



SHIVAJI UNIVERSITY, KOLHAPUR.



Accredited By NAAC with 'A++' Grade

NATIONAL EDUCATION POLICY (NEP-2020)

Syllabus For

B. Sc. Part-I

Physics

Syllabus to be implemented from **AUGEST, 2022** onwards

Shivaji University, Kolhapur
B. Sc. Part – I Semester-I(NEP-2020)

PHYSICS PART-I

DSC A1 MECHANICS-I

Theory: 30 Hours Marks-50 (Credits: 02)



Unit-I

1. **Vector Algebra and Elementary Calculus** : (9 Hours)

Revision– (Vector Algebra: Components of Vectors and Unit Vector, Addition and Subtraction of Vectors), Scalar product, Vector product and their properties, Scalar triple product and its physical significance, Properties of scalar triple product, Vector triple product, properties of vector triple product. Derivatives of a vector with respect to a parameter (velocity and acceleration).

2. **Ordinary Differential Equations:** (6 Hours)

Differential equation, degree, order, linearity and homogeneity of differential equation, Types of Differential Equations: Ordinary and Partial differential equations, First order homogeneous differential equations, Second order homogeneous differential equations with constant coefficients, Examples.

Unit -II

1. **Conservation Theorems** : (9 Hours)

Single particle: Conservation theorem for linear momentum of a particle, Conservation theorem for angular momentum of a particle, work-energy theorem, Conservation theorem for energy of a particle.

System of particles: Center of mass, Conservation theorem for linear momentum, Conservation theorem for angular momentum, Conservation theorem for energy.

2. **Rotational Motion:** (6 Hours)

Angular velocity, Angular momentum, Torque, Kinetic energy of rotation, Moment of Inertia, Moment of inertia of a spherical shell about its diameter, Moment of inertia of solid cylinder about its axis of symmetry.

Reference Books:

1. Mathematical Physics -B. S. Rajput, 25th edition 2013, PragatiPrakashan, Meerut.
2. Mechanics – D. S. Mathur, 2009, S. Chand & Company Ltd., New Delhi.
3. Mathematical Physics – B. D. Gupta, 3rd edition, 2009, Vikas Publishing House Pvt. Ltd., New Delhi.
4. Mathematical Physics – P. P. Gupta, R. P. S. Yadav, G. S. Malik, 4th edition 1983-84, KedarNath Ram Nath, Meerut, Delhi.
5. University Physics. FW Sears, MW Zemansky and HD Young, 13/e, 1986, Addison - Wesley.
6. Mechanics Berkeley Physics course, V.1: Charles Kittel, et. Al. 2007, Tata McGraw Hill.
7. Physics – Resnick, Halliday& Walker 9/e, 2010, Wiley Eastern Ltd, New Delhi.
8. Engineering Mechanics, Basudeb Bhattacharya, 2ndedn., 2015, Oxford University Press.



9. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
10. Physics – S.G. Starling and Woodal Longmams and Green Co. Ltd.
11. Elements of properties of matter – D.S. Mathur, 2016, ShyamLal Charitable Trust, New Delhi.
12. A text Book of properties of matter–N.S. Khare and S. Kumar, Atmaram and Sons New Delhi.
13. Concepts of Physics Vol. I - H.C. Verma, 2014, BharatiBhavan Publishers.

PHYSICS PART-II
DSC A2 MECHANICS-II

Theory: 30 Hours
Marks-50 (Credits: 02)



Unit-I

1. Gravitation

Newton's Law of Gravitation, Motion of a particle in a central force field (motion in a plane, angular momentum is conserved), Kepler's Laws (statement only), Satellite in circular orbit and applications, Geosynchronous orbits, Weightlessness, Basic idea of global positioning system (GPS).

(9 Hours)

2. Oscillations

Simple harmonic motion, Differential equation of SHM and its solutions, Kinetic and Potential Energy, Total energy and their time averages, Damped oscillations, Forced oscillations.

(6 Hours)

Unit-II

1. Elasticity

(Revision Hooke's law, Stress-strain diagram, Definition of elastic constants (Y , η , K and σ)), Bending of beam, Bending moment, Cantilever (without considering weight of cantilever), Beam supported at both the ends (without considering weight of beam), Torsional oscillation and torsional couple per unit twist, Work done in twisting a wire, Torsional pendulum-Determination of rigidity modulus and moment of inertia, Determination of elastic constants (Y , η , and σ) by Searle's method.

(9 Hours)

2. Surface Tension

Surface tension (definition), Molecular theory of surface tension, Angle of contact, Young equation and wettability, Relation between surface tension, excess of pressure and radius of curvature, Experimental determination of surface tension by Jaeger's method, Factors affecting surface tension, Applications of surface tension.

(6 Hours)

Reference Books:

1. University Physics. F W Sears, M W Zemansky and H D Young 13/e, 1986. Addison-Wesley
2. Mechanics Berkeley Physics course, v.1: Charles Kittel, et. Al. 2007, Tata McGraw - Hill.
3. Physics – Resnick, Halliday & Walker 9/e, 2010, Wiley eastern Ltd, New Delhi.
4. Engineering Mechanics, Basudeb Bhattacharya, 2nd edn., 2015, Oxford University Press
5. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
6. Physics – S.G. Starling and Woodall Longmans and Green Co. Ltd.
7. Elements of properties of matter – D.S. Mathur, Shamlal Charitable trust New Delhi.
8. A text Book of properties of matter – N.S. Khare and S. Kumar, Atmaram and sons, New Delhi.
9. Concepts of Physics – Vol.1 H.C. Verma - Bharati Bhavan Publishers.

PHYSICS PART-III
DSC B1 ELECTRICITY AND MAGNETISM-I



Theory: 30 Hours
Marks-50 (Credits: 02)

Unit-I

(15 Hours)

Vector Calculus

Introduction, Del operator, gradient of scalar field and its physical significance, divergence of vector field and its physical significance, curl of vector field, line integral, surface integral, volume integral (definitions only), Gauss divergence theorem (statements and proof), Statements of Stoke's theorem, Greens symmetrical theorem.

Unit-II

(15 Hours)

Electrostatics

Electrostatic field, electric flux, Gauss's theorem of electrostatics, electric potential as line integral of electric field, potential due to a point charge, electric dipole, uniformly charged spherical shell and solid sphere, calculation of electric field from potential, capacitance of an isolated spherical conductor, parallel plate, spherical and cylindrical condenser, energy per unit volume in electrostatic field, dielectric medium, polarization vector, displacement vector, Gauss's theorem in dielectrics, Parallel plate capacitor completely filled with dielectric.

Reference Books:

1. Electricity and Magnetism, Edward M. Purcell, McGraw-Hill Education, Cambridge University Press, (1985).
2. Electricity and Magnetism, J.H. Fewkes & J. Yarwood., Oxford Univ. Press. Vol. - I, (1991).
3. Electricity and Magnetism, D C Tayal, Himalaya Publishing House, 2nd Edition (1988).
4. University Physics, Ronald Lane Reese, Thomson Brooks/Cole Publishing Company, (2003).
5. D.J. Griffiths, Introduction to Electrodynamics, Cambridge University Press, Pearson, (1999).
6. Electricity and Magnetism – N. S. Khare and S. S. Shrivastav, Atma Ram & Sons, Delhi. 9th edition (1976).
7. Foundations of Electromagnetic Theory, John R Reitz, Frederick J. Milford, Addison-Wesley Publishing Company 4th edition (2008)
8. University Physics– Hugh D. Young and Roger A. Freedman, Addison- Wesley Publishing Company, Inc., 9th edition, (1996)
9. Concepts of Physics, H. C. Verma, Bharti Bhawan publisher, Vol-2, (2016)
10. Mathematical Physics, B. D. Gupta, Vikas Publication House Pvt Ltd, 4th edition, (2009).
11. Electricity and Magnetism by R. Murugesan, S. Chand & Co., New Delhi, (2008).

PHYSICS PART-IV
DSC B2 ELECTRICITY AND MAGNETISM – II



Theory: 30 Hours
Marks-50 (Credits: 02)

UNIT I

1. A.C. Circuits

(07 Hours)

Complex numbers and their application in solving a. c. series LCR circuit using j operator and phasor diagram, Resonance in LCR series circuit, Sharpness of resonance (qualitative treatment only), Resonance in LCR Parallel circuit, complex Impedance, Reactance, Admittance, and Susceptance, Examples of series and parallel resonance, A.C. Bridge - Owen's Bridge Q-factor (definition only).

2. Network theorems

(04 Hours)

Review of network terminology (Circuit element, Active element, Passive element, Branch, Node or junction, Loop, Mesh, Voltage source, Current source, Ohms law, Resistances in series, Resistances in parallel), Thevenin theorem, Norton theorem, Equivalence between Thevenin theorem and Norton theorem, solved problems.

3. Ballistic Galvanometer:

(04 Hours)

Construction and working of B. G., expression for charge flowing through ballistic galvanometer, Correction for damping in galvanometer, Constants of ballistic galvanometer.

UNIT II

1. Magnetism

(08 Hours)

Introduction to magnetization and intensity of Magnetization, Biot-Savart's law & its applications- straight conductor, circular coil, solenoid carrying current, Divergence and curl of magnetic field, Magnetic vector potential, Ampere's circuital law.

2. Magnetic materials and their Properties

(07 Hours)

Magnetic intensity, magnetic induction, permeability, magnetic susceptibility. Hysteresis and hysteresis curve, diamagnetic, paramagnetic, ferromagnetic, ferrimagnetic and anti-ferromagnetic materials.

Reference Books

1. Electricity and Magnetism, Edward M. Purcell, 1986, McGraw-Hill Education.
2. Electricity and Magnetism, J.H. Fewkes & J. Yarwood. Vol.I, 1991, Oxford University Press.
3. Electricity and Magnetism, D C Tayal, 1988, Himalaya Publishing House.
4. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
5. Electricity and Magnetism, Khare and Shrivastav. Atma Ram & Sons, Delhi, 1976
6. University Physics 9th Edition, Young and Freedman.
7. Foundations of Electromagnetic Theory, Ritz and Milford. Pearson Publication
8. Electricity and Magnetism, Gupta, Kumar and Singal
9. Basic Electronics and Linear Circuits, N.N. Bhargava, D.C. Kulshrestha and S.S. Gupta, Tata McGraw-Hill
10. Electronic Fundamentals and Applications, J.D. Ryder. Prentice-Hall of India Pvt. Ltd
11. Network theory and Filter Design, V.K. Aatre, New Age International Publisher
12. Principles of Electronics, V.K. Mehata, S. Chand Publication, New Delhi

B. Sc. Part – I
PHYSICS PRACTICAL



Marks 50 (Credits: 02)
DSC A- LAB: MECHANICS

1. Measurements of length (or diameter) using Vernier caliper, screw gauge and travelling microscope.
2. To determine the Moment of Inertia of a Flywheel.
3. To determine the Moment of inertia of a disc using auxiliary annular ring.
4. To determine modulus of rigidity of material of wire by torsional oscillations.
5. To determine Young's modulus of material of Bar by vibration.
6. To determine Y/η of Wire by Searle's method.
7. To determine 'g' by Bar Pendulum.
8. To determine Poisson ratio of rubber (rubber tube).
9. To study exponential decay of amplitude of simple pendulum.
10. To determine surface tension of water by Jaeger's method

DSC B- LAB ELECTRICITY AND MAGNETISM

1. To use digital multimeter for measurement of (a) Resistances, (b) AC and DC Voltages, (c) DC Current and (d) checking electrical fuses.
2. To level the prism table using spirit level and optical method and hence determine angle of prism using spectrometer.
3. To determine constants of B. G. (Figure of merit, Current sensitivity, Voltage sensitivity and charge sensitivity)
4. To compare capacitances using De'Sauty's bridge (B.G/Spot Galvanometer).
5. To determine low resistance by Carey Foster's Bridge.
6. To determine impedance of series LCR circuit.
7. To study the series LCR circuit and determine its resonant frequency and quality factor.
8. To study a parallel LCR circuit and determine its anti-resonant frequency and quality factor.
9. To determine frequency of A. C. mains by sonometer for magnetic or non-magnetic material of wire.
10. To verify Thevenin / Norton theorem.

