

Hemchand Yadav Vishwavidyala, Durg (C.G.)

Zoology

B.Sc. Part III (2021-22)

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
- Principal of systematic toxicology
- Heavy metal Toxicity (Arsenic, Murcury, Lead, Cadmium)
- Animal poisons- snake venom, 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 protozoan's- Entamoeba, Trypanosome & Plasmodium
- Pathogenic helminthes- Schistosoma
- Nematode pathogenic parasites of man
- Vector insects

Dr. Anil Kumar

Dr. Usha Thakur

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Zoology
B.Sc. Part III (2021-22)
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; Cosei-cycle
- Lipid metabolism- Oxidation of glycerol; Oxidation of fatty acids
- Protein Catabolism- Deamination, transamination, transmethylation

Unit: IV (Biotechnology)

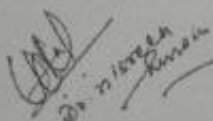
- Application of Biotechnology
- Recombinant DNA & Gene cloning
- Cloned genes & other tools of biotechnology (Tissue culture, Hybridoma, Transgenic Animals and Gene library)

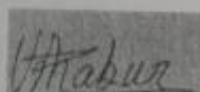
Unit: V (Biotechniques)

1. Principles & techniques about the following:

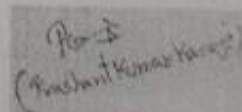
- (i) pH meter
- (ii) Colorimeter
- (iii) Microscopy- Light microscopes: Compound, Phase contrast & Electron microscopes
- (iv) Centrifuge
- (v) Separation of biomolecules by chromatography & electrophoresis

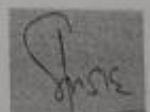

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B. Sc. Part III (2021-22)
Zoology
Practical

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

(Dr. Anil Kumar)

Dr. N. S. S. S. S. S.

Uthabur

(Dr. Anil Kumar)

*Pr. I
(Dr. Anil Kumar)*

S. S. S.

Dr. Usha Thakur

Dr. S. S. S.

B.SC.-III

PAPER- I (BOTANY)

(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, Spectrophotometere

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 can, Bacterial blight of rice, yellow vein mosaic of b hindi, 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, Pytoremediation. 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 Biostatics, measure of central tendency-Mean, Median, Mode, measures of dispersal-Standard deviation, standard error.

Wsu

Case

B.SC.-III

PAPER- II (BOTANY)

**(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 interactions, 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, disaccharids and Polsaccharides

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

UNIT- V

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

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Books Recommended:

- Nelson, DL, Cox, MM, Lehninger 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, Meeru
- Jain, JL, Jain S, Jain, N, Fundamentals of Biochemistry, S Chand Publishing, New Delhi

B.Sc.- III (Botany)

Practical

1. Study of host parasite relationship pf 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 Curd.
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

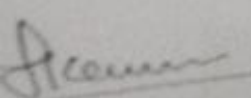
1. Plant Disease/Symptoms	10
2. Instrumentation techniques	05
3. Staining of Microbes	05
4. Tissue Culture techniques	05
5. Spotting	10
6. Project Work/ Field Study	05
7. Viva-Voce	05
8. Sessional	05

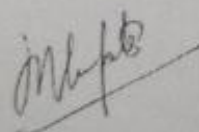
B.Sc. Part-III

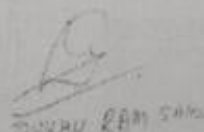
Paper-I

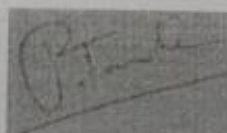
RELATIVITY, QUANTUM MECHANICS, ATOMIC MOLECULAR AND NUCLEAR PHYSICS

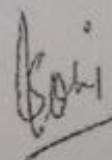
- Unit-1** Reference systems, inertial frames, Galilean invariance propagation of light, Michelson-Morley experiment, search for ether. Postulates for the special theory of relativity, Lorentz transformations, length contraction, time dilation, velocity addition, variation of mass with velocity, mass-energy equivalence, particle with zero rest mass.
- Unit-2** 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 matter 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.
- Unit-3** 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, 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.
- Unit-4** Spectra of hydrogen, deuterium 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 inter-nuclear 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.

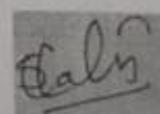





SUKHU RAM SARKAR







Unit-5 Structure of nuclei:- Basic Properties of Nuclei: (1) Mass, (2) Radii, (3) Charge, (4) Angular Momentum, (5) Spin, (6) Magnetic Moment (μ), (7) Stability and (8) 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.

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 Physics".
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 Resnick, "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).
13. Electronic Devices & Circuits By Milliman Helkiyan.

