

Zoology
B.Sc. Part III 2018-19

Paper-I

**ECOLOGY, ENVIRONMENTAL BIOLOGY, TOXICOLOGY,
MICROBIOLOGY AND MEDICAL ZOOLOGY**

Unit: I (Ecology)

- Aims and scopes of ecology
- Major ecosystems of the world-Brief introduction
- Population- Characteristics and regulation of densities
- Communities and ecosystem
- Bio-geo chemical cycles
- Air & water pollution
- Ecological succession

Unit: II (Environmental Biology)

- Laws of limiting factor
- Food chain in fresh water ecosystem
- Energy flow in ecosystem- Trophic levels
- Conservation of natural resources
- Environmental impact assessment

Unit: III (Toxicology)

- Definition and classification of Toxicants
- Basic Concept of toxicology
- Principles of systematic toxicology
- Heavy metal Toxicity (Arsenic, Mercury, Lead, Cadmium)
- Animal poisons- snake venoms, scorpion & bee poisoning
- Food poisoning

Unit: IV (Microbiology)

- General and applied microbiology
- Microbiology of domestic water and sewage
- Microbiology of milk & milk products
- Industrial microbiology: fermentation process, production of penicillin, alcoholic beverages, bioleaching.

Unit: V (Medical Zoology)

- Brief introduction to pathogenic microorganisms, Rickettsia, Spirochaetes, AIDS and Typhoid
- Brief account of life history & pathogenicity of the following pathogens with reference to man: prophylaxis & treatment
- Pathogenic protozoans- Entamoeba, Trypanosome & Plasmodium
- Pathogenic helminths- Schistosoma
- Nematode pathogenic parasites of man
- Vector insects

Zoology
B.Sc. Part III 2018-19
Paper II

GENETICS, CELL, PHYSIOLOGY, BIOCHEMISTRY, BIOTECHNOLOGY AND BIOTECHNIQUES

Unit: I (Genetics)

- Linkage & linkage maps, Sex Determination and Sex Linkage
- Gene interaction- Incomplete dominance & Codominance, Supplementary gene, Complementary gene, Epistasis Lethal gene, Pleiotropic gene and multiple alleles.
- Mutation: Gene and chromosomal mutation
- Human genetics: chromosomal alteration: Down, Edward, Patau, Turner and Klinefelter Syndrome Single gene disorders: Alkaptonuria, Phenylketonuria, Sickle cell anemia, albinism and colour blindness

Unit: II (Cell Physiology)

- General idea about pH & buffer
- Transport across membrane: Diffusion and Osmosis
- Active transport in mitochondria & endoplasmic reticulum
- Enzymes-classification and Action

Unit: III (Biochemistry)

- Amino acids & peptides- Basic structure & Biological function
- Carbohydrates & its metabolism- Glycogenesis, Gluconeogenesis, Glycolysis, Glycogenolysis, Cori-cycle
- Lipid metabolism- Oxidation of glycerol, Oxidation of fatty acids
- Protein Catabolism- Deamination, transamination, transmethylation

Unit: IV (Biotechnology)

- Application of Biotechnology
- Recombinant DNA & Gene cloning
- Cloned genes & other tools of biotechnology (Tissue culture, Hybridoma, Transgenic Animals and Gene library)

Unit: V (Biotechniques)

1. Principles & techniques about the following:
 - (i) pH meter
 - (ii) Colorimeter
 - (iii) Microscopy- Light microscopes: Compound, Phase contrast & Electron microscopes
 - (iv) Centrifuge
 - (v) Separation of biomolecules by chromatography & electrophoresis

B. Sc. Part III 2018-19
Zoology
Practical

The practical work in general shall be based on syllabus prescribed in theory.

The candidates will be required to show knowledge of the following:

- Estimation of population density, percentage frequency, relative density.
- Analysis of producers and consumers in grassland.
- Detection of gram-negative and gram-positive bacteria.
- Blood group detection (A,B,AB,O)
- R, B, C, and W.B.C count
- Blood coagulation time
- Preparation of hematin crystals from blood of rat
- Observation of *Drosophila*, wild and mutant.
- Chromatography-Paper or gel.
- Colorimetric estimation of Protein.
- Mitosis in onion root tip.
- Biochemical detection of Carbohydrate, Protein and Lipid.
- Study of permanent slides of parasites, based on theory paper.
- Working principles of pH meter, colorimeter, centrifuge and microscope.

Scheme of marks distribution

Time: 3:30hrs

| | |
|------------------------------------------------------------------------------------------------|----|
| • Hematological Experiment | 08 |
| • Ecological Experiment: Grassland Ecosystem/ Population Density/Frequency/relative density | 06 |
| • Bacterial staining | 05 |
| • Biochemical experiment | 06 |
| • Practical based on Instrumentation (Chromatography/ pH meter/microscope/centrifuge. | 05 |
| • Spotting (5 spots) | 10 |
| 7 Viva | 05 |
| 8. Sessional | 05 |

B.SC.-III (BOTANY) PAPER -I
**(ANALYTICAL TECHNOLOGY PLANT PATHOLOGY,
EXPERIMENTAL EMBRYOLOGY, ELEMENTARY BIOSTATISTICS,
ENVIRONMENTAL POLLUTION AND CONSERVATION)**

UNIT-I

Structure, Principle and applications of analytical instrumentation.

Chromatography technique, Oven, Incubator, Autoclave, Centrifuge, Spectrophotometer

UNIT-II

Plant Tissue culture techniques, growth media, totipotency, protoplast culture, somatic hybrids and cybrids, micropropagation, somaclonal variations, haploid culture.

Analytical techniques: Microscopy-Light microscope, Electron microscope

UNIT-III

General principles of plant pathology, general symptoms of fungal, bacterial and viral diseases, mode of infection, diseases resistance and control measures, plant quarantine. A study of epidemiology and etiology of following plant diseases.

Rust diseases of wheat, Tikka diseases of ground nut, Red rot of sugar cane, Bacterial blight of rice, Yellow vein mosaic of bhindi, Little leaf of brinjal.

UNIT-IV

Introduction to pollution, green house gases, Ozone depletion, Dissolve oxygen, B.O.D., C.O.D.

Bio magnification, Eutrophication, Acid precipitation, Phytoremediation, Plant indicators, Biogeographical Zones of India, Concept of biodiversity, CBD, MAB, National parks and

biodiversity Hot spots, Conservation strategies, Red Data Book, IUCN threat categories, invasive species, endemic species, concept of sustainable development.