Reference Books:

1. Advanced Practical Physics for students, B.L.Flint&H.T.Worsnop, 1971, Asia Publishing House.
2. A Text Book of Practical Physics, InduPrakash and Ramakrishna, 11th Edition, 2011, KitabMahal, New Delhi.
3. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
4. College Practical Physics – Khanna and Gulati (S. Chand and Co. Ltd, Delhi).
5. Practical Physics – Gupta and Kumar (PragatiPrakationMeerat)
6. Advanced Level Practical Physics – J.M. Nelcon, J.M. Ogloom (EIBS).
7. Engineering Practical Physics- S. Panigrahi& B.Mallick,2015, Cengage Learning India Pvt. Ltd.

TITLES FOR REVISED THEORY COURSES



Semester	Physics Part	Course Code	Course title old and New
I	I	DSC A1	MECHANICS-I
	II	DSC A2	MECHANICS-II
II	III	DSC B1	ELECTRICITY AND MAGNETISM – I
	IV	DSC B2	ELECTRICITY AND MAGNETISM – II

• **Scheme of Practical Examination for B. Sc. Part –I**

1. Practical examination will be conducted annually.
2. Practical examination will be conducted for one day per batch.
3. The examination will be conducted in two sessions per day and each session will be of three hours duration.
4. Every candidate should perform one experiment each from Lab A and Lab B .
5. At least eighty percent practical should be completed by the student.
6. The marks distribution for practical is as below.

Practical groups	Marks
Group I	20
Group II	20
I)Certified laboratory journal	10
Total Marks	50

B. Sc. I Microbiology Practical Course

Paper -I & Paper-II	Practical Course I: Introduction to Microbiology and Microbial diversity (CREDITS: 02; TOTAL HOURS: 30)	No. of Hours per Unit/Credit
Unit I/ Credit I	Introduction to Microbial Techniques	15
	<ol style="list-style-type: none"> 1. Microbiology Good Laboratory Practices <ol style="list-style-type: none"> a) preparations of- stains (0.5% basic fuchsin, 0.5% crystal violet), b) Reagents (phosphate buffer of pH 7, 1 N and 1M solutions of HCL and NaOH), c) physiological saline. 2. Biosafety- <ol style="list-style-type: none"> a) Aseptic techniques: <ol style="list-style-type: none"> i)Table disinfection ii) hand wash, iii) use of aprons b) proper disposal of used material c) Cleaning and sterilization of glasswares 3. Studying parts of Light compound microscope and its use and care. 4. Microscopic observation of bacteria and its parts: <ol style="list-style-type: none"> a) Monochrome staining b) Negative staining c) Gram's staining, d) Motility by Hanging-drop method. e) Cell wall staining (Chance's method) f) Capsule staining (Manuval's method) g) Volutine granule staining (Albert' s method) 5. Study of the principle and applications of instruments used in the microbiology laboratory: <ol style="list-style-type: none"> a) biological safety cabinets b) autoclave, incubator c) hot air oven d) colorimeter e) Colony counter and bacteriological filter assembly. 	

Unit II/ Credit II	Use of Media to Study Microbial diversity	15
	<ol style="list-style-type: none"> 1. Preparation of liquid and solid culture media and their sterilization. <ol style="list-style-type: none"> a) Preparation of - agar plates, butts and slants. 2. Simple media: <ol style="list-style-type: none"> a) Peptone water b) nutrient broth c) nutrient agar 3. Selective media: <ol style="list-style-type: none"> a) Sabourauds agar b) Glucose yeast extract agar 4. Differential and selective media: <ol style="list-style-type: none"> a) MacConkey's agar. 5. Sterilization of culture medium using Autoclave and assessment for sterility. 6. Sterilization of glassware using Hot Air Oven and assessment for sterility 	
Paper -III & Paper-IV	Practical Course II: Bacteriology and Microbial biochemistry (CREDITS: 02; TOTAL HOURS: 30)	No. of Hours per Unit/Credit
Unit I/ Credit I	Study of Bacteria	15
	<ol style="list-style-type: none"> 1. Demonstration of presence of microflora in water and air by solid impaction technique on nutrient agar plates and in water by direct cultivation method. 2. Demonstration of presence of microbes from hand nails, Teeth and skin (swabbing) by cultivation methods. 3. Isolation of pure cultures of bacteria by four quadrant streaking method, and studies of Colony characteristics, Gram staining and motility of - <ol style="list-style-type: none"> a) <i>Escherichia coli</i> b) <i>Bacillus species</i> c) <i>Staphylococcus aureus</i> 4. Enumeration of bacteria from water and milk by SPC method 	

Unit II/ Credit II	Microbial Biochemistry	15
	<ol style="list-style-type: none"> 1. Biochemical tests : <ol style="list-style-type: none"> a) Detection of production of indole b) excess acid c) Acetoin d) utilization of citrate as a carbon source by IMViC test e) Detection of H₂S production ability of bacteria 2. Detection of enzyme production ability of bacteria – <ol style="list-style-type: none"> a) Amylase b) Catalase c) Caseinase 3. Detection of sugar fermentation ability of bacteria – <ol style="list-style-type: none"> a) Glucose b) Lactose 4. Study of MBRT test. 	

-----XX-----

Books recommended for Theory

1. Microbiology by Pelczar, M.J.Jr., Chan E.C.S., Krieger, N.R. 5th edition, 1986 (McGraw Hills Publication).
- 2) Fundamental Principles of bacteriology by A. J. Salle, Tata McGraw Hill.
2. Fundamentals of Microbiology by Frobisher, Hindsdill, Crabtree, Good Heart, W.B. Saunders Company, 7th edition.
3. Medical Microbiology Vol. I and II by Cruick Shank R., Duguid J.P., Marmion B.P., Swain R.H.A., XIIth edition, Churchill Livingston, New York.
4. A textbook of Microbiology by Ananthnarayan – Orient Longman, Bombay
5. General Microbiology by Stanier R. Y. Vth edition, McMillan, London.
6. General Microbiology Vol I and II by Powar and Dagainawala, Himalaya Publications.
7. Medical Bacteriology by Dey and Dey – Allied Agency, Calcutta.
8. Food Microbiology by W. C. Frazier.
9. Basic Experimental Microbiology by Ronal M. Atlas, Alfred E. Brown, Kenneth W. Dobra, Wonas Miller (1986) Pren-tice Hall.
10. General Microbiology by Robert F. Boyd (1984), Times, Mirror/Mosby College.
11. A Biologics guide to principles, techniques of Practical Biochemistry by K. Wilson and K. H. Goulding, Edward Arnold Publication.
12. Introduction to Practical Biochemistry by D. Plummer, J. Willey and Sons.

B.Sc. I Microbiology Semester II

Paper III:	DSC -25 B Bacteriology (CREDITS: 02; TOTAL HOURS: 30)	No. of Hours per Unit/Credit
Unit I/ Credit I	Microbial structure and functions	15
	<p>A. Bacterial Cell organization</p> <ol style="list-style-type: none"> 1) Cell size, shape and arrangement 2) Cytology of Bacteria : <ol style="list-style-type: none"> a) Cell-wall : Composition and detailed structure of Gram-positive and Gram-negative bacterial cell walls b) Cell Membrane: Structure, function and chemical composition of bacterial cell membranes. c) Structure and functions of Capsule and slime layer. d) Structure and functions of Flagella e) Structure and functions of Pili. <p>B. Structure and functions of Cytoplasmic components</p> <ol style="list-style-type: none"> 1. Cytoplasmic Components: <ol style="list-style-type: none"> a) Ribosomes b) mesosomes c) inclusion bodies d) nucleoid e) chromosome f) plasmids g) Endospore: Structure, stages of sporulation. h) Reserve food materials – Nitrogenous and non nitrogenous 	
Unit II/ Credit II	Isolation, preservation of Microorganisms	15
	<p>A. Isolation of Microorganisms from natural habitats.</p> <ol style="list-style-type: none"> 1. Pure culture techniques <ol style="list-style-type: none"> a) Streak plate b) Spread plate c) Pour Plate and micromanipulator 2. Isolation and cultivation of anaerobic organisms by using media components and by exclusion of air/O₂ 3. Preservation of microbial cultures – <ol style="list-style-type: none"> a) Sub-culturing b) overlaying cultures with mineral oils 	

	<p>c) storage at low temperature d) lyophilization.</p> <p>B. Systematic study of pure cultures:</p> <p>1. Morphological characteristics.</p> <p>2. Cultural characteristics – a) Colony characteristics on solid media, b) growth in liquid media c) growth on agar slants.</p> <p>3. Biochemical Characteristics - a) Sugar fermentation b) Production of metabolites - H₂S gas c) Production of enzymes - Amylase, Caseinase and Catalase.</p>	
Paper IV:	26 B Microbial Biochemistry (CREDITS: 02; TOTAL HOURS: 30)	No. of Hours per Unit/Credit
Unit I/ Credit I	Biomolecules	15
	<p>A. Proteins :</p> <p>1 General structure of amino acids , peptide bond. a) Types of amino acids based on R group – i) Nonpolar, aliphatic amino acids. ii) Aromatic amino acids. iii) Polar, Uncharged amino acids. iv) Positively charged (basic) amino acids v) Negatively charged (acidic) amino acids. b) Peptides - properties c) Structural levels of proteins: primary, secondary, tertiary and quaternary.</p> <p>B. Carbohydrates: Definition, classification and brief account of</p> <p>1. Monosaccharides: Classification based on aldehyde and ketone groups; structure of Ribose, Deoxyribose, Glucose, Galactose and Fructose. 2. Disaccharides: Glycosidic bond, structure of lactose and sucrose. 3. Polysaccharides : Structure and biological role, of starch, glycogen and cellulose.</p> <p>C. Lipids :</p> <p>1. Simple lipids – Fats and oils, waxes. 2. Compound lipids – Phospholipid, Glycolipids 3. Derived lipids – Cholesterol</p> <p>D. Enzymes:</p> <p>1. Definition, 2. Structure- Concept of apoenzyme, coenzyme, cofactor</p>	

कला व वाणिज्य महाविद्यालय
वडूज (ग्रंथालय)
शेदणी क्रमांक

SEMESTER I
(PAPER A)

Course Objectives:

1. To acquaint and equip students with communication skills.
2. To inculcate human values among the students through poems and prose.
3. To improve the language competence of the students.