Paper-II

SOLID STATE PHYSICS, SOLID STATE DEVICES AND ELECTRONICS

Unit-1 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.

Unit-2 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), Difference between 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.

Unit-3 Intrinsic and extrinsic semiconductors, 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, I-V characteristics, Tunnel diode, Zener diode, Light emitting diode, solar cell, Bipolar transistors, pnp and npn transistors, characteristics of transistors, different configurations, current amplification factor, FET and MOSFET Characteristics.

Unit-4 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 transistors, 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.

Unit-5 Digital Circuits: Difference between Analog and Digital Circuits, Binary Numbers, Decimal to Binary and Binary to Decimal Conversion, AND, OR and NOT Gates (Realization using Diodes and Transistor), NAND and NOR Gates as Universal Gates, XOR and XNOR Gate, De Morgan's Theorems, Boolean Laws, Simplification of Logic Circuit using Boolean Algebra, Digital to Analog Converter, Analog to Digital Converter.

TEXT AND REFERENCE BOOKS:

1. Introduction to solid state physics: C. Kittel.
2. Solid State Physics: A.J. Dekkar.
3. Electronic Circuits: Mottershead.
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.

PRACTICALS

Minimum 16 (Eight from each group)

Experiments out of the following or similar experiments of equal standard

1. Determination of Planck's constant.
2. Determination of e/m by using Thomson tube.
3. Determination of e by Millikan's methods.
4. Study of spectra of hydrogen and deuterium (Rydberg constant and ratio of masses of electron proton).
5. Absorption spectrum of iodine vapour.
6. Study of alkali or alkaline earth spectra using a concave grating.
7. Study of Zeeman effect for determination of a Lande g -factor.
8. Analysis of a given band spectrum.
9. Study of Raman spectrum using laser as an excitation source.
10. Study of absorption of alpha and beta rays.
11. Study of statistics in radioactive measurement.
12. Coniometric study of crystal faces.
13. Determination of dielectric constant.
14. Hysteresis curve of transformer core.
15. Hall-probe method for measurement of magnetic field.
16. Specific resistance and energy gap of semiconductor.
17. Characteristics of transistor.
18. Characteristics of tunnel diode.
19. Study of voltage regulation system.
20. Study of regulated power supply.
21. Study of lissajous figures using CRO.
22. Study of VTVM.
23. Study of RC and TC coupled amplifiers.
24. Study of AF and RF oscillators.
25. Find roots of $f(x) = 0$ by using Newton-Raphson Method.

HEMCHAND YADAV VISHWAVIDYALAYA, DURG (C.G.)
NEW CURRICULUM OF B.Sc. PART III
SESSION 2021-22
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 μ_{so} (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^2 states, discussion of the electronic spectrum of $[Ti(H_2O)_6]^{3+}$ 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, Mn, 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 (Wilkinsons Catalyst)
2. Polymeration of ethane 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 silicones. Silicates, phosphazenes and polyphosphate.

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. Tarr, Prentice Hall.
8. Advanced Inorganic Chemistry, Satya Prakash.
9. Advanced Inorganic Chemistry, Agarwal and Agarwal.
10. Advanced Inorganic Chemistry, Puri, Sharma, S. Naginchand.
11. Inorganic Chemistry, Madan, S. Chand.
12. Aadhunik Akarbanic Rasayan, A. K. Shrivastav & P. C. Jain, Goel Pub.
13. Uchchattar Akarbanic Rasayan, satya Prakash & G. D. Tuli, Shyamal Prakashan.
14. Uchchattar Akarbanic Rasayan, Puri & Sharma.
15. Selected topic in Inorganic Chemistry by Madan Malik & Tuli, S. Chand.

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- Miller synthesis, Bischler-Napieralski reaction, Pictet- 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

BIOMOLECULES

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.

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 alkene, alkyne, aldehydes and aromatics, Interpretation of NMR spectra of simple organic compounds. ^{13}C MR 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, Solomons, John Wiley.
4. Organic Chemistry, Vol I, II, III S. M. Mukherjee, S. P. Singh and R. P. Kapoor, Wiley Easters (New Age).
5. Organic Chemistry, F. A. Carey, McGraw Hill.
6. Introduction to Organic Chemistry, Struiweisser, Heathcock and Kosover, Macmillan.
7. Acheson, R.M. Introduction to the Chemistry of Heterocyclic compounds, John Wiley & Sons (1976).
8. Graham Solomons, 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 rotator, 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 oscillator

Raman spectrum: Concept of polarizability, quantum theory of Raman spectra, stokes and antistokes lines, pure rotational and pure vibrational Raman spectra. Applications of Raman Spectra.