UNIT-V

ELEMENTARY BIOSTATISTICS:

Introduction and application of Biostatistics, measure of central tendency-Mean, Median, Mode, measures of dispersal-Standard deviation, standard error.

Books Recommended:

Singh, R.S, *Plant Diseases*, Oxford & IBH, New Delhi.

Pandey, BP, *Plant Pathology*, S.Chand Publishing, New Delhi

Sharma, PD, *Microbiology and Plant pathology*, Rastogi Publications, Meerut

Sharma PD, *Mycology and Phytopathology*, Rastogi Publications, Meerut

Singh JS, Singh SP and Gupta, SR, *Ecology Environmental Science and Conservation*, S. Chand Publishing, New Delhi

Sharma, PD, *Ecology and Environment*, Rastogi Publications, Meerut

Bhojwani, SS and Razdan, MK, *Plant Tissue Culture: Theory and Practices*, Elsevier

Sharma AK, *Text book of Biostatistics*, Discovery Publishing House Pvt. Ltd.

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B.Sc.-III (BOTANY) PAPER -II
(GENETICS, MOLECULAR BIOLOGY, BIOTECHNOLOGY AND
BIOCHEMISTRY)

UNIT-I

Cell and cell organelles, organization and morphology of chromosomes, giant chromosomes, cell division, Mendel's laws, gene interaction, linkage and crossing over, chromosomal aberration, polyploidy, sex linked inheritance, sex determination, cytoplasmic inheritance, gene concept: cistron, muton, recon.

UNIT-II

Nucleic acids, structure and forms of DNA and RNA, DNA/RNA as genetic material, replication of DNA, biochemical and molecular basis of mutation, genetic code and its properties, mechanism of transcription and translation in prokaryotes, regulation of gene expression, Operon model.

UNIT-III

Recombinant DNA, Enzymes in recombinant DNA technology, cloning vectors (Plasmid, Bacteriophages, Cosmids, Phagemids), gene cloning, PCR, Application of Biotechnology; G.M.Plants, Monoclonal antibodies, DNA finger printing

UNIT-IV

Protein: Chemical composition, primary, secondary and tertiary structure of Proteins.

Carbohydrate: general account of monosaccharides, disaccharide and Polysaccharides

Fat: Structure and properties of fats and fatty acids, synthesis and breakdown.

UNIT-V

ENZYMES: Nomenclature and classification, components of enzyme, theories of enzyme action, enzyme kinetics (Michaelis-Menten constant), allosteric enzymes, isozymes, Abzymes, Ribozymes, factors affecting enzyme activity.

Books Recommended:

Nelson, DL, Cox, MM, *Lehringer Principles of Biochemistry*, W.H. Freeman and Company, New York, USA.

Cooper, GM, *The Cell: A Molecular Approach*, ASM Press & Sunderland, Washington, D.C. Sinauer Associates, MA.

Singh BD, *Fundamental of Genetics*, Kalyani Publication

Singh BD, *Genetics*, Kalyani Publication

Gupta, PK, *Cell and Molecular Biology*, Rastogi Publications, Meerut

Singh, BD, *Biotechnology: Expanding Horizons*, Kalyani publications

Gupta, PK, *Elements of Plant Biotechnology*, Rastogi Publications, Meerut

Gupta, SN, *Concepts of Biochemistry*, Rastogi Publications, Meerut

Jain, J.L., Jain S, Jain, N, *Fundamentals of Biochemistry*, S Chand Publishing, New Delhi

B.Sc.-III (Botany)

Practical

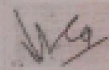
1. Study of host parasite relationship of plant diseases listed above.
2. Demonstration of preparation of Czapek's Dox medium and Potato dextrose agar medium, sterilization of culture medium and pouring.
3. Inoculation in culture tubes and petriplates.
4. Gram Staining.
5. Microscopic examination of Card.
6. Study of plant diseases as listed in the theory paper.
7. Biochemical test of carbohydrate and protein.
8. Instrumentation techniques

PRACTICAL SCHEME

TIME: 4 Hrs.

M.M. : 50

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|----|----------------------------|----|
| 1. | Plant Disease/Symptoms | 10 |
| 2. | Instrumentation techniques | 05 |
| 3. | Staining of Microbes | 05 |
| 4. | Tissue Culture techniques | 05 |
| 5. | Spotting | 10 |
| 6. | Project Work/ Field Study | 05 |
| 5. | Viva-Voce | 05 |
| 6. | Seminar | 05 |

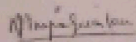


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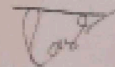


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15

**New Proposed Syllabus
For
UNDERGRADUATE PROGRAMME
(B.Sc. PROGRAM in PHYSICS)**

B.Sc. Programme in Physics

Course structure

B.Sc. - Part-I

| | |
|---------|------------------------------------------------------|
| PAPER 1 | Mechanics, Oscillations and Properties Of Matter |
| PAPER 2 | Electricity and Magnetism And Electromagnetic Theory |

B.Sc. - Part-II

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|---------|--------------------------------------------------------|
| PAPER 1 | Thermodynamics, Kinetic Theory And Statistical Physics |
| PAPER 2 | Waves, Acoustics and Optics |

B.Sc. - Part-III

| | |
|---------|---------------------------------------------------------------------|
| PAPER 1 | Relativity, Quantum Mechanics, Atomic Molecular and Nuclear Physics |
| PAPER 2 | Solid State Physics, Solid State Device And Electronics |

