ii) Concept of 'Purple Membrane' in *Halobacterium* and its significance.
 - iii) Plant /Algal/*Cynobacterial* Photosynthesis.

References:

1. Michael Pelczar ECS Chan, Noel Krieg, Microbiology 11th print 1998, Tata Mcgraw Hill Publishing Company Limited, New Delhi. (Topic No. II and III)
2. Prescott L.M., J.P. Harley and D.A. Klein Microbiology 5th Edition 2002, McGraw Hill Higher Education.(Topic No. II)
3. Roger V. Stainier 1995, John L. Ingraham, Mark L. Wheelis, Page R. Painter, General Microbiology 5th Edition, Macmillan Press Ltd., Houndmills, Basingstoke Hampshire & London.(Topic No II and IV)
4. Tortora G.J., B.R. Funke and C.L. Case Microbiology an Introduction , 8th Edition Pearson education
5. Voet D and J.G.Voet (2004) Biochemistry 3rd Edition Vol I John Wiley & Sons Inc.(Topic No. II)
6. Trevor,Palmer,Understanding of Enzymes,2ⁿ Edition,John Wiley& sons limited(Topic No-I)
7. Kulkarni,Deshpande,General Enzymology,First Edition,Himalay Publishing House(Topic No.I)

S. Y. B.Sc. (CBCS - 2018 Course)

Semester III

MB – 32 Bacterial Genetics

Total credits 04

Total 60 Lectures

Course Outcomes:

At the end of this course the students will be able to:

1. Understand different aspects of genetics needed for commercial exploitation of microorganisms.
2. Understand replication of bacterial DNA.
3. Know concept of genetic code and the process of translation and transcription in bacteria.
4. Understand the process of mutagenesis and repair.

Course Content

No. Of lectures

I. Structure of DNA, Gene and Chromosome	13
i) Characteristics of Genetic Material	
ii) The Molecular Basis of Heredity:-	
a) Different experiments which helped to understand the structure and function of DNA 1928-1956	
b) RNA as Genetic Material	
iii) The Structure of DNA	
a) The Primary and Secondary Structure of DNA	
b) DNA Methylation, Bends in DNA	
II. DNA Replication	15
i) Semi conservative Replication	
ii) Meselson and Stahl's Experiment	
iii) Requirements of Replication: Enzymes, Proteins and mechanisms involved	
iv) The Mechanism of Replication:	
a) Initiation, Unwinding, Primers, Elongation, Termination	
b) Bacterial DNA Replication- Components required for Replication	
c) The fidelity of DNA replication	
III. The Genetic Code	12
i) The one gene one enzyme hypothesis	
ii) The Genetic code:	
a) Milestones in deciphering the Genetic code	
b) Dictionary of the Genetic code	
iii) Features of the Genetic code:	
a) Genetic code is degenerate	
b) Genetic code is universal	
c) Genetic code is a triplet code	
d) Genetic code is non-overlapping	
e) Genetic code is comma less	

- iv) Initiation and Termination codons
- v) Wobble hypothesis, Isoaccepting tRNAs
- vi) The Central Dogma, Overlapping Genes
- vii) The process of Transcription and Translation

IV. Mutagenesis and Repair

20

- i) Mutagenesis: Definitions, Auxotrophic Mutants, Conditional Lethal mutants, Resistant Mutants. Experiments using mutants
- ii) Mutations are Spontaneous or induced?: Luria and Delbruck Experiment, the Newcomb Experiment, The Lederberg's Experiment
- iii) Mutation Rate: Calculation of mutation Rates
- iv) Types of Mutations:
 - a) Microlesions and Macrolesions: different types
 - b) Transitions and Transversions
 - c) Chemicals that mimic normal DNA bases-base analogs
 - d) Chemicals that react with DNA bases-base modifiers
 - e) Chemicals that bind DNA bases- Intercalators
 - f) Mutagens that physically damage the DNA; Ultraviolet light and ionizing radiations
- v) Reversion and suppression: Types with examples
- vi) Isolating mutants : Réplica plating, Enrichment techniques
- vii) Complementation
- viii) Ames' Test: How have we exploited mutants?
- ix) Repair:
 - a) Photo- reactivation
 - b) The methyl – Directed mismatch Repair system
 - c) Nucleotide Excision repair d) Recombination repair
 - d) SOS inducible repair

References:

- Gardner E.J, Simmons M.J and D.P.Snustad (1991) Principles of Genetics.8th edition, John Wiley and Sons.Inc.
- Lewin B (2000) Genes VII.Oxford University Press.
- Pierce B.A. (2005) Genetics a conceptual Approach 2nd Edition W.H. Freeman and Company New York. Chapter No. 10,12,15,17.
- Russel P.J. (2006) 1. Genetics a Molecular Approach. 2nd Edition Pearson Benjamin Cummings san Fransisco, Boston New York. Chapter No. 1,2,3,4,5,6,7.
- Stanier R Y, J.N.Ingraham, M.L.Wheelis and P.R.Painter (1996) General Microbiology, 5th Edition, MacMillan Press.
- Snyder L and W. Champers (2003) Molecular Genetics of bacterial 2nd Edition ASM Press, Washington. Chapter No. 1, 2,3,11.
- Trun Nancy and Janine Trempy (2004) fundamental Bacterial Genetics Blackwell Publishing. Chapter No. 2, 3, 4.

S. Y. B.Sc. (CBCS - 2018 Course)
Semester III
MB-33 : Practical Course
(based on MB 31, MB 32)

Course Outcomes:

At the end of this course the students will be able to:

1. Develop the skills for detecting different microbial enzymes.
2. Understand carbohydrate fermentations and other tests used for gross identification of bacteria.
3. Learn the techniques used for study and control of microbial growth.
4. Understand the basic laboratory techniques for the study of bacterial genetics.

Course content

Total number of Experiments: 18

- | | |
|--|-------------|
| I. Extracellular Enzymatic Activities of Micro-organisms | (04) |
| i) Starch hydrolysis | |
| ii) Lipid hydrolysis | |
| iii) Caesin hydrolysis | |
| iv) Gelatin hydrolysis | |
| II. Intracellular Enzymatic Activities of Microorganisms. | (06) |
| i) Carbohydrate fermentation – Lactose, Sucrose, Dextrose, | |
| ii) Triple Sugar Iron Agar test. | |
| iii) Hydrogen sulfide test. | |
| iv) Urease test. | |
| v) Litmus milk test. | |
| vi) Nitrate Reduction test. | |
| vii) Catalase test. | |
| III. Study of bacterial Growth | (02) |
| i) Enumeration of cell numbers-direct counting/ turbidometry. | |
| ii) Determination of viable count. | |
| IV. Study of Environmental Influences on Bacterial Growth | (02) |
| i) Study of Effect of Energy Source and Role of buffers on growth | |
| ii) Study of oxygen requirements of bacteria. | |
| V. Study of control of Microbial Growth by Antimicrobial Agents (Any Two) | (01) |
| i) Study of Effect of Antiseptic and Disinfectant. | |
| ii) Determination of Phenol coefficient. | |
| ii) Study of lethal action of UV light and photoreaction in Bacteria. | |
| VI. Study of Bacterial Genetics (Any Two) | (02) |
| i) Isolation of Temperature variants/Antibiotic Resistant variants. | |
| ii) Isolation of Nutritional Mutants by Replica plating | |
| iii) Mutant isolation by Gradient Plate method. | |

References:–

1. Bradshaw L. Jack (1979) Laboratory Microbiology, 3rd Edition W.B. Saunders co Philadelphia, London, Toronto.
2. Benson H.J. (1990) Microbiological Applications A Laboratory manual in General Microbiology, 5th Edition Wm. C Brown Publisher.
3. Cappuccino J.G. and N. Sharma (2004) Microbiology A Laboratory manual Sixth Edition.
4. Cruickshank R and J.P. Duguid (1980) Medical Microbiology Volume II, 12th Edition. The Practice of Medical Microbiology, Churchill Livingstone Edinburgh, London and New York.
5. Pelczar M.J. and E.C. Schwann (1972) Laboratory. Exercise in Microbiology 3rd Edition (Practical Manual Tata McGraw Hill) Edition New Delhi.
6. Sharma K. (2005) Manual of Microbiology Tools & Techniques Anne Book New Delhi.

S.Y.B.Sc. (CBCS 2018 Course)
Semester – III
M – 31: Calculus of Several Variables

Total Credit: 04

Total Lectures: 60

Course Learning Outcomes:

At the end of this course students are expected to be able to-

- i) Examine and evaluate the limits of functions of two and three variables.
- ii) Discuss and examine the continuity of functions at given points.
- iii) Expansions of functions about the point by Taylor's theorem.
- iv) Evaluate double and triple integrals.