Electronic Spectroscopy: Basic principles, Electronic Spectra of diatomic molecules, 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

REFERENCE BOOKS

1. Physical chemistry, G.M.Barrow. International Student Edition McGraw Hill.
2. University General Chemistry, CNR Rao, Macmillan.
3. Physical Chemistry R.A.Alberty, Wiley Eastrn.
4. The elements of Physical Chemistry P.W.Aikin,Oxford.
5. Physical Chemistry through problems, S.K.Dogra, Wiley Eastern.
6. Physical Chemistry B.D.Khosla.
7. Physical Chemistry, Puri & Sharma.
8. Bhoutic Rasayan, Puri & Sharma.
9. Bhoutic Rasayan, P.L.Soni.
10. Bhoutic Rasayan, Bahl & Tuli.
11. Physical Chemistry, R.L.Kapoor, Vol- I-IV.
12. Introduction to quantum chemistry,A.K.Chandra,Tata McGraw Hill.
13. Quantum Chemistry,Ira N.Levine, Prentice Hall.

INORGANIC CHEMISTRY

Gravimetric analysis:

- Estimation of nickel (II) using Dimethylglyoxime (DMG).
- Estimation of copper as CuSCN
- Estimation of iron as Fe_2O_3 by precipitating iron as $\text{Fe}(\text{OH})_3$.
- Estimation of Al (III) by precipitating with oxine and weighing as $\text{Al}(\text{oxine})_3$ (aluminium oxinate).
- Estimation of Barium as BaSO_4

Inorganic Preparations:

- Tetraamminecopper (II) sulphate, $[\text{Cu}(\text{NH}_3)_4]\text{SO}_4 \cdot \text{H}_2\text{O}$
- Cis and trans $\text{K}[\text{Cr}(\text{C}_2\text{O}_4)_2 \cdot (\text{H}_2\text{O})_2]$ Potassium dioxalatodiaquachromate(III)
- Tetraamminecarbonatocobalt (III) ion
- Potassium tris(oxalate)ferrate(III)/ Sodium tris(oxalate)ferrate(III)
- Cu(I) thiourea complex, Bis (2,4-pentanedionate) zinc hydrate; Double salts (Chrome alum/ Mohr's salt)

ORGANIC CHEMISTRY

1. Preparation of organic Compounds

- Acetylation of one of the following compounds: amines (aniline, o-, m-, p- toluidines and o-, m-, p-anisidine) and phenols (β -naphthol, vanillin, salicylic acid)
- Benzoylation of one of the following amines (aniline, o-, m-, p- toluidines and o-, m-, p-anisidine) and one of the following phenols (β -naphthol, resorcinol, p cresol) Schotten-Baumann reaction.
- Bromination of any one of the following: a. Acetanilide by conventional method b. Acetanilide using green approach (Bromate-bromide method)
- Nitration of any one of the following: a. Acetanilide/nitrobenzene by conventional method b. Salicylic acid by green approach (using ceric ammonium nitrate).
- Reduction of p-nitrobenzaldehyde by sodium borohydride.
- Hydrolysis of amides and esters.
- Semicarbazone of any one of the following compounds: acetone, ethyl methyl ketone, cyclohexanone, benzaldehyde.
- Benzylisothiuronium salt of one each of water soluble and water insoluble (benzoic acid, oxalic acid, phenyl acetic acid and phthalic acid).
- Aldol condensation using either conventional or green method.

- Benzil-Benzilic acid rearrangement.
- Preparation of sodium polyacrylate.
- Preparation of urea formaldehyde.
- Preparation of methyl orange.

The above derivatives should be prepared using 0.5-1g of the organic compound. The solid samples must be collected and may be used for recrystallization, melting point and TLC.

2. Qualitative Analysis Analysis of an organic mixture containing two solid components using water, NaHCO_3 , NaOH for separation and preparation of suitable derivatives.
3. Extraction of caffeine from tea leaves.
4. Analysis of Carbohydrate: aldoses and ketoses, reducing and non-reducing sugars.
5. Identification of simple organic compounds by IR spectroscopy and NMR spectroscopy. (Spectra to be provided).
6. Estimation of glycine by Sorenson's formalin method.
7. Study of the titration curve of glycine.
8. Estimation of proteins by Lowry's method.
9. Study of the action of salivary amylase on starch at optimum conditions.
10. Effect of temperature on the action of salivary amylase.

PHYSICAL CHEMISTRY

Conductometry

- Determination of cell constant
- Determination of equivalent conductance, degree of dissociation and dissociation constant of a weak acid.
- Perform the following conductometric titrations:
 - i. Strong acid vs. strong base
 - ii. Weak acid vs. strong base
 - iii. Mixture of strong acid and weak acid vs. strong base
 - iv. Strong acid vs. weak base
- To determine the strength of the given acid conductometrically using standard alkali solution.
- To determine the solubility and solubility product of a sparingly soluble electrolyte conductometrically
- To study the saponification of ethyl acetate conductometrically.