Contents

Semester I (Paper A)		Module Writer	Page Nos.
	Module I		
A.	Developing Vocabulary	Dr. G. D. Ingale, Nipani	
B.	Technology with a Human Face - E.F. Schumacher		01 - 15
C.	How Beautiful - P. K. Padhy		16 - 24
	Module II		25 - 27
A.	Narration	Mr. V. K. Maydeo, Ajara	
B.	As a Flower I Come - Sundaram		28 - 32
	Module III		33 - 35
A.	Description	Dr. S.V. Shelke, Nagthane	
B.	I Have a Dream - Martin Luther King, Jr.		36 - 44
	Module IV		45 - 54
A.	The Auspicious Vision - Rabindranath Tagore	Mr. R. J. Patil, Walva	
B.	The Book - Iftikhar Rizvi		55 - 62
	Semester -II (Paper-B)		63 - 66
	Module V		
A.	Telephonic Communication	Dr. Kalpana Gangatirkar	
B.	Lost Forest - Johannes Jensen		67 - 74
C.	Stopping by Woods - Robert Frost		75 - 80
	Module VI		81 - 83
A.	English for Spesific Purposes	Dr. D.S. Kale, Medha	
B.	Putting Data to Effective Use - Satish Tripathi		84 - 90
	Module VII		91 - 97
A.	English for Advertising	Dr. H.B. Patil, Palus	
B.	An Epitaph- W.H.Davies		98 - 110
	Module VIII		111 - 113
A.	The Golden Touch -Nathaniel Hawthorne	Mr. R .P. Patil, Ichalkaranji	
B.	Offering in the Temple -Desika Vinayakam Pillai		114 - 121
			122 - 125

DSC-3A- Chemistry paper I (Inorganic Chemistry)
(Theory Credits: 02 : 30 Lectures)

Unit I: Atomic Structure and Periodicity of Elements

(09)

- 1.1 Bohr's theory of hydrogen atom and its limitations
- 1.2 Wave particle duality
- 1.3 Heisenberg uncertainty principle
- 1.4 Quantum numbers and their significance
- 1.5 Shapes of *s*, *p* and *d* atomic orbitals
- 1.6 Electrons filling rules in various orbitals: a) Aufbau's principle b) Hund's rule of maximum multiplicity c) Pauli's exclusion principle
- 1.7 Electronic configuration of elements. Stability of empty, half-filled and completely filled orbitals
- 1.8 Periodicity of the elements: General discussion of the following properties of the elements with reference to s block elements: a) electronic configuration b) atomic radii c) ionic radii d) ionization energy e) electron affinity f) electronegativity g) metallic characters h) reactivity i) oxidation state j) melting and boiling points k) chemical properties

Unit II: Chemical Bonding and Molecular structure (A) Ionic Bonding

(07)

- 2:1 Definition and formation of ionic bond. General characteristics of ionic bonding
- 2:2 Energetic in Ionic bond formation
- 2:3 Born-Haber cycle for NaCl and its applications
- 2:4 Fajan's Rule, Applications of Fajan's rule for,
 - Polarizing power and polarizability
 - Ionic character in covalent compounds
 - Bond moment, dipole moment and percentage ionic character

Unit III: Chemical Bonding and Molecular structure (B) Valence bond theory (VBT). (07)

- 3.1 Concept of hybridization, different types of hybridization and geometry of following molecules,
 - Linear geometry- BeCl_2 (*sp* hybridization)

- Planer trigonal geometry- BF_3 (sp^2 hybridization)
- Tetrahedral geometry- SiCl_4 (sp^3 hybridization)
- Trigonal bipyramidal geometry- PCl_5 (sp^3d hybridization)
- Octahedral geometry- SF_6 (sp^3d^2 hybridization)
- Pentagonal bipyramidal geometry - IF_7 (sp^3d^3 hybridization)

Unit IV: Chemical Bonding and Molecular structure (C) Molecular orbital theory (MOT) (07)

- 4.1 LCAO method, formation of bonding , anti bonding and nonbonding molecular orbitals.
- 4.2 Conditions for successful overlap, Types of overlaps - S-S ,S-px, Px-Px, Py-Py and Pz-Pz overlaps.
- 4.3 Bond order and its significance.
- 4.4 Energy level sequence for molecular orbital when $n=1$ & 2 .
- 4.5 MO diagrams for homonuclear diatomic molecule of 1st & 2nd period Elements (He_2 , Li_2 , B_2 , N_2 , O_2).
- 4.6 Molecular orbital diagrams for heteroatomic diatomic molecules. (CO, NO)

Reference Books:

- 1) Lee, J.D. *Concise Inorganic Chemistry* ELBS, 1991.
- 2) Cotton, F.A., Wilkinson, G. & Gaus, P.L. *Basic Inorganic Chemistry*, 3rd ed., Wiley.
- 3) Douglas, B.E., McDaniel, D.H. & Alexander, J.J. *Concepts and Models in Inorganic Chemistry*, John Wiley & Sons.
- 4) Huheey, J.E., Keiter, E.A., Keiter, R.L. & Medhi, O.K. *Inorganic Chemistry*:
- 5) Principles of Structure and Reactivity, Pearson Education India, 2006.
- 6) Puri, Sharma, Kalia. *Principles of Inorganic Chemistry*
- 7) Madan R. L. *Chemistry for Degree Students* (B. Sc. First year), S. Chand Publications

DSC-4A- Chemistry paper II (Organic Chemistry)
(Credits: 02 : 30 Lectures)**Unit I: Fundamentals of Organic Chemistry**

(08)

Introduction, Curved arrow notations, Cleavage of Bonds: Homolysis and Heterolysis. Organic molecular species: Nucleophiles and electrophiles. Electronic Displacements: Inductive Effect, Electromeric Effect, Resonance and Hyperconjugation effect, Reactive Intermediates: Generation, Structure, Stability and Reactions of Carbocations, Carbanions and carbon free radicals.

Unit II: Stereochemistry

(09)

Hrs

Introduction, Types of Stereoisomerism, Optical Isomerism: Concept of Chirality, Elements of Symmetry, Optical Isomerism in tartaric acid, 2, 3 Dihydroxybutanoic acid, Enantiomerism, Diastereomerism and Meso compounds, Geometrical isomerism in C=C, C=N and alicyclic compounds. Nomenclature of stereoisomers: D and L, erythro and threo, R and S, E and Z.

Unit III: Aromaticity

(07)

Introduction, Characteristics properties of organic compounds, Meaning of terms: Aromatic, Non aromatic, Antiaromatic, Pseudoaromatic, Structure of Benzene: Kekule structure, Resonance structure, M.O. picture, Modern theory of Aromaticity, Mechanism of Electrophilic substitution reactions: Nitration, Sulphonation, Halogenation and Friedel craft reaction.

Unit IV: Cycloalkanes, cycloalkenes and alkadienes

(06)

Cycloalkanes: - Introduction. Method of formation - a) By addition of carbene to alkene b) Action of metallic sodium on dihaloalkane c) Diels - Alder reaction d) By reduction of aromatic compounds, Chemical properties- a) Photohalogenation b) Catalytic halogenations c) Catalytic hydrogenation d) Effect of heat e) Reaction with hydrogen halide

GG

Cycloalkenes : Introduction, Method of formation from cyclic compounds, Chemical Properties - a) Hydrogenation b) Addition of Halogens and halogen acids, c) Allylic halogenations

Alkadienes : Introduction, Classification, Buta-1,3-diene - a) Structure b) Methods of formation - from cyclohexane, From Butane by dehydrogenation, From acetylene, From Butane-1,3 - diol, From ethanol and acetaldehyde (Industrial method), Chemical Properties - a) Reaction with hydrogen halide b) Reaction with halogens -With one molar equivalent of halogens (Cl_2 or Br_2) c) Diels- Alder reaction d) Reduction – hydrogenation e) Oxidation – Ozonolysis f) Polymerization

Reference Books:

- 1) Graham Solomon, T.W., Fryhle, C.B. & Snyder, S.A. *Organic Chemistry*, John Wiley & Sons (2014).
- 2) McMurry, J.E. *Fundamentals of Organic Chemistry*, 7th Ed. Cengage Learning India Edition, 2013.
- 3) Sykes, P. *A Guidebook to Mechanism in Organic Chemistry*, Orient Longman, New Delhi (1988).
- 4) Eliel, E.L. *Stereochemistry of Carbon Compounds*, Tata McGraw Hill education, 2000.
- 5) Finar, I.L. *Organic Chemistry* (Vol. I & II), E.L.B.S.
- 6) Morrison, R.T. & Boyd, R.N. *Organic Chemistry*, Pearson, 2010.
- 7) Bahl, A. & Bahl, B.S. *Advanced Organic Chemistry*, S. Chand, 2010.
- 8) D.Nasipuri :Stereochemistry of Organic compounds
- 9) R. L. Madan, Chemistry for Degree Students (B. Sc. First Year), S. Chand.Publication

CHEMISTRY-DSC 3B: Chemistry Paper-III (Physical Chemistry)

(Credits :02 , Lectures-30)

Unit -I Chemical Energetics

(06)

A) Thermodynamics

Introduction, Basic concepts of thermodynamics, First law of thermodynamics Spontaneous and non-spontaneous process with examples, Statements of second law of thermodynamics, Carnot's cycle and its efficiency. Entropy, Physical Significance of entropy, Statement of Third Law of thermodynamics and calculation of absolute entropies of substances

B) Thermochemistry

(04)

Important principles and definitions of thermochemistry. Concept of standard state and standard enthalpies of formations, integral and differential enthalpies of solution and dilution. Calculation of bond energy, bond dissociation energy and resonance energy from thermochemical data. Variation of enthalpy of a reaction with temperature – Kirchhoff's equation.

Unit II . Chemical Equilibrium:

(06)

Chemical Equilibrium: Free energy change in a chemical reaction. Thermodynamic derivation of the law of chemical equilibrium. Distinction between ΔG and ΔG° , Le Chatelier's principle. Relationships between K_p , K_c and K_x for reactions involving ideal gases.

Unit- III. Kinetic Theory of Gases

(07)

Postulates of Kinetic Theory of Gases and derivation of the kinetic gas equation. Ideal and Non ideal gases, Deviation of real gases from ideal behaviour, compressibility factor, causes of deviation. Van der Waals equation of state for real gases. Explanation of real gas behaviour by Van der Waal's equation, Boyle temperature (derivation not required). Critical Phenomena: PV-isotherms of real gases (Andrew's isotherms), Continuity of state, Critical constants and their calculation from vander Waals equation. Maxwell Boltzmann distribution laws of molecular velocities and molecular energies (graphic representation – derivation not required) and their importance. Temperature dependence

of these distributions. Most probable, average and root mean square velocities (no derivation).
Numerical Problems.

Unit- IV. Chemical Kinetics

(07)

Introduction, Rate of reaction, Definition and units of rate constant, Factors affecting rate of reaction. (Nature of reactant, Concentration, pressure, temperature and catalyst.) Order and Molecularity of reaction, Zero order reaction, First order reaction, Characteristics of first order reaction. examples, Pseudo-unimolecular reactions, examples. Second order reaction: Derivation of rate constant for equal and unequal concentration of the reactants. Characteristics of Second order reaction., Determination of order of reaction by i) integration method ii) graphical method iii) Half life method, Effect of temperature on rate of reaction, Arrhenius equation, Concept of energy of activation.

Theories of Reaction Rates: Collision theory and Activated Complex theory of bimolecular reactions. Comparison of the two theories (qualitative treatment only). Numerical problems.