B.Sc. Part-III

Subject: Physics

Paper-I: RELATIVITY, QUANTUM MECHANICS, ATOMIC MOLECULAR AND NUCLEAR PHYSICS

| UNIT | Current Course | New Proposed Course | Justification |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
| I | Reference systems, inertial frames, Galilean invariance and conservation laws, propagation of light, Michelson-Morley experiment, search for ether. Postulates for the special theory of relativity, Lorentz transformations, length contraction, time dilation, velocity addition theorem, variation of mass with velocity, mass-energy equivalence, particle with zero rest mass, Compton effect. | Reference systems, inertial frames, Galilean invariance propagation of light, Michelson-Morley experiment, search for ether. Postulates for the special theory of relativity, Lorentz transformations, length contraction, time dilation, velocity addition, variation of mass with velocity, mass-energy equivalence, particle with zero rest mass. | No modification |
| II | Origin of the quantum theory: Failure of classical physics to explain the phenomena such as black-body spectrum, photoelectric effect. Wave-particle duality and uncertainty principle : de Broglie's hypothesis for matter waves : the concept of wave and group velocities, evidence for diffraction & interference of particles, experimental demonstration of mater waves. Davisson and Germer's experiment. Consequence of de Broglie's concepts, quantisation in hydrogen atom, energies of a particle in a box, wave packets. Consequence of the uncertainty relation: gamma ray microscope, diffraction at a slit. | Origin of the quantum theory : Failure of classical physics to explain the phenomena such as black-body spectrum, photoelectric effect, Compton effect, Wave-particle duality, uncertainty principle, de Broglie's hypothesis for matter waves, the concept of Phase and group velocities, experimental demonstration of mater waves. Davisson and Germer's experiment. Consequence of de Broglie's concepts, Bohr's complementary Principle, Bohr's correspondence principle, Bohr's atomic model , energies of a particle in a box, wave packets. Consequence of the uncertainty relation, gamma ray microscope, diffraction at a slit. | Relevant topic introduced |
| III | Quantum Mechanics: Schrodinger's equation. Postulatory basis of quantum mechanics, operators, expectation values, transition probabilities, applications to particle in a one and three dimensional | Quantum Mechanics: Schrodinger's equation. Statistical interpretation of wave function, Orthogonality and normalization of wave function, Probability current density, Postulatory basis of quantum mechanics, operators, expectation values, | Relevant topic introduced |

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|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|
| | boxes, harmonic oscillator in one dimension, reflection at a step potential, transmission across a potential barrier. Hydrogen atom: natural occurrence of n, l and m quantum numbers, the related physical quantities. | Ehrenfest's theorem, transition probabilities, applications to particle in a one and three dimensional boxes, harmonic oscillator in one dimension, reflection at a step potential, transmission across a potential barrier. | |
| IV | Spectra of hydrogen, deuteron and alkali atoms spectral terms, doublet fine structure, screening constants for alkali spectra for s, p, d and f states, selection rules. Discrete set of electronic energies of molecules, quantisation of vibrational and rotational energies, determination of internuclear distance, pure rotational and rotation vibration spectra. Dissociation limit for the ground and other electronic states, transition rules for pure vibration and electronic vibration spectra. Raman effect, Stokes and anti-Stokes lines, complimentary character of Raman and infrared spectra, experimental arrangements for Raman spectroscopy. | Spectra of hydrogen, deuteron and alkali atoms spectral terms, doublet fine structure, screening constants for alkali spectra for s, p, d and f states, selection rules. Discrete set of electronic energies of molecules, quantisation of vibrational and rotational energies, determination of internuclear distance, pure rotational and rotation vibration spectra. Dissociation limit for the ground and other electronic states, transition rules for pure vibration and electronic vibration spectra. Raman effect, Stokes and anti-Stokes lines, complimentary character of Raman and infrared spectra, experimental arrangements for Raman spectroscopy. | No modification |
| V | Interaction of charged particles and neutrons with matter, working of nuclear detectors, G-M counter, proportional counter and scintillation counter, cloud chambers, spark chamber, emulsions. Structure of nuclei, basic properties (r ₁ , μ, Q and binding energy), deuteron binding energy, p-p and n-p scattering and general concepts of nuclear forces, Beta decay, range of alpha particle Geiger-Nuttal law. Gamow's explanation of beta decay, alpha decay and continuous and discrete spectra. Nuclear reactions, channels, compound nucleus, direct reaction (concepts). Shell model & liquid drop model, fission and fusion (concepts), energy | Structure of nuclei:- Basic Properties of Nuclei: (1) Mass, (2) Radii, (3) Charge, (4) Angular Momentum, (5) Spin, (5) Magnetic Moment (μ), (6) Stability and (7) Binding Energy, Nuclear Models:- Liquid Drop Model, Mass formula, Shell Model, Types of Nuclear reactions, laws of conservation, Q-value of reactions, Interaction of Energetic particles with matter, Ionization chamber, GM Counter, Cloud Chambers, Fundamental Interactions, Classification of Elementary Particles, Particles and Antiparticles. Baryons, Hyperons, Leptons, and Mesons. Elementary Particle Quantum Numbers : Baryon Number, Lepton Number, Strangeness, Electric Charge, Hypercharge and Isospin, introductory idea of discovery of Higg's Boson. | Idea of high energy physics is introduced. |

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| production in stars by p-p and carbon cycles (concepts). | |
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TEXT AND REFERENCE BOOKS :

1. H.S. Mani and G.K. Metha : "Introduction to Modern Physics"" (Affiliated East-West Press,1989)
2. A Beiser, "Prospective of Modern Physics"
3. H.E. White, Introduction to Atomic Physic"
4. Barrow, "Introduction to Molecular Physics!"
5. R.P. Feynman, R.B. Leighton and M Sands, "The Feynman Lectures on Physics", Vol.III (B.I. Publications, Bombay, Delhi, Calcutta, Madras).
6. T.A. Littlefield and N Thorley, "Atomic and Nuclear Physics" (Engineering Language Book Society)
7. H.A. Enge, "Introduction to Nuclear Physics", (Addision-Wesly)
8. Eisenberg and Resnik, "Quantum Physics of Atoms, Molecules, Solids, Nuclei and Particles" (John Wiley)
9. D.P. Khandelwal, "Optics and Atomic Physics", (Himalaya Publishing House, Bombay,1988).
10. Quarks and Leptons, F. Halzen and A.D. Martin, Wiley India, New Delhi, 1984.
11. Radiation detection and measurement, G.F. Knoll (John Wiley & Sons, 2000).
12. Theoretical Nuclear Physics, J.M. Blatt & V.F. Weisskopf (Dover Pub. Inc., 1991).