Course content :

Unit 01 - FUNCTIONS OF SEVERAL VARIABLES:

1. Functions of two and three variables
2. Notions of limits and continuity for functions of two and three variables.
3. Simultaneous limit, limit along a path, repeated limits.
4. If $f(x,y)$ approaches to l as (x, y) approaches (a, b) then $f(x,y)$ approaches the limit l along any path (Proof).
5. Counter examples on continuity.
6. Partial derivatives and higher order partial derivatives
7. Chain rules.
8. Differential and differentiability. Necessary and sufficient Conditions for differentiability (with proof), Counter examples..
9. Euler's theorem for homogeneous functions and its corollary.
10. Converse of Euler's theorem (with proof).
11. Jacobians.

Unit-02 - MEAN VALUE THEOREMS.

1. Lagrange's mean value theorem for functions of two variables (with proof).
2. Taylor's theorem for functions of two variables (with proof).
3. Statement of Maclaurin's theorem (without proof).
4. Expansions of functions of two and three variables by using Taylor's Theorem, and Maclaurin's theorem.

Unit-03 - EXTREME VALUES

1. Extreme values for functions of two variables.
2. Maxima, minima and saddle points of functions of two variables.
3. Necessary condition for extreme values (with proof).
4. Sufficient condition for the existence of extreme values. (without proof).
5. Lagrange's method of undetermined multipliers.

Unit - 04 - MULTIPLE INTEGRALS -

1. Integrals over plane areas in xy plane.
2. Evaluation of double and triple integrals.
3. Area of a region by double integrals.
4. Volume by double and triple integrals.
5. Change of order of integration for two variables.
6. Change of variables in double integrals.
7. Change of variables in polar co-ordinates.
8. Illustrative examples of change of variables using Jacobians.

Reference Books :-

1. T. M. Apostol; Calculus, Wiley Student edition.
2. D. Somasundaram and B Choudhary : A first course in Mathematical Analysis; Narosa Publishing House, New Delhi 1997.
2. Gorakh Prasad : Differential Calculus; Pothishala Pvt. Ltd. Allahabad
3. Gorakh Prasad : Integral Calculus ; Pothishala Pvt. Ltd., Allahabad.
4. Shanti Narayan : A Course of Mathematical Analysis; S. Chand and Company, New Delhi.
6. J.N. Sharma - Mathematical Analysis - II (Chapter 4); Krishna Prakashan Mandir, 119 Shivaji Rd., Meerat
7. 7. J.N.Sharma - Differential Calculus (Chapter 3); Krishna Prakashan Mandir, 119 Shivaji Rd., Meerat
8. M.L.Khanna : Integral Calculus . (Chapter 5 & 7); Jai Prakash Nath

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S.Y.B.Sc. (CBCS 2018 Course)
Semester – III
M-32: Group Theory and Differential Equations

Total Credit: 04

Total Lectures: 60

Course Learning Outcomes:

At the end of this course students are expected to be able to.

- (i) Understand the concepts in Group and simple properties of group.
- (ii) Understand the concepts of subgroup and simple properties of subgroup.
- (iii) Understand the concept of differential equations of first order and higher degree.
- (iv) Concept of linear differential equations with constant coefficients.

Course content :

Unit-01: GROUPS :

1. Binary operations, definition and examples.
2. Definition of a group with examples.
3. Types of groups.
4. Simple properties of group.
5. Integral powers of Elements in a Group.

Unit-02 : SUBGROUPS :

1. Introduction.
2. Subgroups.
3. Criteria for a subset to be subgroup.
 - a. H is subgroup of G iff for all $a, b \in G$ implies $ab^{-1} \in G$
 - b. H is subgroup of G iff
 - i. for all $a, b \in G$ implies $ab \in G$
 - ii. $a \in G$ implies $a^{-1} \in G$
 - c. Intersection of two subgroups of a group G is also a subgroup G.
4. Order of an element in a group.
5. Properties of order of an element in a group.
6. Cyclic subgroups.
7. Properties of cyclic subgroup

Unit-03 : DIFFERENTIAL EQUATIONS OF FIRST ORDER AND HIGHER DEGREE

1. Equations solvable for p.
2. Equations solvable for y.
3. Equations solvable for x.
4. Clairaut's equation.
5. Lagrange's equation.