Reference Books:

1. Principles of Physical Chemistry Puri, Sharma and Pathania, Vishal Publishing House, 44th Edition
2. Advanced Physical Chemistry Gurdeep Raj GOEL Publishing House, 36th Edition
3. Essentials of Physical Chemistry, Bahl, Tuli and Bahl
4. Text Book of Physical Chemistry, Soni and Dharmarha
5. Essentials of Nuclear Chemistry by H J Arnikar, New Age, 4th edition.
6. Mathematical preparation of Physical Chemistry : F. Daniel, Mc-Graw Hill Book Company Ltd.
7. Elements of Physical Chemistry : S. Glasstone and D. Lewis
(D. Van Nostrand Co. Inc)
8. Physical Chemistry : W. J. Moore (Orient Longman)
9. Principles of Physical Chemistry : Maron Prutton
10. University Chemistry : B. H. Mahan (Addison - Wesley Publ. Co.)
11. Chemistry for Degree students (B. Sc. First Year): R L Madan (S. Chand and Company)

B.Sc. I Semester II
DSC-4B-Chemistry Paper IV (Analytical Chemistry)
(Theory Credits:02, Lectures-30)

- 1. Introduction to analytical Chemistry (06)**
 - 1.1 Introduction
 - 1.2 Importance of analysis
 - 1.3 Analytical processes (Qualitative and Quantitative)
 - 1.4 Methods of analysis (Only classification)
 - 1.5 Sampling of solids, liquids and gases
 - 1.6 Errors, types of errors (determinate and indeterminate), methods of expressing accuracy (Absolute and relative error)
 - 1.7 Significant figures, mean, median, standard deviation (Numerical problems expected)

- 2. Chromatography (06)**
 - 2.1 Introduction, Basic Principle of Chromatography, Basic terms, Classification of Chromatography
 - 2.2 Paper Chromatography- Principle, Methodology-types of papers and treatment, sample loading, choice of solvent, development-ascending, descending, circular, location of spots, determination of R_f value, Applications, advantages and disadvantages
 - 2.3 Thin layer chromatography; Principle, Solvent system, stationary phases, preparation of TLC plate, Detecting reagents, methodology-sample loading, development, detection of spot, R_f value, Applications, advantages and disadvantages
 - 2.4 Comparison of paper chromatography and TLC

- 3. Theory of titrimetric Analysis (06)**
 - 3.1 Introduction
 - 3.2 Acid-base indicators
 - 3.3 Theory of indicators w.r.t. Ostwald's ionization theory and quinoid theory
 - 3.4 Neutralization curves and choice of indicators for
 - a. Strong acid-strong base
 - b. Strong acid-weak base
 - c. Strong base-weak acid
 - 3.5 Complexometric titrations
 - a. Introduction
 - b. Types EDTA titrations
 - c. Metallochromic indicators-Eriochrome black- T
 - d. Indicator Action of Eriochrome black- T

4. **Water Analysis** (06)
- 4.1 Physical analysis of water – pH, Conductance, Colour, odour, Turbidity and taste
- 4.2 Chemical Analysis – Total Dissolved solids, Hardness, Salinity, Alkalinity, Acidity, Sulphates, Nitrates, Dissolved Oxygen, Chemical Oxygen Demand, Biological Oxygen Demand
5. **Analysis of Fertilizers** (06)
- 5.1 Introduction
- 5.2 Types of fertilizers
- 5.3 Necessity and requirements of good fertilizers
- 5.4 Sampling and sample preparation
- 5.5 Analysis of Nitrogen by Kjeldahl's method
- 5.6 Analysis of Phosphorus by phosphomolybdate method
- 5.7 Analysis of Potassium by sodium tetraphenyl borate method

References:

1. Textbook of quantitative Inorganic analysis-A.I. Vogel
2. Instrumental methods of Chemical analysis-H. Kaur
3. Instrumental methods of Chemical analysis-B.K. Sharma
4. Instrumental methods of Chemical analysis-Chatwal Anand
5. Fundamental of analytical Chemistry-Skoog and West
6. Basic Concepts of analytical Chemistry-S.M. Khopkar
7. Analytical Chemistry-Alka Gupta (Pragati Prakashan)
8. Indian Pharmacopoeia
9. Chromatography-H. Kaur
10. Chemistry for Degree students(B.Sc. First Year): R. L. Madan (S. Chand and Company)

**B.Sc. I Semester I and II
Practical Course**

(Credits 02: Lectures-04 per week)

A) Inorganic Chemistry (Any Six)

1. To prepare standard 0.1 N KMnO_4 solution and to determine the strength of given oxalic acid solution.
2. To determine quantity of Fe(II) ions from the given solutions by titrating it with 0.1 N $\text{K}_2\text{Cr}_2\text{O}_7$ solution by using internal indicator
3. To estimate amount of Cu(II) ions by iodometric titration by using $\text{Na}_2\text{S}_2\text{O}_3$ solution.
4. To standardize supplied EDTA solution by titrating with 0.01 M ZnSO_4 solution and to estimate amount of calcium from given solution by using Erio-T as an indicator.
5. Quality control-To determine percentage purity of the given sample of soda ash Na_2CO_3 by titrimetric method.
6. Estimation of amount of Acetic acid from the given vinegar sample by titrimetric method
7. Chromatography : Separation and identification of cations by Paper Chromatographic technique from the following mixtures :
 - a) $\text{Ni}^{2+} + \text{Cu}^{2+}$
 - b) $\text{Ni}^{2+} + \text{Co}^{2+}$

B) Organic Chemistry

1. **Estimations** (any two) :
 1. Estimation of aniline. (by bromination method)
 2. Estimation of acetamide.
 3. Estimation of Aspirin.
2. Organic Qualitative Analysis: Detection of physical constant, type, functional group, elements, and Confirmatory test.
 Identification of Organic Compounds (at least eight) (four containing at least one extra element- N, S, Cl, Br, I)
 - a) Acids: Oxalic acid, Benzoic acid, cinnamic acid
 - b) Phenols: Beta-Naphthol, Resorcinol
 - c) Base: Aniline, p-Nitroaniline

d) Neutral: Acetone, Acetanilide, Chloroform, m-Dinitrobenzene, Thiourea, Bromobenzene

3. Purification of organic compounds by crystallization (from water and alcohol) and distillation.

References:

- 1) Vogel's Text Book of Quantitative Chemical Analysis. (Longman) ELBS Edition.
- 2) Vogel's Text Book of Qualitative Chemical Analysis. (Longman) ELBS Edition.
- 3) Hand book of Organic Qualitative Analysis : Clarke.
- 4) Comprehensive Practical Organic Chemistry – Qualitative Analysis by V. K. Ahluwalia, Sunita Dhingra. University Press. Distributor – Orient Longman Ltd.
- 5) Comprehensive Practical Organic Chemistry preparation and Quantitative Analysis : V. K. Ahluwalia, Renu Aggarwal. University Press. Distributor – Orient Longman Ltd.
- 6) A Laboratory Hand - Book of Organic Qualitative Analysis and Separation : V. S. Kulkarni. Dastane Ramchandra & Co. Pune

C) Physical Chemistry

Physical Chemistry (Any Six)

1. Determination of equivalent weight of Mg by Eudiometer.
2. Study of specific reaction rate of hydrolysis of methyl acetate in presence of HCl.
3. Determination of heat of ionization of weak acid by using polythene bottle.
4. Determination of heat capacity of calorimeter for different volumes.
5. Determination of enthalpy of neutralization of hydrochloric acid with sodium hydroxide.
6. Determination of integral enthalpy of solution of salts (KNO_3 , NH_4Cl).
7. Determination of enthalpy of hydration of copper sulphate.
8. Study of the solubility of benzoic acid in water and determination of ΔH .

References:

- 1) Practical book of Physical Chemistry: Nadkarni, Kothari & Lawande.

- 2) Experimental Physical Chemistry: A. Findlay.
- 3) Systematic Experimental Physical Chemistry: S. W. Rajbhoj, Chondhekar.
(Anjali Publication.)
- 4) Experiments in Physical Chemistry: R. C. Das and B. Behra. (Tata Mc Graw Hill)
- 5) Advanced Practical Physical Chemistry: J. B. Yadav (Goel Publishing House.)
- 6) Practical Physical Chemistry: B. D. Khosala. (R. Chand & Sons)
- 7) Experiments in Chemistry: D. V. Jahagirdar.
- 8) A Text Book of Quantitative Inorganic Analysis Including Elementary Instrumental
Analysis: A.I. Vogel (Third Ed.) (ELBS)

SHIVAJI UNIVERSITY, KOLHAPUR.



Accredited By NAAC with 'A++' Grade

CHOICE BASED CREDIT SYSTEM

Syllabus For

**B.Sc. Part - I
ZOOLOGY**

SEMESTER I AND II

(Syllabus to be implemented from June, 2022 onwards.)

B. Sc. Part – I Semester –I

ZOOLOGY

DSC – 15A (ANIMAL DIVERSITY-I)
Theory: 30 hrs. (37.5 lectures of 48 minutes)
Marks -50 (Credits: 02)

Unit 1:

Kingdom Protista	(3hrs.)
General characters and classification up to classes; Locomotory organelles and locomotion in Protozoa	
Phylum Porifera	(3hrs.)
General characters and classification up to classes; Canal System in <i>Sycon</i>	
Phylum Cnidaria	(3hrs.)
General characters and classification up to classes; Polymorphism in Hydrozoa	
Phylum Platyhelminthes	(3hrs.)
General characters and classification up to classes; Life history of <i>Taenia solium</i> and its parasitic adaptations	
Phylum Nematelminthes	(3hrs.)
General characters and classification up to classes; Life history of <i>Ascaris lumbricoides</i> and its parasitic adaptations	

Unit 2:

Phylum Annelida	(3hrs.)
General characters and classification up to classes; Metamerism in Annelida	
Phylum Arthropoda	(5hrs.)
General characters and classification up to classes; Vision in Arthropoda, Metamorphosis in Insects	
Phylum Mollusca	(3hrs.)
General characters and classification up to classes; Torsion in gastropods	
Phylum Echinodermata	(4hrs.)
General characters and classification up to classes; Water-vascular system in Asteroidea	

Total Periods – 30 hrs

B. Sc. Part – I Semester –II

ZOOLOGY

DSC – 15 B (Animal Diversity and Insect Vector)

Theory: 30 hrs. (37.5 lectures of 48 minutes)

Marks-50 (Credits: 02)

Animal Diversity and Insect Vectors

Unit: I Animal Diversity

(16 hrs)

Type Study: Rat (*Rattus rattus*) (Physiology is not expected)

- Systematic position, Habit and Habitat
- Morphological Characters
- Digestive System
- Respiratory System
- Circulatory System (Composition of Blood and Heart)
- Excretory System
- Reproductive System
- Brain for Rat

Unit: II : Insect Vectors

1. Mosquito as an insect vector

(8hrs)

Mosquito born diseases with respect to causal organism, life cycle and symptoms

- a. Malaria
- b. Dengue
- c. Chikungunya
- f. Control Measures of mosquitoes

2. Housefly as an important mechanical vector

(2 hrs)

Housefly born diseases with respect to Causal organism, life cycle, symptoms

- a. Myiasis
- b. Control Measure of housefly

3. Flea as an insect vector

(4 hrs)

Flea born diseases with respect to Causal organism, life cycle and symptoms

- a. Plague
- b. Typhus fever
- c. Control offleas

Total Periods – 30 hrs

B. Sc. Part – I Semester –II

ZOOLOGY

DSC – 16 B (Genetics)

Theory: 30 hrs. (37.5 lectures of 48 minutes)

Marks-50 (Credits: 02)

Genetics

Unit: 1

Introduction to Genetics

(3hrs.)

Mendel's work on transmission of traits, Genetic Variations, Molecular basis of Genetic Information

Mendelian and postMendelian Genetics

(8hrs.)

Principles of Inheritance, Incomplete dominance and co-dominance, gene interaction, Multiple alleles w.r.t. ABO, Rh blood groups and coat colour in rabbit, sex linked inheritance.

Linkage, Crossing Over

(4hrs.)

Linkage and process of crossing over, Coupling and repulsion theory, Cytological evidence of crossing over.

Unit 2:

Mutations

(8hrs.)

Chromosomal Mutations: Deletion, Duplication, Inversion, Translocation, Aneuploidy and Polyploidy, induced gene mutation.

Sex Determination

(7hrs.)