B.Sc. Part-III

Subject: Physics

Paper-II: SOLID STATE PHYSICS, SOLID STATE DEVICES AND ELECTRONICS

| UNIT | Current Course | New Proposed Course | Justification |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|
| I | Amorphous and crystalline solids, Elements of symmetry, seven crystal system, Cubic lattices, Crystal planes, Miller indices, Laue's equation for X-ray diffraction, Bragg's Law. Bonding in solids, classification. Cohesive energy of solid. Madelung constant, evaluation of Parameters. Specific heat of solids, classical theory (Dulong-Petit's law). Einstein and Debye theories. Vibrational modes of one dimensional monoatomic lattice, Dispersion relation, Brillouin Zone. | Amorphous and crystalline solids, Elements of symmetry, seven crystal system, Cubic lattices, Crystal planes, Miller indices, Laue's equation for X-ray diffraction, Bragg's Law, Bonding in solids, classification. Cohesive energy of solid, Madelung constant, evaluation of Parameters, Specific heat of solids, classical theory (Dulong-Petit's law), Einstein and Debye theories, Vibrational modes of one dimensional monoatomic lattice, Dispersion relation, Brillouin Zone. | No modification |
| II | Free electron model of a metal, Solution of one dimensional Schrodinger equation in a constant potential. Density of states. Fermi Energy, Energy bands in a solid (Kronig-Penny model without mathematical details). Metals, Insulator and Semiconductors. Hall effect. Dia, Para and Ferromagnetism. Langevin's theory of dia and para-magnetism. Curie- Weiss's Law. Qualitative description of Ferromagnetism (Magnetic domains), B-H. curve and Hysteresis loss. | Free electron model of a metal, Solution of one dimensional Schrödinger equation in a constant potential, Density of states. Fermi Energy, Energy bands in a solid (Kronig- Penny model without mathematical details), <u>Difference between Metals, Insulator and Semiconductors</u> , Hall effect. Dia, Para and Ferromagnetism. Langevin's theory of dia and para-magnetism, Curie- Weiss's Law, Qualitative description of Ferromagnetism (Magnetic domains), B-H curve and Hysteresis loss. | No modification only basic idea about categorization of metal introduced |

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| <p>III</p> <p>Intrinsic semiconductors, carrier concentration in thermal equilibrium, Fermi level, Impurity semiconductor, donor and acceptor levels, Diode equation, junctions, junction breakdown, Depletion width and junction capacitance, abrupt junction, Tunnel diode, Zener diode, Light emitting diode, solar cell, Bipolar transistors, pnp and npn transistors, characteristics of transistors, different configurations, current amplification factor, P.E.T.</p> | <p><i>Intrinsic and extrinsic semi conductors, Concept of Fermi level, Generation and recombination of electron hole pairs in semiconductors, Mobility of electrons and holes, drift and diffusion currents, p-n junction diode, depletion width and potential barrier, Junction capacitance, Light emitting diode, Tunnel diode, Zener diode, Light emitting diode, solar cell, Bipolar transistors, pnp and npn transistors, characteristics of transistors, different configurations, current amplification factor, P.E.T and MOSFET Characteristics.</i></p> | <p>This syllabus is changed in accordance with the syllabus of other universities</p> |
| <p>IV</p> <p>Half and full wave rectifier, rectifier efficiency ripple factor, Bridge rectifier, Filters, Inductor filter, L and π filters, Zener diode, regulated power supply, Applications of transistors, Bipolar Transistor as amplifier, Single stage and CE small signal amplifiers, Emitter followers, Transistor as power amplifier, Transistor as oscillator, Wein-Bridge Oscillator and Hartley oscillator.</p> | <p>Half and full wave rectifier, rectifier efficiency ripple factor, Bridge rectifier, Filters, Inductor filter, L and π section filters, Zener diode, regulated power supply using zener diode, Applications of transistor, bipolar Transistor as amplifier, h-parameter, h-parameter equivalent circuit, Transistor as power amplifier, Transistor as oscillator, principle of an oscillator and Barkhausen's condition, requirements of an oscillator, Wein-Bridge oscillator and Hartley oscillator.</p> | <p>introduced h-parameter, h-parameter Equivalent Circuit, are easy way to understand of various amplification circuit.</p> |
| <p>V</p> <p>Introduction to computer organisation, time sharing and multi programming systems, window based word processing packages, MS Word, Introduction to C programming and application to simple problems of arranging numbers in ascending / descending orders ; sorting a given data in an array, solution of simultaneous equation.</p> | <p>Digital Circuits: Difference between Analog and Digital Circuits, Binary Numbers, Decimal to Binary and Binary to Decimal Converter, AND, OR and NOT Gate; (Realization using Diode and Transistor), NAND and NOR Gate as Universal Gates, XOR and XNOR Gate, De Morgan's Theorem, Boolean Law, Simplification of Logic Circuit using Boolean Algebra, Digital to Analog Converter, Analog to Digital Converter.</p> | <p>The topic of Computer programming does not match with the title. Digital electronics is introduced in place of computers, as computer is taught as a different stream.</p> |

- TEXT AND REFERENCE BOOKS :
1. Introduction to solid state physics : C.Kittel
 2. Solid State Physics : A.J. Dekker
 3. Electronic Circuits : Motherhead
 4. Electronic Circuits : Millman and Halkias

- 5. Semiconductor Devices : S.M. Sze
- 6. Electronic devices : T.L. Floyd
- 7. Device and Circuits : J. Millman and C. Halkias.
- 8. Electronic Fundamental and Applications: D. Chatopadhyay and P.C. Rakshit.
- 9. Electricity and Magnetism : K.K. Tiwari.

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PHYSICS

OBJECTIVES OF THE COURSE

The undergraduate training in physics is aimed at providing the necessary inputs so as to set forth the task of bringing about new and innovative ideas/concepts so that the formulated model curricula in physics becomes in tune with the changing scenario and incorporate new and rapid advancements and multi disciplinary skills, societal relevance, global interface, self sustaining and supportive learning.

It is desired that undergraduate i.e. B.Sc. level besides grasping the basic concepts of physics should in addition have broader vision. Therefore, they should be exposed to societal interface of physics and role of physics in the development of technologies.

EXAMINATION SCHEME:

1. There shall be 2 theory papers of 3 hours duration each and one practical paper of 4 hours duration. Each paper shall carry 50 marks.
2. Numerical problems of at least 50% will compulsorily be asked in each theory paper.
3. In practical paper, each student has to perform two experiments one from each groups as listed in the list of experiments.
4. Practical examination will be of 4 hours duration- one experiment to be completed in 2 hours.

The distribution practical marks as follows:

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|---------------------|------------|
| Experiment | : 15-15-20 |
| Viva voce | : 10 |
| Internal assessment | : 10 |

5. The external examiner should ensure that at least 16 experiments are in working order at the time of examination and submit a certificate to this effect.