Unit-04 : LINEAR DIFFERENTIAL EQUATIONS WITH CONSTANT COEFFICIENTS:

1. Introduction.
2. Complementary function and Particular Integral.
3. Fundamental laws of operators, $f(D)y = o,$

4. The operator $\frac{1}{f(D)}$
5. Evaluation of $\frac{1}{f(D)} e^{ax}$
6. Evaluation of $(D^2 + a^2)^{-1} \sin ax$ and $(D^2 + a^2)^{-1} \cos ax$.
7. Evaluation of $\frac{1}{f(D)} x^m$
8. Evaluation of $\frac{1}{f(D)} e^{ax} V$ and $\frac{1}{f(D)} (xV)$

where V is a function of x

Reference Books :-

- 1) N.S. Gopalkrishana ; University Algebra ; Wiley Eastern, 1986.
- 2) P.B. Bhattacharya, S.K.Jain and S.R.Nagpal Basic Abstract Algebra (2nd Edition), Cambridge University Press, Indian Edition 1997.
- 3) Shanti Narayan : A Text Book of Modern Abstract Algebra, S.Chand & co; New Delhi.
- 4) Vivek Sahai and Vikas Bist : Algebra ; Narosa Publishing house. 1997.
- 5) D.A. Murry; Introductory course in Differential Equations; Orient Longman (India 1967)
- 6) E.A. Cochington; A Introduction to ordinary Differential Equations; Prentice Hall of India, 1961.
- 7) Gupta P.P.; Malik G.S.; Mittal S.K.; Differential Equations; Pragati Prakashan Meerut.
- 8) Earl D. Rainville and Phillip E. Bedient : Elementary Differential Equations; Maxwell Mac. Millan International Edition.
- 9) David A Murray: Introductory Course in Differential Equations; Orient Logman.

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S.Y.B.Sc. (CBCS 2018 Course)

Semester – III

M-33: Mathematics Practical Course-III

(Practicals based on the applications and Problems of articles in M-31 and M-32)

Total Credit :02

Course Learning Outcomes:

At the end of this course students are expected to be able to

1. Knowledge of applications of Euler's theorem, Taylor's theorem and Maclaurin's series.
2. Finding the extreme values of multivariable functions.
3. Solving the problems of double and triple integration.
4. Solving the Differential equations of first order and higher degree.
5. Finding the solution of Linear differential equations with constant coefficient.

Course content

List of Practicals:

- 1) Euler's theorem for homogeneous functions.
- 2) Expansions of functions of two and three variables by using Taylor's theorem and Maclaurin's theorem.
- 3) Lagrange's method of undetermined multipliers.
- 4) Necessary condition for extreme values.
- 5) Evaluation of double integrals by change of order of integration and change of variables in double integrals.
- 6) Problems in Groups.
- 7) Problems in Subgroups.
- 8) Differential equations of first order and higher degree.
- 9) Clairaut's equation and Lagrange's equation.
- 10) Linear differential equations with constant coefficients.

S.Y.B.Sc. (CBCS 2018 Course)

Semester – III

ENG 31: English – I

Course Outcomes:

At the end of this course, a student shall be able to:

- get exposed to the prose passages, grammar units and communicative skills
- read and interpret the various types of texts on their own and discuss them among peers
- communicate effectively by developing their proficiency in language
- understand their language abilities and facilitate them to with the necessary online & offline resources

Course content:

60

Lectures

a. Texts - *Pleasant Prose Selection* by Oxford University Press

- | | | |
|--------------------------|---|---------------------|
| 1. Old Man at the Bridge | - | Ernest Hemingway |
| 2. Mebel | - | W. Somerset Maugham |
| 3. Too Dear | - | Leo Tolstoy |
| 4. The Open Window | - | H.H. Munro ('Saki') |
| 5. The Bet | - | Anton Chekhov |
| 6. The Necklace | - | Guy de Maupassant |

b. Dialogue Writing:

- | | |
|---|---------------|
| 1. Asking, Giving & Refusing Permission | 2. Inviting |
| 3. Asking for Information | 4. Suggesting |

c. English Grammar:

- | | |
|-----------------|-----------------|
| 1. Prepositions | 2. Conjunctions |
|-----------------|-----------------|

The books recommended:

1. Chettur G. K.: *English Grammar, Composition and Essay*.
2. M.L. Tickoo: *A Remedial Grammar, Usage and Grammar* (Orient Longman, 1976)
3. Thomson A. J. & Martinet A.V.: *Practical English Grammar* (OUP, 1986).
4. Tickoo C. & Shashikumar J.: *Writing With Purpose* (Oxford University Press, 1979).

S.Y.B.Sc.: (CBCS 2018 Course)

Semester-III

SEC32: MARATHI - I

अध्ययन निष्पत्ती :

१. मराठीतील विज्ञान साहित्याच्या प्रेरणा, उगम, वाटचाल आणि विकास जाणून घेण्यास मदत झाली.
२. वैज्ञानिक साक्षरता व वैज्ञानिक दृष्टिकोन विकसित झाला.
३. विज्ञानाचा प्रसार स्वभाषेतून करण्यासाठी आवश्यक ती भाषिक क्षमता वाढीस लागली.
४. मराठीतील विज्ञान कथांचा स्थूल स्वरूपात परिचय झाला.