Chromosomal theory, Genic balance theory, Haploidy-Diploidy mechanism, Environmental Theory

Total Periods – 30 hrs

Suggested Readings :

- P.S.Varma & V.K.Agarwal – Cell Biology, Genetics, Molecular Biology, Evolution and Ecology
- R. P. Meyyan, N, Arumugam – Genetics & Evolution
- Gardner, E.J., Simmons, M.J., Snustad, D.P. (2008). *Principles of Genetics*. VIII Edition. Wiley India.
- Snustad, D.P., Simmons, M.J. (2009). *Principles of Genetics*. V Edition. John Wiley and Sons Inc.
- Klug, W.S., Cummings, M.R., Spencer, C.A. (2012). *Concepts of Genetics*. X Edition. Benjamin Verma P. S. and Agarwal V. K. – Genetics, S. Chand and Company
- Strickberger – Genetics. C Millian Publications
- Winchester – Genetics, Oxford Publication
- Genetics by P.P. Meyyan, Cummings.
- Russell, P. J. (2009). *Genetics- A Molecular Approach*. III Edition. Benjamin Cummings.
- Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B. *Introduction to Genetic Analysis*. IX Edition. W. H. Freeman and Co.
- Imms, A.D. (1977). *A General Text Book of Entomology*. Chapman & Hall, U K Chapman, R.F. (1998).
- *The Insects: Structure and Function*. IV Edition, Cambridge University Press, U K Pedigo L.P. (2002).
- *Entomology and Pest Management*. Prentice Hall Publication Mathews, G. (2011).
- *Integrated Vector Management: Controlling Vectors of Malaria*
- *Insect Vector Borne Diseases*. Wiley-Blackwell
- *Biology of Vertebrates* Walter & Sayles; (McMillan).
- *Chordate Zoology*, P.S. Dhama & J. K. Dhama - R. Chand & Co., New Delhi.
- *Modern Textbook of Zoology*, R.L. Kotpal, Rastogi Publications, Meerut.
- *The Life of Vertebrates*, 3rd Edition, 1993, J. Z. Young E. L. B.S. Oxford.
- *Chordate Zoology* - E.L. Jordan, S. Chand & Co., New Delhi.
- *The Phylum Chordata* - 1987, H.H. Newman, Distributor Satish Book Enterprise, Agra.
- *Comparative Anatomy of the Vertebrates* G. C. Kent.

B. Sc. Part – I

ZOOLOGY PRACTICALS

Marks -50 (Credits: 02)
(DSC– 15A,B and 16 A,B:
LAB)

1. Study of the following specimens:

- i Study of *Amoeba*, *Euglena*, *Plasmodium*, *Paramecium*, w.r.t. classification and locomotion
- ii Study of *Sycon*, *Hyalonema*, and *Euplectella*, *Obelia*, *Physalia*, *Aurelia*, *Tubipora*, *Metridium*, *Taenia solium*, Male and female *Ascaris lumbricoides*, *Aphrodite*, *Nereis*, *Pheretima*, *Hirudinaria*, *Palaemon*, *Cancer*, *Limulus*, *Palaemon*, *Scolopendra*, *Julus*, *Periplaneta*, *Apis*, *Chiton*, *Dentalium*, *Pila*, *Unio*, *Loligo*, *Sepia*, *Octopus*, *Pentaceros*, *Ophiura*, *Echinus*, *Cucumaria* and *Antedon*, w.r.t. classification and morphological peculiarities.

2. Study of the following:

- i T.S. or L.S. of *Sycon*,
- ii Life history *Taenia* and *Ascaris* and their parasitic adaptations.

3. Preparation of haemincrystals

4. Study Tour: Visit to any suitable place to study animal diversity or any place related to theory syllabus and submission of report.

5. Preparation of blood smear and identification of ABO and Rh blood groups

6. Cytological Preparations:

Mitochondria – Stained preparation of mitochondria from onion peeling / Hydrilla leaf / Oral mucosa by using Janus Green -B.

Polytene Chromosomes – Stained preparation of polytene chromosome in Chironomid larva / *Drosophila* larva.

7. Study of fossil evidences from plaster cast models and pictures.

8. Demonstration of Rat to study,

- Digestive system, Lungs, Heart, Kidney, Testis, Ovary and Brain of Rat

9. Study of Mendelian Inheritance and gene interactions (Non-Mendelian Inheritance) using suitable examples. Minimum 10 Examples on: Monohybrid & Dihybrid ratio, Incomplete dominance, Co-dominance, Multiple alleles, Sex linked inheritance, Linkage, Crossing over and Gene interaction.

10. Study of following insect vectors through permanent slides or photographs

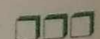
1. Mosquito born diseases (Causal organism, symptoms and control measures)
 - a. Malaria
 - b. Dengue
 - c. Chikungunya
2. Housefly born diseases (Causal organism, symptoms and control measures)
 - a. Myiasis
3. Flea born diseases (Causal organism, symptoms and control measures)
 - a. Plague
 - b. Typhus fever

SUGGESTED READINGS

- Ruppert and Barnes, R.D. (2006). *Invertebrate Zoology*, VIII Edition. Holt Saunders International Edition.
- Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). *The Invertebrates: A New Synthesis*, III Edition, Blackwell Science
- Young, J. Z. (2004). *The Life of Vertebrates*. III Edition. Oxford university press.
- Pough H. *Vertebrate life*, VIII Edition, Pearson International.
- Hall B.K. and Hallgrimsson B. (2008). *Strickberger's Evolution*. IV Edition. Jones and Bartlett Publishers Inc.
- Practical Zoology by Kotpal.
- Practical Zoology by Verma and Agarwal. Physiology by C.C. Chattarji. Vol. I & II.
- Lehane, M. J. (1991). *Biology of blood sucking insects*. Harper Collins Academic, London.
- Service M. W. (1986). *Blood sucking insects : Vectors of disease, studies in biology*. No. 167, Arnold, London.

CONTENTS

1. **Microbes-Viruses** 1
 - * Discovery * General Characters and Structure of Viruses * Types of Viruses - DNA Viruses, T phase, RNA Viruses, TMV * Economic Importance of Viruses * Questions.
2. **Microbes-Bacteria** 32
 - * Discovery * General Characters * Cell Structure Types of Bacteria * Reproduction in Bacteria - Vegetative Reproduction, Asexual Reproduction, Sexual Reproduction * Economic Importance * Questions.
3. **Algae** 62
 - * General Characters * Classification (as per G. M. Smith) up to classes * General Characters of each Division with Suitable Examples * Economic Importance of Algae * Morphology and Life Cycles of (a) Cyanophyceae : *Nostoc* (b) Chlorophyceae : *Spirogyra* * Questions.
4. **Fungi** 88
 - * Introduction * General Characters, Classification (as per Ainsworth, 1973) upto classes * General Characters of FUNGI General Characters of Division -I-MYXOMYCOTA, EMYCOTA * Economic Importance * Morphology and Life Cycle of (a) Zygomycotina : *Mucor* (b) Ascomycotina : *Penicillium* * Questions.
- ◆ **Glossary** 114
- ◆ **Bibliography** 118
- ◆ **New Syllabus** 120



CONTENTS

1. **Bryophytes** 1
 - * Introduction * General Characters, Adaptations to Land Habit, Classification (as per G. M. Smith) up to orders alteration of Generation, Economic Importance
 - * Morphology, Anatomy and Life Cycle of Hepaticopsida (Riccia) * Morphology * Internal Structure * Sexual Reproduction * Fertilization - Sexual Reproduction * Bryopsida - Funaria (Moss) - External Characters of Gametophyte * Reproduction - Archegonial Branch - Fertilization * The Apical Region - Economic Importance * University Type Questions.
2. **Pteridophytes** 00
 - * Introduction * General Characters, Classification as per G. M. Smith upto order * Lycopside : Morphology and Anatomy Cycle (Excluding Development Stages Pteropsida : pteris) - Internal Structure - Reproduction - Gametophyte - Reproduction Heterospory and Seed Habitat * University Type Questions.
3. **Gymnosperms** 85
 - * Introduction * General Characters of Gymnosperms
 - * Classification as per Sporne (1965) * General Characters of Cycadopsida * General Characters of Gnetopsida * Morphology, Anatomy and Life Cycle of Gentopsida - Reproduction - Fertilization - Economic Importance of Gnetum * University Type Questions.
- ◆ **Glossary** 109
- ◆ **Bibliography** 116



CONTENTS

1. Introductory Taxonomy	1
* Introduction * Importance of Taxonomy	
* Functions of Taxonomy * Salient Features of International Code of Botanical Nomenclature (ICBN) * Herbarium * Botanical Gardens	
* University Type Questions.	
2. Angiosperms and Systems of Classification	25
* Classification of Angiosperms	
* Introduction * Salient Features of Angiosperms * Types of Classification * The Outline of Bentham and Hooker's System of Classification * Study of Angiosperm Families (1) Caesalpiaceae, (2) Solanaceae, (3) Nyctaginaceae, (4) Liliaceae * University Type Questions.	
◆ Glossary	61
◆ Bibliography	67
◆ New Syllabus	69
◆ Nature of Question Paper	70
◆ About Authors	72



CONTENTS

1. Ecological Factors and Adaptations	1
* Introduction, Definition and Scope of Ecology, Ecological Factors : Edaphic Factors Soil - Origin and Formation, Composition, Soil Profile * Composition of the Soil * Light and Temperature as Ecological Fractors	
* Ecological Adaptations - Concept of Plant Adaptation * Morphological (External) Adaptation of Xerophytes * Morphological Adaptations of Hydrophytes * Epiphytes and Parasites	
* Plant Communities - Introduction, Characteristic Features, Forms and Structure * Raunkier's Life Forms	
* Plant Succession - Concept and Process * Hydrosere and Xerosere * University Type Questions.	
2. Ecosystem and Phytogeography	76
* Ecosystem Introduction, Composition (Components) Abiotic and Biotic Components	
* Food Chain and Web - Ecological Pyramids - Pyramid of Number, Biomass and Energy	
* Biogeochemical Cycles - Introduction, Sedimentary Cycle, Phosphorus Cycle, Gaseous Cycle, Nitrogen Cycle	
* Phytogeography - Phytogeographic Regions of India (as per Chatterjee and Mani) * University Type Questions.	
◆ Glossary	111
◆ Bibliography	122
◆ New Syllabus	124
◆ Nature of Question Paper	125
◆ About Authors	127



SHIVAJI UNIVERSITY, KOLHAPUR.



Accredited By NAAC with 'A++' Grade

CHOICE BASED CREDIT SYSTEM

Syllabus For

B.Sc. Part – I

Statistics

SEMESTER I AND II

(Syllabus to be implemented from June, 2022 onwards.)

B. Sc. Part – I Semester – I
DSC –7A – STATISTICS – I
(DESCRIPTIVE STATISTICS – I)

Theory: 30 hrs. Marks -50 (Credits: 02)

- Course Outcomes:** The students will acquire knowledge of
- i. meaning and scope of Statistics, various statistical organizations,
 - ii. data and types of data, various data presenting methods,
 - iii. population, sample and various methods of sampling,
 - iv. various measures of central tendencies and dispersion,
 - v. moments, skewness and kurtosis.

CONTENTS:

Unit - 1

(15 hrs.)

- 1.1 Introduction to Statistics:** Meaning of Statistics as a Science, Importance of Statistics, Definition of Statistics, Various fields where Statistics is used, Names of various statistical organizations in India.
- 1.2 Population and Sample:** Statistical population. Finite population, Infinite population, Census method, Sampling method, Advantages of sampling method over census method.
Methods of sampling (Description only): Sample and Random sample, Simple random sampling with and without replacement (SRSWR and SRSWOR), Stratified random sampling, Systematic sampling.
- 1.3 Nature of Data:** Primary and Secondary data, Time series data, Quantitative and Qualitative data, Attributes, Variables, Discrete and Continuous variables, Scales of measurement - Nominal, Ordinal, Interval and Ratio scale, illustrative examples.
- 1.4 Presentation of Data:**
- Classification:** Raw data and its classification, Discrete frequency distribution, Continuous frequency distribution, Cumulative frequency distribution, Inclusive and Exclusive methods of classification, Open end classes, Relative frequency distribution, illustrative examples.
- Tabulation:** Parts of table, Characteristics of good table, Types of table, illustrative examples.
- Diagrammatic Presentation:** Introduction to Simple Bar Diagram, Multiple Bar Diagram, Sub-Divided Bar Diagram, Pie Diagram.
- Graphical Presentation:** Histogram, Frequency Polygon, Frequency Curve, Ogive curves and Box plot.