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विषय/संकाय/प्रश्नपत्र का नाम: B.Sc. Part-III (Mathematics)

Paper-III (Optional Papers)

| वर्तमान पाठ्यक्रम | नवीन संशोधित पाठ्यक्रम | नवीन संशोधित पाठ्यक्रम का औचित्य |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| (I) PRINCIPLES OF COMPUTER SCIENCE (II) DISCRETE MATHEMATICS (III) APPLICATION OF MATHEMATICS IN FINANCE AND INSURANCE (IV) PROGRAMMING IN C AND NUMERICAL ANALYSIS (V) MATHEMATICAL MODELLING | (I) PRINCIPLES OF COMPUTER SCIENCE (II) DISCRETE MATHEMATICS APPLICATION OF MATHEMATICS IN FINANCE AND INSURANCE (III) PROGRAMMING IN C AND NUMERICAL ANALYSIS MATHEMATICAL MODELLING | पूर्व में प्रचलित 5 वैकल्पिक प्रश्नपत्रों में से दो को अलोकप्रिय होने के कारण विलोपित किया गया है। विगत 10 वर्षों में किसी भी छात्र/छात्रा द्वारा उक्त प्रश्नपत्रों का चयन नहीं किया गया है। |
| प्रश्नपत्र का पाठ्यक्रम यथावत है। | | |

Prof.H.K.Pathak

Prof.B.S.Thakur

Prof.M.A.Siddiqui

Dr.S.K.Bhatt

Dr.R.K.Mishra

Dr.A.K.Mishra

S.K.Gupta

Sangeeta Pandey

MATHEMATICS

There shall be three theory papers. Two compulsory and one optional. Each paper carrying 50 marks is divided into five units and each unit carry equal marks.

B.Sc. Part-III PAPER - I ANALYSIS

REAL ANALYSIS

UNIT-I Series of arbitrary terms. Convergence, divergence and oscillation. Abel's and Dirichlet's test. Multiplication of series. Double series. Partial derivation and differentiability of real-valued functions of two variables. Schwarz and Young's theorem. Implicit function theorem. Fourier series. Fourier expansion of piecewise monotonic functions.

UNIT-II Riemann integral. Integrability of continuous and monotonic functions. The fundamental theorem of integral calculus. Mean value theorem of integral calculus. Improper integrals and their convergence. Comparison tests. Abel's and Dirichlet tests. Fubini's integral. Integral as a function of a parameter. Continuity, derivability and integrability of an integral of a function of a parameter.

COMPLEX ANALYSIS

UNIT-III Complex numbers as ordered pairs. Geometrical representation of complex numbers. Stereographic projection. Continuity and differentiability of complex functions. Analytic functions. Cauchy-Riemann equations. Harmonic functions. Elementary functions. Mapping by elementary functions. Mobius transformations. Fixed points, Cross ratio. Inverse points and critical mappings. Conformal mappings.

METRIC SPACES

UNIT-IV Definition and examples of metric spaces. Neighbourhoods, Limit points, Interior points, Open and Closed sets, Closure and interior. Boundary points, Sub-space of a metric space. Cauchy sequences, Completeness, Cantor's intersection theorem. Contractive principle, construction of real numbers as the completion of the incomplete metric space of rationals. Real numbers as a complete ordered field. Dense subsets. Baire Category theorem. Separable, second countable and first countable spaces. Continuous functions. Extension theorem. Uniform continuity, isometry and homeomorphism. Equivalent metrics. Compactness, sequential compactness. Totally bounded spaces. Finite intersection property. Continuous functions and Compact sets, Connectedness, Components. Continuous functions and Connected sets.

REFERENCES :

1. T.M. Apostol, *Mathematical Analysis*, Narosa Publishing House, New Delhi, 1985.
2. R.R. Goldberg, *Real Analysis*, Oxford & BHJ Publishing Co., New Delhi, 1970.
3. S. Lang, *Undergraduate Analysis*, Springer-Verlag, New York, 1983.
4. D. Somasundaram and B. Choudhury, *A First Course in Mathematical Analysis*, Narosa Publishing House, New Delhi, 1997.
5. Shanti Narayan, *A Course of Mathematical Analysis*, S. Chand & Co. New Delhi.
6. P.K. Jain and S.K. Kaushik, *An Introduction to Real Analysis*, S. Chand & Co., New Delhi, 2000.
7. R.V. Churchill and J.W. Brown, *Complex Variables and Applications*, 5th Edition, McGraw-Hill, New York, 1990.
8. Mark J. Ablowitz and A.S. Fokas, *Complex Variables : Introduction and Applications*, Cambridge University Press, South Asian Edition, 1998.
9. Shanti Narayan, *Theory of Functions of a Complex Variable*, S. Chand & Co., New Delhi.
10. E.T. Copson, *Metric Spaces*, Cambridge University Press, 1968.
11. P.K. Jain and K. Ahmad, *Metric Spaces*, Narosa Publishing House, New Delhi, 1996.
12. G.F. Simmons, *Introduction to Topology and Modern Analysis*, McGraw-Hill, 1963.

B.Sc. Part-III
PART - II
ABSTRACT ALGEBRA

- UNIT-I** Group-Automorphisms, Inner automorphisms, Automorphism of groups and their computation, Conjugacy relation, Normaliser, Counting principle and the class equation of a finite group, Center for Group of prime-order, Abelianizing of a group and its universal property, Sylow's theorem, Sylow subgroup, Structure theorems for finite Abelian groups.
- UNIT-II** Ring theory-Ring homomorphisms, Ideals and quotient rings, Field of quotients of an integral domain, Euclidean rings, polynomial rings, Polynomials over the rational field, The Eisenstein criterion, polynomial rings over commutative rings, Unique factorization domain, R unique factorisation domain implies to $R[x_1, x_2, \dots, x_n]$, Modules, Submodules, Quotient modules, Homomorphism and Isomorphism theorems.
- UNIT-III** Definition and examples of vector spaces, Subspaces, Sum and direct sum of subspaces, Linear span, Linear dependence, independence and their basic properties, Basis, Finite dimensional vector spaces, Existence theorem for bases, Invariance of the number of elements of a basis set, Dimension, Existence of complementary subspace of a finite dimensional vector space, Dimension of sums of subspaces, Quotient space and its dimension.
- UNIT-IV** Linear transformations and their representation as matrices, The Algebra of linear transformations, The rank nullity theorem, Change of basis, Dual space, Bidual space and natural isomorphism, Adjoint of a linear transformation, Eigenvalues and eigenvectors of a linear transformation, Diagonalisation, Annihilator of a subspace, Bilinear, Quadratic and Hermitian forms.
- UNIT-V** Inner Product Spaces-Cauchy-Schwarz inequality, Orthogonal vectors, Orthogonal Complements, Orthonormal sets and bases, Bessel's inequality for finite dimensional spaces, Gram-Schmidt Orthogonalisation process.