Total Credit :- 04

तासिका - ६०

घटक-विश्लेषण :

१. संकरित (विज्ञानकथासंग्रह) - डॉ.संजय ढोले, मेहता पब्लिशिंग हाऊस, पुणे
(१) उत्परिवर्तन (२) परिवर्तन (३) मोहीम फत्ते (४) कोळिष्टक (५) अकल्पित (६) संकरित
२. मराठी विज्ञान साहित्याच्या प्रेरणा
३. मराठी विज्ञान साहित्याची वाटचाल
४. मराठी विज्ञान साहित्याचा विकास
५. मराठी विज्ञान साहित्यातील कथांचे स्वरूप
६. विज्ञान साहित्य आणि मराठी वाचक
७. मराठी विज्ञान साहित्यातील विषयांची विविधता
८. निबंधलेखन

संदर्भ - साहित्य

१. विज्ञान : उदय व विकास-डॉ. प्र. न. जोशी, सन पब्लिकेशन्स, पुणे
२. श्रद्धा-अंधश्रद्धा-डॉ. नरेंद्र दाभोळकर, राजहंस प्रकाशन, पुणे
३. भ्रमनिरास -डॉ. नरेंद्र दाभोळकर, राजहंस प्रकाशन, पुणे
४. मराठी विज्ञान साहित्य-संपा. म. सु. पगारे, प्रशांत प्रकाशन, पुणे
५. विज्ञान कथा : स्वरूप आणि समीक्षा - श्री. विश्वेश्वर सावदेकर, शलाका प्रकाशन, मुंबई
६. विज्ञान साहित्य आणि संकल्पना- व. दि. कुलकर्णी, निरंजन घाटे, निहारा प्रकाशन, पुणे
७. विज्ञान युग- वार्षिक दिवाळी अंक १९८६, विज्ञान कथा विशेषांक
८. निबंध आणि कला - डॉ.प्र.न.जोशी, स्नेहवर्धन प्रकाशन, पुणे
९. व्यावहारिक मराठी - (संपा) डॉ.लीला गोविलकर, डॉ.जयश्री पाटणकर, स्नेहवर्धन प्रकाशन, पुणे
१०. व्यावहारिक मराठी - (संपा) डॉ.स्नेहल तावरे, स्नेहवर्धन प्रकाशन, पुणे

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S.Y.B.Sc. (CBCS 2018 Course)
Semester – III
UG - SEC 31: MEDICAL DIAGNOSTICS

Total Credits: 02

Total lectures: 30

Course Learning Outcomes:

On completion of the course, students are able to:

1. Understand and study importance of medical diagnostic.
2. Study diagnostics methods used for analysis of blood.
3. Study and understand diagnostic methods used for urine analysis.
4. Impart the knowledge about non-infectious and infectious diseases.
5. Understand and study types of tumors, detection and metastasis; MRI and CT Scan (using photographs).

Course Content

Unit 1: Introduction to Medical Diagnostic and its Importance

Unit 2: Diagnostics Methods Used for Analysis of Blood

Blood composition, Types of Blood groups, Methods of Blood grouping – slide method, six tube method, Haemolytic Disease of New born (HDN)

Unit 3: Diagnostic Methods Used for Urine Analysis

Urine Analysis: Physical characteristics; Abnormal constituents

Unit 4: Non-infectious Diseases

Causes, types, symptoms, complications, diagnosis and prevention of Diabetes (Type I and Type II), Hypertension (Primary and secondary), Testing of blood glucose using Glucometer/Kit

Unit 5: Infectious Diseases

Causes, types, symptoms, diagnosis and prevention of Tuberculosis and Hepatitis

Unit 6: Tumours

Types (Benign/Malignant), Detection and metastasis; MRI and CT Scan (using photographs).

SUGGESTED READINGS

1. Park, K. (2007), preventive and Social Medicine, B.B. Publishers
2. Godkar P.B. and Godkar D. P Textbook of Medical Laboratory Technology, II Edition Bhalani Publishing House
3. Cheesbrough M., A Laboratory Manual for Rural Tropical Hospital, A Basis for Training Courses
4. Guyton A.C. and Hall J.E. Textbook of Medical Physiology, Saunders
5. Robbins and Cortan, Pathologic Basis of Disease, VIII Edition, Saunders
6. Prakash, G. (2012), Lab Manual on Blood Analysis and Medical Diagnostics, S Chand and Co. Ltd.