Unit - 2

(15 hrs.)

- 2.1 Measures of Central Tendency:** Mathematical and positional, Concept of central tendency of statistical data, statistical average, requirements of good statistical average.
Arithmetic Mean (A.M.): Definition, Effect of change of origin and scale, Deviation of observations from A.M., Mean of pooled data, Weighted A.M.

Geometric Mean (G.M): Definition, illustrative examples.

Harmonic Mean (H.M.): Definition, Relation: $A.M \geq G.M \geq H.M$ (proof for $n = 2$ positive observations), illustrative examples.

Median: Definition, Derivation of formula for grouped frequency distribution.

Mode: Definition, Derivation of formula for grouped frequency distribution. Empirical relation between mean, median and mode. Graphical method of determination of Median and Mode.

Partition values: Quartiles, Deciles and Percentiles.

Comparison between averages in accordance with requirements of good average. Situations where one kind of average is preferable to others, illustrative examples.

2.2 Measures of Dispersion: Concept of dispersion, Absolute and Relative measures of dispersion, Requirements of a good measure of dispersion.

Range: Definition, Coefficient of range.

Quartile Deviation (Q. D. or Semi-inter quartile range): Definition, Coefficient of Q.D.,

Mean Deviation (M.D.): Definition, Coefficient of M.D., Minimal property of M.D.,

Mean Square Deviation (M.S.D.): Definition, Minimal property of M.S.D.,

Variance and Standard Deviation (S.D.): Definition, Effect of change of origin and scale, variance and S.D. of pooled data (proof for two groups).

Coefficient of Variation: Definition and use. Illustrative examples.

2.3 Moments, Skewness and Kurtosis: Moments: Raw moments and central moments for ungrouped and grouped data. Effect of change of origin and scale on central moments, relation between central moments and raw moments (up to 4th order). Sheppard's corrections.

Skewness: Concept of skewness of a frequency distribution, types of skewness. Bowley's coefficient of skewness, Karl Pearson's coefficient of skewness, measure of skewness based on moments.

Kurtosis: Concept of kurtosis of a frequency distribution, Types of kurtosis, Measure of kurtosis based on moments. Illustrative examples.

Books Recommended:

1. Bhat B. R., Srivenkatramana T. and Madhava Rao K. S. (1996): Statistics: A Beginner's Text, Vol. 1, New Age International (P) Ltd.
2. Croxton F. E., Cowden D.J. and Kelin S. (1973): Applied General Statistics, Prentice Hall of India.
3. Goon A.M., Gupta M.K., and Dasgupta B.: Fundamentals of Statistics Vol. I and II, World Press, Calcutta.
4. Gupta S. P. (2002): Statistical Methods, Sultan Chand and Sons, New Delhi.
5. Gupta V.K. & Kapoor S.C.: Fundamentals of Mathematical Statistics.- Sultan & Chand.
6. Hogg R. V. and Crag R. G.: Introduction to Mathematical Statistics Ed.4.
7. Hoel P. G. (1971): Introduction to Mathematical Statistics, Asia Publishing House.
8. Kore B. G. and Dixit P. G.: "Descriptive statistics-I", Nirali Prakashan, Pune.

9. Mood A. M., Graybill F. A. and Boes D. C. (1974): Introduction to the Theory of Statistics, McGraw Hill.
10. Snedecor G.W. and Cochran W. G. (1967): Statistical Methods, Iowa State University Press.
11. Waiker and Lev.: Elementary Statistical Methods.

Note: 1. In theory examination, the weightage to numerical problems should not exceed 30%.
2. Students can use scientific calculators in theory examination.

B. Sc. Part – I Semester – I
DSC –8A – STATISTICS – II
(ELEMENTARY PROBABILITY THEORY)

Theory: 30 hrs. Marks -50 (Credits: 02)

Course outcomes: Students will be able to;

- i. distinguish between random and non-random experiments
- ii. acquire knowledge of concepts of probability
- iii. use the basic probability rules, including additive and multiplicative laws
- iv. understand concept of conditional probability and independence of events.
- v. understand concept of univariate random variable and its probability distributions
- vi. acquire knowledge of mathematical expectation of univariate random variable.

CONTENTS:

Unit – 1

(15 hrs.)

1.1 Sample space and events: Concepts of experiments and random experiments. Definitions: Sample space, Discrete sample space (finite and countably infinite), Event, Elementary event, Compound event. Algebra of events (Union, Intersection, Complementation). Definitions of mutually exclusive events, Exhaustive events, Impossible events, Certain event. Power set $|P(\Omega)$ (sample space consisting at most 3 sample points). Symbolic representation of given events and description of events in symbolic form. Illustrative examples.

1.2 Probability: Equally likely outcomes (events), apriori (classical) definition of probability of an event. Equiprobable sample space, simple examples of computation of probability of the events based on permutations and combinations. Definition of probability in terms of odd ratio with illustrative examples. Axiomatic definition of probability. Proof of the results: i) $P(\Phi) = 0$, ii) $P(A^c) = 1 - P(A)$, iii) $P(A \cup B) = P(A) + P(B) - P(A \cap B)$ (with proof) and its generalization (Statement only), iv) If $A \subseteq B$, $P(A) \leq P(B)$, v) $0 \leq P(A \cap B) \leq P(A) \leq P(A \cup B) \leq P(A) + P(B)$.

Unit – 2

(15 hrs.)

2.1 Conditional Probability and Independence of events: Definition of conditional probability of an event. Multiplication theorem for two events. Examples on conditional probability. Concept of independence of two events. Proof of the result that if A and B are

independent then, i) A and B^C are independent, ii) A^C and B are independent, iii) A^C and B^C are independent. Pairwise and Mutual independence for three events. Elementary examples.

Partition of sample space. Idea of posteriori probability, statement and proof of Baye's theorem, illustrative examples on Baye's theorem.

2.2 Univariate Probability Distributions (finite sample space): Definition of discrete random variable. Probability mass function (p.m.f.) and cumulative distribution function (c.d.f.) of a discrete random variable, Properties of c.d.f. (statements only). Probability distribution of function of random variable. Median and mode of a univariate discrete probability distribution. Examples.

2.3 Mathematical expectation (Univariate random variable): Definition of expectation of a random variable. Expectation of a function of a random variable, Results on expectation of a functions of a random variable: i) $E(c) = c$, where c is a constant, ii) $E(aX + b) = aE(X) + b$, where a and b are constants, definitions of mean, variance of univariate distribution, $V(aX + b) = a^2V(X)$, definition of raw, central moments, definition of probability generating function (p.g.f.) of a random variable, obtaining mean and variance by using p.g.f. Effect of change of origin and scale on p.g.f.

Books Recommended

1. Bhat B. R., Srivenkatramana T. and Madhava Rao K. S. (1996): Statistics: A Beginner's Text, Vol. 1, New Age International (P) Ltd.
2. Edward P. J., Ford J. S. and Lin (1974): Probability for Statistical Decision-Making, Prentice Hall.
3. Goon A.M., Gupta M.K., and Dasgupta B.: Fundamentals of Statistics Vol. I and II, World Press, Calcutta.
4. Gupta V.K. & Kapoor S.C. Fundamentals of Mathematical Statistics.- Sultan & Chand.
5. Hogg R. V. and Crag R. G.: Introduction to Mathematical Statistics Ed.4.
6. Hoel P. G. (1971): Introduction to Mathematical Statistics, Asia Publishing House.
7. Kore B. G. and Dixit P. G.: "Elementary Probability Theory", Nirali Prakashan, Pune.
8. Meyer P.L. (1970): Introductory Probability and Statistical Applications, Addison Wesley.
9. Mukhopadhyay P. (2006): Probability. Books and Allied (P) Ltd.
10. Rohatgi V. K. and Saleh A. K. Md. E. (2002): An Introduction to probability and statistics. John wiley & Sons (Asia).
11. Snedecor G.W. and Cochran W. G. (1967): Statistical Methods, Iowa State University Press.

Note:

1. In theory examination, the weightage to the numerical problems should not exceed 30%.
2. Students can use scientific calculators in theory examination.

B. Sc. Part – I Semester – II

DSC -7B - STATISTICS - III
(DESCRIPTIVE STATISTICS - II)

Theory: 30 hrs. Marks -50 (Credits: 02)

Course Outcomes: Students will acquire knowledge of;

- i. correlation coefficient and interpret its value.
- ii. regression coefficients, interpret its value and use in regression analysis.
- iii. qualitative data including concept of independence and association between two attributes
- iv. vital statistics and concept of mortality and fertility and growth rates.

CONTENTS:

Unit - 1

(15 hrs.)

1.1 Correlation: Bivariate data, Need of analysis of bivariate data, Concept of correlation between two variables, Types of correlation.

Methods of studying correlation: 1) Scatter diagram, its utility, Covariance: Definition, Effect of change of origin and scale, 2) Karl Pearson's coefficient of correlation (r): Definition, Computation for ungrouped and grouped data. Properties: i) $-1 \leq r \leq 1$, Interpretation for different values of r , ii) Effect of change of origin and scale, 3) Spearman's rank correlation coefficient: Definition, Computation (with and without ties). Derivation of the formula for without ties and modification of the formula for with ties. Illustrative examples.

1.2 Regression: Concept of regression, Lines of regression of Y on X ($Y = a + bX + \epsilon$) and X on Y, fitting of lines of regression by the least square method, Regression coefficients b_{xy} , b_{yx} and their geometric interpretations

Properties: i) $b_{xy} \times b_{yx} = r^2$, ii) $b_{xy} \times b_{yx} \leq 1$, iii) $\frac{b_{xy} \times b_{yx}}{2} \geq r$, iv) Effect of change of origin and scale on regression coefficients, The point of intersection of two regression lines, Derivation of acute angle between the two lines of regression, Concept of residual, Mean residual sum of squares, Residual Plot (Residual versus fitted value) and its interpretation, Explained and unexplained variation, coefficient of determination, Illustrative examples.

Unit - 2

(15 hrs.)

2.1 Attributes: Introduction and Notations of Attribute, Dichotomy, class, order of class, positive and negative class, class frequency, ultimate class frequency, fundamental set of class frequency, relationships among different class frequencies (up to three attributes), Concept of consistency, Concept of independence and association of two attributes, Yule's coefficient of association (Q): Definition, $-1 \leq Q \leq +1$, interpretation, Coefficient of colligation (Y): Definition, interpretation, Relation between Q and Y : 1) $Q = \frac{2Y}{1+Y^2}$, 2) $|Q| \geq |Y|$, Correlation Coefficients: 1) Point Biserial Correlation Coefficient, 2) Phi Coefficient, 3) Tetrachoric Correlation Coefficient, Illustrative examples.

2.2 Demography: Introduction, vital events and need of vital statistics, Measures of fertility: Crude Birth Rate (CBR), Age Specific Fertility Rate (ASFR), General Fertility Rate

(GFR), Total Fertility Rate (TFR), Measures of reproduction: Gross Reproduction rate (GRR), Net Reproduction Rate (NRR), Measures of mortality: Crude death rate (CDR), Specific Death Rate (SDR) by i) Direct method ii) Indirect method, Standardized Death Rate (STDR), Population projection at time t , Life Table - construction and its applications in insurance, Use and Applications

Books Recommended:

1. Bhat B. R., Srivenkatramana T and Madhava Rao K. S. (1997): Statistics: a Beginner's Text, Vol. I, New Age International (P) Ltd.
2. Croxton F. E., Cowden D.J. and Kelin S. (1973): Applied General Statistics, Prentice Hall of India.
3. Goon A. M., Gupta M. K., Das Gupta B. (1999): Fundamentals of Statistics, Vol. I and II, World Press, Calcutta.
4. Gupta S. P. (2002): Statistical Methods, Sultan Chand & Sons Pvt. Ltd. New Delhi.
5. Gupta V.K. & Kapoor S.C. Fundamentals of Mathematical Statistics.- Sultan Chand & Sons Pvt. Ltd. New Delhi.
6. Kapur, J. N and Gupta, H. C. : Fundamentals of Mathematical Statistics, S. Chand and sons, New Delhi.
7. Kore B. G. and Dixit P. G.: "Descriptive Statistics-II", Nirali Prakashan, Pune.
8. Srivastav D. S: A Text book of Demography
9. Snedecor G.W. and Cochran W. G. (1967): Statistical Methods, Iowa State University Press.
10. Waiker and Lev.: Elementary Statistical Methods.