REFERENCES :

1. I.N. Herstein, Topics in Algebra, Wiley Eastern Ltd., New Delhi, 1975.
2. N. Jacobson, Basic Algebra, Vols. I & II, W.H. Freeman, 1980 (also published by Hindustan Publishing Company).
3. Shanti Narayan, A Text Book of Modern Abstract Algebra, S.Chand & Co. New Delhi.
4. K.B. Datta, Matrix and Linear Algebra, Prentice Hall of India Pvt. Ltd., New Delhi, 2006.
5. P.B. Bhattacharya, S.K. Jain and S.R. Nagpal, Basic Abstract Algebra (7th Edition) Cambridge University Press, Indian Edition, 1997.
6. K. Hoffman and R. Kunze, Linear Algebra, (2nd Edition), Prentice Hall, Englewood Cliffs, New Jersey, 1971.
7. S.K. Jain, A. Gunawardena and P.B. Bhattacharya, Basic Linear Algebra with MATLAB, Key College Publishing (Springer-Verlag) 2001.
8. S. Karumaran, Linear Algebra, A Geometric Approach, Prentice-Hall of India, 2006.
9. Vivek Sahai and Vikas Bhat, Algebra, Narosa Publishing House, 1997.
10. I.S. Luthar and I.D.S. Passi, Algebra, Vol. I-Groups, Vol. II-Rings, Narosa Publishing House (Vol. I-1996, Vol. II-1999)
11. D.S. Malik, I.N. Mordeson, and M.K. Sen, Fundamentals of Abstract Algebra, McGraw- Hill International Edition, 1993.

B.Sc. Part-III
PAPER - III - (OPTIONAL)
(II) DISCRETE MATHEMATICS

- UNIT-I** Sets and Propositions - Cardinality, Mathematical Induction, Principle of inclusion and exclusion, Computability and Formal Languages - Ordered Sets, Languages, Phrase Structure Grammars, Types of Grammars and Languages, Permutations, Combinations and Discrete Probability.
- UNIT-II** Relations and Functions - Binary Relations, Equivalence Relations and Partitions, Partial Order Relations and Lattices, Chains and Antichains, Pigeon Hole Principle.
- Graphs and Planner Graphs** - Basic Terminology, Multigraphs, Weighted Graphs, Paths and Circuits, Shortest Paths, Eulerian Paths and Circuits, Travelling Salesman Problem, Planner Graphs, Trees.
- UNIT-III** Finite State Machines - Equivalent Machines, Finite State Machines as Language Recognizers, Analysis of Algorithms - Time Complexity, Complexity of Problems, Discrete Numeric Functions and Generating Functions.
- UNIT-IV** Recurrence Relations and Recursive Algorithms - Linear Recurrence Relations with constant coefficients, Homogeneous Solutions, Particular Solution, Total Solution, Solution by the Method of Generating Functions, Brief review of Groups and Rings.
- UNIT-V** Boolean Algebra - Lattices and Algebraic Structures, Duality, Distributive and Complemented Lattices, Boolean Lattices and Boolean Algebra, Boolean Functions and Expressions, Propositional Calculus, Design and Implementation of Digital Networks, Switching Circuits.

REFERENCES :

1. C.L. Liu, Elements of Discrete Mathematics, (Second Edition), McGraw Hill, International Edition, Computer Science Series, 1986

Meeting of Central Board of Studies(Chemistry): 18th June, 2018

Subject/ Faculty/ Name of Question Paper Chemistry/Science

| Existing Syllabus | New Modified Syllabus | Justification of New Modified Syllabus |
|-------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|
| B.Sc. PART-III PAPER-I (Inorganic Chem) | | |
| Unit-I Metal Ligand Bonding in Transition Metal Complexes | Modified with inclusion of topics like 'Jahn Teller distortion in octahedral complexes' | Upgradation |
| Unit-II Magnetic Properties of Transition Metal Complexes | No Change | |
| Unit-III Organometallic Chemistry | Drastic changes in the content (more than 60%). Added topics like 'Catalysis by organometallic compounds.' | Upgradation |
| Unit-IV Bioinorganic Chemistry | No Change | |
| Unit-V Hard and Soft Acids and Bases (HSAB) | Changed to 'Hard and Soft Acids and Bases' & 'Inorganic Polymers' | Change in nomenclature only |
| Laboratory Course Experiments based on Synthesis of inorganic complexes and their analysis and gravimetric analysis of elements | Gravimetric analysis list expanded with analysis of Aluminium with oxides. Expansion in list of synthesis of inorganic complexes | Upgradation |

(Signature of members of Central Board of Studies)

Dr. P. S. N. Murthy
18/6/18

Dr. S. S. S. Murthy
18/6/18

Dr. A. S. Murthy
18/6/18

Dr. S. S. S. Murthy
18/6/18

Dr. S. S. S. Murthy
18/6/18

Dr. S. S. S. Murthy
18/6/18

Dr. S. S. S. Murthy
18/6/18

Meeting of Central Board of Studies(Chemistry): 18th June, 2018

Subject/ Faculty/ Name of Question Paper Chemistry/Biochemistry

| Existing Syllabus | New Modified Syllabus | Justification of New Modified Syllabus |
|--------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|---------------------------------------------------|
| B.Sc. PART-III PAPER-III (Practical Chem) | | |
| Unit-I Quantum Mechanics-I | Deleted 'De Broglie idea of matter waves, ... Schrodinger wave equation'. (Remaining topics are not changed) | Already taught in earlier classes. Less important |
| Unit-II Quantum Mechanics-II | No change | - |
| Unit-III Spectroscopy-I (A. Introduction; B. Vibrational Spectra; C. Raman Spectra) | No change | - |
| Unit-IV Spectroscopy-II (A. Electronic Spectra; B. Photochemistry) | Changed to 'Electrochemistry-I' | Reappropriate |
| Unit-V Thermodynamics | Changed to 'Electrochemistry-2' | Reappropriate |
| Laboratory Course Experiments based on Electrochemistry, Refractometry, Polarimetry, Molecular weight determination, Calorimetry | Changed to experiments based techniques like Conductometry, pH and Potentiometry, and UV-Vis Spectroscopy | Update the data |

(Signature of members of Central Board of Studies)

Handwritten signatures and dates:

- 18/6/18
- 18/6/18
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- 18/6/18
- 18/6/18

NEW CURRICULUM OF B.Sc. PART III

CHEMISTRY

The new curriculum will comprise of three papers of 33, 33 and 34 marks each and practical work of 50 marks. The Curriculum is to be completed in 180 working days as per UGC norms and conforming to the directives of Govt. of Chhattisgarh. The theory papers are of 60 hrs. each duration and practical work of 180 hrs duration.