Note:

1. In theory examination, the weightage to the numerical problems should not exceed 30%.
2. Students can use scientific calculators in theory examination.

B. Sc. Part – I Semester – II

DSC –8B – STATISTICS – IV

(DISCRETE PROBABILITY DISTRIBUTIONS)

Theory: 30 hrs. Marks -50 (Credits: 02)

Course Outcome: Student will be able to acquire knowledge of;

- i. bivariate discrete distributions, independence of bivariate r.v.s., Mathematical expectation of bivariate discrete random variable.
- ii. one point distribution, two point distribution, Bernoulli distribution,
- iii. Uniform distribution, Binomial distribution, Hypergeometric distribution,
- iv. Poisson distribution, Geometric distribution and Negative binomial distribution.

CONTENTS:

(15 hrs.)

Unit – 1

- 1.1 Bivariate Discrete Distribution:** Definition of bivariate discrete random variable (X, Y) on finite support, Joint p.m.f., and c.d.f., Properties of c.d.f. (without proof), computation of probabilities of events in bivariate probability distribution, marginal and conditional probability distribution. Independence of two discrete r.v.s.,
- 1.2 Mathematical Expectation:** Definition of expectation of function of r.v. in bivariate distribution. Theorems on expectations: (i) $E(X+Y) = E(X) + E(Y)$, (ii) $E(XY) = E(X) \cdot E(Y)$ when X and Y are independent. Expectation and variance of linear combination of two discrete r.v.s., Definition of conditional mean, conditional variance. Covariance and correlation coefficient. $Cov(aX+bY, cX+dY)$. Distinction between uncorrelated and independent variables, Proof of the p.g.f. of sum of two independent r.v. as the product of their p.g.f.

Unit – 2

(15 hrs.)

2.1 Some Standard Discrete Probability Distributions: (finite support):

One point distribution: p.m.f., mean and variance,

Two point distribution: p.m.f., mean and variance,

Bernoulli distribution: p.m.f., p.g.f., mean, variance.

Discrete Uniform Distribution: p.m.f., mean and variance.

Binomial Distribution: Binomial random variable, p.m.f. with parameters (n, p) , recurrence relation for obtaining successive probabilities, mean, and variance, skewness, p.g.f., Additive property of binomial variates, distribution of sum of independent and identically distributed Bernoulli variables.

Hyper geometric Distribution: p.m.f. with parameters (N, M, n) , Computation of probability of different events, recurrence relation for successive probabilities, mean and variance of distribution assuming $n \leq N - M \leq M$, Approximation of hypergeometric to binomial distribution (Statement only).

2.2 Some Standard Discrete Probability Distributions: (Countable infinite support):

Poisson Distribution: Definition of Poisson with parameter λ , mean, variance, probability generating function (p.g.f.). Recurrence relation for obtaining successive probabilities. Additive property of Poisson distribution. Poisson distribution as a limiting case of Binomial distribution (Statement Only).

Geometric Distribution: Definition of Geometric distribution with parameter p , mean and variance, cumulative distribution function, p.g.f. Lack of memory property.

Negative Binomial Distribution: Definition of Negative binomial distribution with parameters (k, p) . Geometric distribution is a particular case of Negative binomial distribution, mean, variance, p.g.f., Recurrence relation for obtaining successive probabilities.

Books Recommended:

1. Bhat B. R., Srivenkatramana T and Madhava Rao K. S. (1997): Statistics: a Beginner's Text, Vol. II, New Age International (P) Ltd.
2. Edward P. J., Ford J. S. and Lin (1974): Probability for Statistical Decision-Making, Prentice Hall.

3. Goon A. M., Gupta M. K., Das Gupta B. (1999): Fundamentals of Statistics, Vol. I and II, World Press, Calcutta.
4. Gupta S. P. (2002): Statistical Methods, Sultan Chand and Sons, New Delhi.
5. Gupta V.K. & Kapoor S.C. Fundamentals of Mathematical Statistics, Sultan & Chand
6. Hogg R. V. and Crag R. G.: Introduction to Mathematical Statistics Ed.4.
7. Hoel P. G. (1971): Introduction to Mathematical Statistics, Asia Publishing House.
8. Kapur J. N. and Gupta H. C. : Fundamentals of Mathematical Statistics, S. Chand and sons, New Delhi.
9. Kore B. G. and Dixit P. G.: Discrete Probability Distributions, Nirali Prakashan, Pune.
10. Meyer P. L. (1970): Introductory Probability and Statistical Applications, Addison Wesley.
11. Mood A. M., Graybill F. A. and Boes D. C. (1974): Introduction to the Theory of Statistics, McGraw Hill.
12. Mukhopadhyay P. (2006): Probability. Books and Allied (P) Ltd
13. Rohatgi V. K. and Saleh A. K. Md. E. (2002): An Introduction to probability and statistics. John wiley & Sons (Asia)

- Note:** 1. In theory examination, the weight age to the numerical problems should not exceed 30%.
2. Students can use scientific calculators in theory examination.

Practical Paper-I (Credit 2+2)

Pre requisites: Knowledge of the topics in the theory papers.

Course Outcomes: Students will able to;

- i. acquire knowledge of computations using MS-Excel.
- ii. represent statistical data diagrammatically and graphically.
- iii. compute various measures of central tendency, dispersion, moments, skewness and kurtosis.
- iv. compute correlation coefficient, regression coefficients.
- v. understand consistency, association and independence of attributes.
- vi. interpret summary Statistics of computer output.
- vii. know applications of some standard discrete probability distributions.
- viii. compute the various fertility rates, mortality rates and growth rates.

List of Practicals:

1. Data handling using MS-Excel
2. Computations using MS-Excel
3. Diagrammatic and Graphical presentation.
4. Measures of central tendency
5. Measures of the dispersion
6. Moments, skewness and kurtosis.
7. Use of random numbers to draw SRSWOR, SRSWR, Stratified and Systematic sample.
8. Computation of probabilities using Baye's theorem.

9. Correlation coefficient, and regression (ungrouped data)
10. Correlation coefficient and regression (grouped data)
11. Spearman's rank correlation coefficient
12. Attributes (Missing frequencies, consistency, association and independence).
13. Demography (Computations of Fertility rates, Mortality rates and Growth rates)
14. Applications of Uniform, Binomial and Hypergeometric distribution.
15. Applications of Poisson, Geometric and Negative Binomial distribution.
16. Bivariate Discrete distribution I. (Marginal and conditional distribution, computation of probabilities of events).
17. Bivariate Discrete distribution II (Expectation /conditional expectation / variance / conditional variance /covariance / correlation coefficient)
18. Case study equivalent to 3 practicals.

Notes:

- a. Students must complete all experiments using MS-EXCEL.
- b. Case study - Different data sets from newspapers, internet, magazines may be collected and students will be asked to use statistical techniques/tools which they have learnt.
- c. MS-EXCEL should be used at the time of practical examination for calculation.
- d. Student must complete the entire practical to the satisfaction of the teacher concerned.
- e. Student must produce laboratory journal along with completion certificate signed by Head of the Department, at the time of practical examination.

Laboratory Requirements:

Laboratory should be well equipped with at least 20 computers along with necessary Software's, at least two printers, sufficient back up facility (UPS/ Inverter/ Generator).

Nature of Practical Question Paper:

- a) In the practical question paper there shall be four questions each of 16 marks, a student has to attempt any two questions.
- b) Computations should be completed using MS-EXCEL and should be demonstrated to examiner. Experiment aim, formulae, results etc. should be written on practical answer paper.
- c) 8 marks are reserved for case study, 5 marks are reserved for the journal and 5 marks for the oral examination.
- d) Practical examination is of four hours duration which includes viva (oral) examination and on line demonstration.

SHIVAJI UNIVERSITY, KOLHAPUR.



Accredited By NAAC with 'A++' Grade

Choice Based Credit System with Multiple Entry and Multiple Exit Option

(NEP-2020)

CHOICE BASED CREDIT SYSTEM

Syllabus for

B.Sc. Part – I

MATHEMATICS

SEMESTER I AND II

(Syllabus to be implemented from Academic Year 2022-23)

B.Sc. Part I (Mathematics), Semester-I & II
Choice Based Credit System with Multiple Entry and Multiple Exit Option
(NEP-2020)

Syllabus to be implemented from Academic Year 2022-23

1. **TITLE:** Mathematics
2. **YEAR OF IMPLEMENTATION:** Revised Syllabus will be implemented from June 2022 onwards.
3. **DURATION:** B.Sc. in Mathematics Part- I. The duration of course shall be one year and two semesters.
4. **PATTERN:** Pattern of examination will be semester.
5. **STRUCTURE OF COURSE:**

STRUCTURE OF COURSE

Sr. No.	Paper	Name of Paper	Marks
Mathematics (Semester I)			
1	DSC-A5	Calculus	50 (Theory)
2	DSC-A6	Differential Equations	50 (Theory)
Mathematics (Semester II)			
3	DSC-B5	Multivariable Calculus	50 (Theory)
4	DSC-B6	Basic Algebra	50 (Theory)
Practical (Annual)			
5	CCPM-I	Core Course Practical in Mathematics - I	50 (Practical)

B.Sc. (Mathematics) (Part I) (Semester – I)
Choice Based Credit System with Multiple Entry and Multiple Exit Option (NEP-2020)
Syllabus to be implemented from Academic Year 2022-23

Course code:	DSC – A5
Title of course:	Calculus
Theory:	32 Hrs. (40 lecturers)
Marks:	50 (Credit: 02)

Course Learning Outcomes: Upon successful completion of the course students will be able to:

1. Evaluate the limit and examine the continuity of a function at a point.
2. Understand the consequences of mean value theorems for differentiable functions.
3. Apply Leibnitz theorem to obtain higher derivatives of product of two differentiable functions.

Unit – 1: Limit, Continuity and Differentiability

(20 lect.)

1.1 Limits: $\epsilon - \delta$ definition, infinite limit ($f \rightarrow \infty$ as $x \rightarrow c$), limit at infinity ($f \rightarrow l$ as $x \rightarrow \infty$ and $f \rightarrow \infty$ as $x \rightarrow \infty$).

1.2 Left hand and Right hand limits: definition and examples.

1.3 Properties of limits:

Theorem: If f and g are two functions defined on some neighbourhood of c such that

$$\lim_{x \rightarrow c} f(x) = l, \lim_{x \rightarrow c} g(x) = m \text{ then}$$

$$(i) \lim_{x \rightarrow c} (f + g)(x) = l + m$$

$$(ii) \lim_{x \rightarrow c} (f - g)(x) = l - m$$

$$(iii) \lim_{x \rightarrow c} (f \cdot g)(x) = lm$$

$$(iv) \lim_{x \rightarrow c} (f/g)(x) = l/m \text{ if } m \neq 0 \text{ (without proof)}$$

1.4 Evaluation of limit: Examples (using techniques like factorization, rationalization, Left hand and Right hand limits etc.).

1.5 Continuous functions: definition of Continuity at a point, definition of continuity in an interval.

1.6 Properties of continuous functions:

1.6.1 Theorem: Let f and g be two functions continuous at a point c , then the functions $f + g$, $f - g$, fg are also continuous at c and if $g(c) \neq 0$, then f/g is also continuous at c .