Paper - I
INORGANIC CHEMISTRY 60 Hrs., Max Marks 33

UNIT-I

METAL-LIGAND BONDING IN TRANSITION METAL COMPLEXES

(A) Limitations of valence bond theory, Limitation of Crystal Field Theory, Application of CFSE, tetragonal distortions from octahedral geometry, Jahn-Teller distortion, square planar geometry, Qualitative aspect of Ligand field and MO Theory.

(B) Thermodynamic and kinetic aspects of metal complexes. A brief outline of thermodynamic stability of metal complexes and factors affecting the stability, substitution reactions of square planar complexes, Trans-effect, theories of trans effect. Mechanism of substitution reactions of square planar complexes.

UNIT-II

MAGNETIC PROPERTIES OF TRANSITION METAL COMPLEXES

Types of magnetic behavior, methods of determining magnetic susceptibility, spin only formula, L-S coupling, correlation of $\mu_{\text{obs}}(\text{spin only})$ and μ_{eff} values, orbital contribution to magnetic moments, application of magnetic moment data for 3d metal complexes.

Electronic spectra of Transition Metal Complexes.

Types of electronic transitions, selection rules for d-d transitions, spectroscopic ground states, spectro-chemical series. Orgel-energy level diagram for d^1 and d^9 states, discussion of the electronic spectrum of $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$ complex ion.

UNIT-III

ORGANOMETALLIC CHEMISTRY

Definition and classification of organometallic compounds on the basis of bond type. Concept of hapticity of organic ligands. Metal carbonyls: 18-electron rule, electron count of mononuclear, polynuclear and substituted metal carbonyls of 3d series. General methods of preparation (direct combination, reductive carbonylation, thermal and photochemical decomposition) of mono and binuclear carbonyls of 3d series.

Structures of mononuclear and binuclear carbonyls of Cr, Mo, Fe, Co and Ni using VBT. π -acceptor behavior of CO (MO diagram of CO to be discussed), Zeise's salt: Preparation and structure.

Catalysis by Organometallic Compounds -

Study of the following industrial processes and their mechanism :

1. Alkene hydrogenation (Wilkinson Catalyst)
2. Polymerization of ethene using Ziegler - Natta Catalyst

UNIT-IV

BIOINORGANIC CHEMISTRY

Essential and trace elements in biological processes, excess and deficiency of some trace metals, Toxicity of some metal ions (Hg, Pb, Cd and As), metalloporphyrins with special reference to hemoglobin and myoglobin. Biological role of alkali and alkaline earth metals with special reference to Ca^{2+} and Mg^{2+} , nitrogen fixation.

UNIT-V

HARD AND SOFT ACIDS AND BASES (HSAB) Classification of acids and bases as hard and soft. Pearson's HSAB concept, acid-base strength and hardness and softness. Symbiosis, Applications of HSAB principle.

INORGANIC POLYMERS

Types of inorganic polymers, comparison with organic polymers, synthesis, structural aspects and applications of siloxanes, silicates, phosphazenes and polyphosphates.

REFERENCE BOOKS

1. Basic Inorganic Chemistry, F. A. Cotton, G. Wilkinson and P. L. Gaus, Wiley.
2. Concise Inorganic Chemistry, J. D. Lee, ELBS.
3. Concepts of Models of Inorganic Chemistry, B. Douglas, D. Mc Daniel and J. Alexander, John Wiley.
4. Inorganic Chemistry, D. E. Shriver, P. W. Atkins and C. H. Langford, Oxford.
5. Inorganic Chemistry, W. W. Porterfield, Addison - Wiley.
6. Inorganic Chemistry, A. G. Sharp, ELBS.
7. Inorganic Chemistry, G. L. Miessler and D. A. Tar, Prentice Hall.
8. Advanced Inorganic Chemistry, Satya Prakash.
9. Advanced Inorganic Chemistry, Agarwal and Agarwal.
10. Advanced Inorganic Chemistry, Paul, Sharma, S. Nagindhand.
11. Inorganic Chemistry, Madan, S. Chand.
12. Aardhanik Akarhanic Rasayan, A. K. Shrivastav & P. C. Jain, God Pub.
13. Uchchatar Akarhanic Rasayan, satya Prakash & G. D. Tal, Shyomal Prakashan.
14. Uchchatar Akarhanic Rasayan, Paul & Sharma.
15. Selected topics in Inorganic Chemistry by Madan Mehta & Tal, S. Chand.

Paper – II
ORGANIC CHEMISTRY

60 Hrs. Max Marks 33

UNIT-I
HETEROCYCLIC COMPOUNDS

Classification and nomenclature, Structure, aromaticity in 5-membered and 6-membered rings containing one heteroatom; Synthesis, reactions and mechanism of substitution reactions of: Furan, Pyrrole (Paal-Knorr synthesis, Knorr pyrrole synthesis, Hantzsch synthesis), Thiophene, Pyridine (Hantzsch synthesis), Indole (Fischer indole synthesis and Madelung synthesis), Quinoline and isoquinoline, (Skraup synthesis, Friedlander's synthesis, Knorr quinoline synthesis, Doebner-Müller synthesis, Bischler-Napieralski reaction, Fictet- Spengler reaction, Pomeranz-Fritsch reaction).

UNIT II

A. ORGANOMETALLIC REAGENT

Organomagnesium compounds: Grignard reagents formation, structure and chemical reactions.

Organozinc compounds: formation and chemical reactions.

Organolithium compounds: formation and chemical reactions.

B. ORGANIC SYNTHESIS VIA ENOLATES

Active methylene group, alkylation of diethylmalonate and ethyl acetoacetate, Synthesis of ethyl acetoacetate: The Claisen condensation, Keto-enol tautomerism of ethyl acetoacetate, Robinson annulations reaction.