Functions continuous on closed intervals:

1.6.2 Definition of bounded function

1.6.3 Theorem (Statement only): If a function f is continuous in a closed interval, then it is bounded therein.

- 1.6.4 Theorem: If a function f is continuous on a closed interval $[a, b]$, then it attains its bounds at least once in $[a, b]$.
- 1.6.5 Theorem: If a function f is continuous at an interior point c of an interval $[a, b]$ and $f(c) \neq 0$, then \exists a $\delta > 0$ such that $f(x)$ has the same sign as $f(c)$, for every $x \in]c - \delta, c + \delta[$.
- 1.6.6 Corollary (Statement only): If f is continuous at the end point b of $[a, b]$ and $f(b) \neq 0$, then there exists an interval $]b - \delta, b[$ such that $f(x)$ has the sign of $f(b)$ for all x in $]b - \delta, b[$.
- 1.6.7 Corollary (Statement only): If f is continuous at the end point a of $[a, b]$ and $f(a) \neq 0$, then there exists an interval $[a, a + \delta[$ such that $f(x)$ has the sign of $f(a)$ for all x in $[a, a + \delta[$.
- 1.6.8 Theorem: If a function f is continuous on a closed interval $[a, b]$ and $f(a)$ and $f(b)$ are of opposite signs ($f(a) \cdot f(b) < 0$), then there exists at least one point $\alpha \in]a, b[$ such that $f(\alpha) = 0$.
- 1.6.9 Intermediate Value Theorem.
- 1.6.10 Corollary (Statement only): A function f , which is continuous on a closed interval $[a, b]$, assumes every value between its bounds.
- 1.7 Discontinuous functions: Definition, Types of discontinuities – (i) removable discontinuity (ii) discontinuity of first kind (iii) discontinuity of second kind.
- 1.8 Examples on 1.5 and 1.7
- 1.9 Uniform continuity: definition and simple examples
- 1.10 Theorem: A function which is uniformly continuous on an interval is continuous on that interval.
- 1.11 Differentiability at a point and Differentiability in an interval: definitions.
- 1.12 Examples on 1.11
- 1.13 (Differentiability and continuity) Theorem: A function which is derivable at a point is necessarily continuous at that point

Unit – 2: Mean Value Theorems, Successive Differentiation, Expansions of functions

(20 lect.)

- 2.1 Mean Value Theorems
- 2.1.1 Rolle's Mean Value Theorem, Geometrical interpretation.
- 2.1.2 Lagrange's Mean Value Theorem, Geometrical interpretation.
- 2.1.3 Cauchy's Mean Value Theorem.
- 2.1.4 Examples on 2.1.1, 2.1.2, 2.1.3.
- 2.2 Successive Differentiation
- 2.2.1 Higher order derivatives: notations.

2.2.2 Calculation of n^{th} derivative: Standard results

$(ax + b)^m$, $1/(ax + b)$, $\log(ax + b)$, a^{mx} , e^{mx} , $\sin(ax + b)$, $\cos(ax + b)$,
 $e^{ax} \sin(bx + c)$, $e^{ax} \cos(bx + c)$.

2.2.3 Determination of n^{th} derivative: examples.

2.2.4 Leibnitz's Theorem.

2.2.5 Examples on 2.2.4.

2.3 Expansion of functions

2.3.1 Maclaurin's theorem (Statement only), examples using Maclaurin's theorem.

2.3.2 Taylor's theorems (Statement only), examples using Taylor's theorem.

Recommended Books:

1. **Mathematical Analysis**, S. C. Malik and Savita Arora, New Age International Publishers
4th Edition (2012) – For Unit 1
2. **Differential Calculus**, Shanti Narayan and P.K. Mittal, S. Chand publishing, 15th edition
(2016) – For Unit 2.

Reference Books:

1. **Differential Calculus**, Gorakh Prasad, Pothishala Pvt. Ltd., 19th edition (2016).
2. **Aspects of Calculus**, Gabriel Klambauer, Springer-Verlag.(1986)
3. **Calculus with Maple Labs**, Wieslaw Krawcewicz & Bindhyachal Rai, Narosa (2003).
4. **Calculus**, George B. Thomas Jr., Joel Hass, Christopher Heil & Maurice D. Weir Pearson
Education, 14th edition (2018).

B.Sc. (Mathematics) (Part I) (Semester – I)
Choice Based Credit System with Multiple Entry and Multiple Exit Option (NEP-2020)
Syllabus to be implemented from Academic Year 2022-23

Course code: DSC – A6
Title of course: Differential Equations
Theory: 32 Hrs. (40 lecturers)
Marks: 50 (Credit: 02)

Course Learning Outcomes: Upon successful completion of the course students will able to:

1. Understand types of differential equations.
2. Solve different types of ordinary differential equations.
3. Understand applications of differential equations.

Unit – 1: Ordinary differential equations of first order and first degree (22 lect.)

Definition, Order and Degree, Exact differential equations, Necessary and sufficient condition for exactness, Differential equations reducible to exact, Integrating factors with rules, Linear differential equations, Differential equations reducible to linear differential equation, Bernoulli's differential equations.

Orthogonal trajectories, orthogonal trajectories to Cartesian and polar curves. Differential equations of first order but not of first degree: Equations that can be factorized, Equations solvable for p , Equations that cannot be factorized, Equations solvable for x , Equations solvable for y and Clairaut's form.

Unit – 2: Linear differential equations with constant coefficients (18 lect.)

Definition, General solution, Auxiliary equation, Complementary function, Types of complementary function: real and distinct roots, real and repeated roots, complex roots, complex and repeated roots, mixed roots, Examples on different types of complementary function, Particular integral, Particular integrals of the functions: e^{ax} , $\sin ax$, $\cos ax$, x^m , $e^{ax} V$, $x.V$ and general method.

Recommended Books:

1. **Ordinary and partial differential equations**, M. D. Raisinghania, S. Chand and Company Pvt. Ltd, New Delhi, 18th Revised Edition (2016).

Reference Books:

1. **Introductory course in differential equations**, D. A. Murray, Khosala Publishing House, Delhi.
2. **An Introduction to Differential Equations**, R. K. Ghosh and K. C. Maity. Book and Allied (P) Ltd., Seventh Edition (2000).
3. **Differential Equations and Their Applications**, Zafar Ahasan, PHI, Second Edition (2004).

B.Sc. (Mathematics) (Part I) (Semester – II)
Choice Based Credit System with Multiple Entry and Multiple Exit Option (NEP-2020)
Syllabus to be implemented from Academic Year 2022-23

Course code:	DSC – B5
Title of course:	Multivariable Calculus
Theory:	32 Hrs. (40 lecturers)
Marks:	50 (Credit: 02)

Course Learning Outcomes: Upon successful completion of the course students will able to:

1. Learn conceptual variations while advancing from one variable to several variables in calculus.
2. Set up and solve optimization problems involving several variables.
3. Learn the concept of Jacobian of a transformation.

Unit – 1: Partial differentiation

(20 lect.)

Functions of two variables: domain, Neighbourhood of a point, Continuity of functions of two variables (at a point), Limit of functions of two variables, Partial derivatives: first order partial derivatives, partial derivatives of higher order, Geometrical interpretation of partial derivatives, examples,

Homogeneous functions: definition, Euler's theorem on homogeneous functions (Case of two and three variables), examples using Euler's theorem. Total Differentials, Differentiation of composite functions, examples, Implicit function: first and second order derivative of implicit functions and its examples. Taylor's theorem for a function of two variables, its examples.

Unit – 2: Extreme values and Jacobian

(20 lect.)

Maxima and minima of functions of two variables: Condition for existence of maxima or minima, stationary and extreme points, Sign of quadratic expression, Lagrange's condition for maximum and minimum values of a function of two variables, examples, Lagrange's method of undetermined multipliers, examples using Lagrange's method.

Jacobian: Definition, examples. Jacobian of function of function (for the case of two and three variables and proof of the corollary $J \cdot J' = 1$ is expected), Jacobian of implicit functions, examples using these properties.

Recommended Books:

1. **Differential Calculus**, Shanti Narayan and P.K. Mittal, S. Chand publishing, 15th edition (2016).

Reference Books:

1. **Basic Multivariable Calculus**, J. E. Marsden, A. J Tromba & A. Weinstein; Springer Verlag, New New York, 1993.
2. **Calculus, Early Transcendental**, H. Anton, I. Birens and Davis, John Wiley and Sons, 11th Edition (2015).
3. **Differential Calculus**, Maity and Ghosh, New Central Book Agency (P) limited, Kolkata, India. 2007.
4. **Calculus: Early transcendental**, James Stewart, Brooks/ Cole Cengage Learning, 7th edition (2012).

B.Sc. (Mathematics) (Part I) (Semester – II)
Choice Based Credit System with Multiple Entry and Multiple Exit Option (NEP-2020)
Syllabus to be implemented from Academic Year 2022-23

Course code:	DSC – B6
Title of course:	Basic Algebra
Theory:	32 Hrs. (40 lecturers)
Marks:	50 (Credit: 02)

Course Learning Outcomes: Upon successful completion of the course students will able to:

1. Use fundamental concepts in Mathematics like sets, relations and functions.
2. Use fundamental concepts in Number theory.
3. Solve examples on congruence.
4. Determine n^{th} roots of unity.
5. Understand various properties of hyperbolic functions.

Unit – 1: Functions, divisibility and congruence (20 lect.)

- 1.1 Set, Relations on sets, type of relations, equivalence relations, Equivalence classes and partitions of a set.
- 1.2 Functions: One-one, onto functions and bijections, composition of functions (Definitions and examples).
- 1.3 The induction principle and strong induction principle.
- 1.4 Divisibility and congruence:
 - 1.4.1 The division algorithm: Theorem and its applications.
 - 1.4.2 Definitions of Greatest common divisor least common multiple.
 - 1.4.3 Euclidean Algorithm.
 - 1.4.4 Fundamental Theorem of Arithmetic.
 - 1.4.5 The theory of Congruence: Basic Properties of congruence.

Unit – 2: Complex numbers (20 lect.)

- 2.1 Complex numbers (Revision): Sums and Products, Basic Algebraic Properties, Moduli, complex conjugates and polar representation of complex numbers.
- 2.2 Theorem: De Moivre's theorem.
 - 2.2.1 n^{th} roots of unity.
 - 2.2.2 Examples.
- 2.3 Complex logarithm and complex power.
- 2.4 Hyperbolic functions and identities.
- 2.5 Relation between hyperbolic and trigonometric functions.
- 2.6 Identities of hyperbolic functions.

- 2.7 Hyperbolic equations.
- 2.8 Inverses of hyperbolic functions.
- 2.9 Derivative of hyperbolic and inverse hyperbolic functions

Recommended books:

- 1 **A Foundation Course in Mathematics**, Ajit Kumar, S. Kumeresan and Bhaba Kumar Sarma, Narosa Publication House.
Unit 1 (1.1): Chapter 4: 4.1 to 4.4, (1.2): Chapter 3: 3.1 to 3.3, (1.3): Chapter 5: 5.1 to 5.2.
- 2 **Elementary Number Theory**, Seventh edition: David M. Burton, McGraw-Hill.
Unit 1 (1.4): Chapter 2: 2.2 to 2.4, Chapter 3: 3.1, Chapter 4: 4.2.
- 3 **Foundation Mathematics for the Physical Sciences**, Riley and Hobson, Cambridge University press, 2011.
Unit 2 (2.1 to 2.9): Chapter 5: 5.1 to 5.7.

Reference Books:

- 1 **Foundations of Complex Analysis**, S. Ponnusamy, Narosa Publishing House, India, Second Edition Reprint 2019.
- 2 **Introduction to Real Analysis**, R.G. Bartle and D.R. Sherbert, John Wiley and Sons Inc, Fourth Edition.