UNIT-III
BIMOLECULES

A. CARBOHYDRATES

Occurrence, classification and their biological importance, Monosaccharides: relative and absolute configuration of glucose and fructose, epimers and anomers, mutarotation, determination of ring size of glucose and fructose, Haworth projections and conformational structures; Interconversions of aldoses and ketoses; Killiani Fischer synthesis and Ruff degradation; Disaccharides - Structural comparison of maltose, lactose and sucrose. Polysaccharides - Elementary treatment of starch and cellulose.

B. AMINO ACIDS, PROTEINS AND NUCLEIC ACIDS

Classification and Nomenclature of amino acids, Configuration and acid base properties of amino acids, Isoelectric Point, Peptide bonds, Protein structure, denaturation/renaturation, Constituents of nucleic acid, DNA, RNA nucleoside, nucleotides, double helical structure of DNA.

UNIT-IV

SYNTHETIC POLYMERS

A. Addition or chain growth polymerization, Free radical vinyl polymerization, Ziegler-Natta polymerization, Condensation or Step growth polymerization, polyesters, polyamides, phenols-formaldehyde resins, urea-formaldehyde resins, epoxy resins and polyurethanes, natural and synthetic rubbers.

B. SYNTHETIC DYES

Colour and constitution (Electronic Concept), Classification of Dyes, Chemistry of dyes, Chemistry and synthesis of Methyl Orange, Congo Red, Malachite Green, Crystal Violet, phenolphthalein, fluorescein, Alizarine and Indigo.

UNIT-V

A. INFRA-RED SPECTROSCOPY

Basic principle, IR absorption Band their position and intensity, IR spectra of organic compounds.

B. UV-VISIBLE SPECTROSCOPY

Beer Lambert's law, effect of Conjugation, Types of electronic transitions λ_{max} , Chromophores and Auxochromes, Bathochromic and Hypsochromic shifts, Intensity of absorption Visible spectrum and colour.

C. NMR SPECTROSCOPY

Basic principles of Proton Magnetic Resonance, Tetramethyl silane (TMS) as internal standard, chemical shift and factors influencing it; Spin-Spin coupling and coupling constant (J); Anisotropic effects in alkanes, alkyne, aldehydes and aromatics, Interpretation of NMR spectra of simple organic compounds. ^{13}C NMR spectroscopy: Principle and applications.

REFERENCE BOOKS

1. Organic Chemistry, Morrison and Boyd, Prentice-Hall.
2. Organic Chemistry, L. G. Wade Jr, Prentice Hall.
3. Fundamentals of Organic Chemistry, Solomon, John Wiley.
4. Organic Chemistry, Vol I, II, III S. M. Mukherjee, S. P. Singh and R. P. Kapoor, Wiley Eastern (New Age).
5. Organic Chemistry, F. A. Carey, McGraw Hill.
6. Introduction to Organic Chemistry, Struikweiser, Heathcock and Kosover, Macmillan.
7. Acheson, R.M. Introduction to the Chemistry of Heterocyclic compounds, John Wiley & Sons (1976).
8. Graham Solomon, T.W. Organic Chemistry, John Wiley & Sons, Inc.
9. McMurry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013.
10. Kalsi, P. S. Textbook of Organic Chemistry 1st Ed., New Age International (P) Ltd. Pub.
11. Clayden, J.; Greeves, N.; Warren, S.; Wothers, P.; Organic Chemistry, Oxford University Press.

UNIT-I

QUANTUM MECHANICS-I

Black-body radiation, Planck's radiation law, photoelectric effect, Compton effect. Operator: Hamiltonian operator, angular momentum operator, Laplacian operator, postulate of quantum mechanics, eigen values, eigen function, Schrodinger time independent wave equation, physical significance of ψ & ψ^2 , application of Schrodinger wave equation to particle in a one dimensional box, hydrogen atom (separation into three equations) radial and angular wave functions.

UNIT-II

A. QUANTUM MECHANICS-II

Quantum Mechanical approach of Molecular orbital theory, basic ideas-criteria for forming M.O. and A.O., LCAO approximation, formation of H_2^+ ion, calculation of energy levels from wave functions, bonding and antibonding wave functions, Concept of σ , σ^* , π , π^* orbitals and their characteristics, Hybrid orbitals- sp , sp^2 , sp^3 Calculation of coefficients of A.O.'s used in these hybrid orbitals.

Introduction to valence bond model of H_2 , comparison of M.O. and V.B. models. Huckel theory, application of Huckel theory to ethene, propene, etc.

UNIT III

SPECTROSCOPY

Introduction: Characterization of Electromagnetic radiation, regions of the spectrum, representation of spectra, width and intensity of spectral transition, Rotational Spectrum of Diatomic molecules. Energy levels of a rigid rotor, selection rules, determination of bond length, qualitative description of non-rigid rotor, isotopic effect.

Vibrational Spectroscopy: Fundamental vibration and their symmetry vibrating diatomic molecules, Energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, determination of force constant, anharmonic oscillation

Raman spectrum: Concept of polarizability, quantum theory of Raman spectra, Stokes and anti-Stokes lines, pure rotational and pure vibrational Raman spectra. Applications of Raman Spectra.

Electronic Spectroscopy: Basic principles, Electronic Spectra of diatomic molecule, Franck-Condon principle, types of electronic transition, application of electronic spectra.

UNIT-IV

ELECTROCHEMISTRY-I

- A. Electrolytic conductance: Specific and equivalent conductance, measurement of equivalent conductance, effect of dilution on conductance, Kohlrausch law, application of Kohlrausch law in determination of dissociation constant of weak electrolyte, solubility of sparingly soluble electrolyte, absolute velocity of ions, ionic product of water, conductometric titrations.
- B. Theories of strong electrolyte: limitations of Ostwald's dilution law, weak and strong electrolytes, Elementary ideas of Debye-Huckel-Onsager's equation for strong electrolytes, relaxation and electrophoretic effects.
- C. Migration of ions: Transport number, Determination by Hittorf method and moving boundary method, ionic strength.

UNIT-V

ELECTROCHEMISTRY-II

- A. Electrochemical cell and Galvanic cells - reversible and irreversible cells, conventional representation of electrochemical cells, EMF of the cell and effect of temperature on EMF of the cell, Nernst equation Calculation of ΔG , ΔH and ΔS for cell reactions.
- B. Single electrode potential : standard hydrogen electrode, calomel electrode, quinhydrone electrode, redox electrodes, electrochemical series
- C. Concentration cell with and without transport, liquid - junction potential, application of concentration cells in determining of valency of ions , solubility product and activity coefficient
- D. Corrosion-types , theories and prevention