Potentiometry/pH metry

Perform the following potentio/pH metric titrations:

- i. Strong acid vs. strong base
- ii. Weak acid vs. strong base
- iii. Dibasic acid vs. strong base
- iv. Potassium dichromate vs. Mohr's salt
- v. Determination of pK_a of monobasic acid

B.A. /B. Sc. Part III
PAPER - I
REMOTE SENSING AND GIS
Max. Marks: 50

- Unit I** Basics of Remote Sensing: definition, history, and Scope; Electro-magnetic Radiation: Characteristics, Spectral regions and Bands; Interaction with earth surface features and atmosphere; Spectral Signature.
- Unit II** Types of Remote Sensing: Air borne and Space borne; Aerial photos: Types and Characteristics; Remote Sensing satellites: Platforms and sensors: active and passive, sensor characteristics: spatial resolution, spectral resolution, radiometric resolution, temporal resolution. Product.
- Unit III** Visual and Digital image processing techniques; Remote Sensing application in resource mapping and environmental monitoring, remote sensing in India: development and Growth. Indian Satellites, Space Organizations and data products.
- Unit IV** Introduction of GIS: Definition of Geoinformatics, Scope and Importance of Geoinformatics, History of GIS, Components of GIS, Functions of GIS, GIS tasks- Input, Manipulation, Management, Query analysis, Visualization, Toposheets, Surveying, Aerial photographs, Satellite data and images, Data types-Spatial and Non spatial.
- Unit V** Data model and data analysis: Raster data and their characteristics, Vector data and their characteristics, Raster data analysis- grid cells or Pixels. Vector data analysis- Spatial data, Generation in Vector Format, Spatial and Non -Spatial data Management. Spatial information Technology

Books Recommended:

1. Bhatta, B. (2010): Remote Sensing and GIS, Oxford University Press, New Delhi.
2. Campbell, J.B. (2002): Introduction to Remote Sensing. 5th edition, Taylor and Francis, London
3. Curran, P.J. (1985): Principles of Remote Sensing, Longman, London
4. Kang-tsung Chang (2003) Geographic Information Systems, Tata McGraw Hill, New Delhi
5. Lillesand, T.M. and Kiefer, R.W. (2000): Remote Sensing and Image Interpretation. 4th edition. John Wiley and Sons, New York
6. Lo Albert, C.P., and Young, K.W (2003) Concepts and Techniques of Geographical Information Systems, Prentice Hall of India Pvt. Ltd., New Delhi.
7. Nag Prithvish and Kudrat M. (1998): Digital Remote Sensing, Concept Publishing Company, New Delhi
8. Star J, and J. Estes, (1994), Geographic Information Systems: An Introduction, Prentice Hall, New Jersey.
9. Williams J. (1995): Geographic information from space, John Wiley and Sons, England,

B.A./B.Sc Part III
PAPER - II
GEOGRAPHY OF CHHATTISGARH
Max. Marks: 50

- Unit I** Physical Features : Geological Structure, Relief and Physiographic Regions, Drainage, Climate.
- Unit II** Natural Resources : Soils – Types, characteristics and their Distribution. Water Resources (Major Irrigation and Hydel Power Projects), Forests-types, Distribution, Conservation of Forest. Mineral Resources-iron-ore, Coal, Dolomite Lime stone, Bauxite, etc. Power Resources of Chhattisgarh.
- Unit III** Agriculture and Populations – Agriculture: Cereals, Pulses and other crops. Population: Growth, Distribution, and Density; Tribal Populations; and Urban and Rural Population.
- Unit IV** Industries - Iron and Steel, Cement, Sugar, Aluminum; Industrial Regions of Chhattisgarh.
- Unit V** Trade and Transport, Tourism, Socio-Economic Development of Chhattisgarh.

Books Recommended:

1. Jha, Vibhash Kumar and Saumya Naiyyar (2013) Chhattisgarh Samagra, Chhattisgarh Rajya Hindi Granth Akadmi, Raipur
2. Kumar, Pramila (2003): Chhattisgarh Ek Bhugolik Addhyayan. Madhya Pradesh Hindi Granth Akadmi, Bhopal
3. Nagesh Jitendra and at all (2014): Chhattisgarh Sandarbh 2014 Jansanmpark Vibhag, C.G. Govt., Raipur
4. Tiwari, Vijay Kumar (): Geography of Chhattisgarh, Himalya Publishing House, Pvt. Ltd
5. Tripathi, Kaushlendra and Pursottam Chandrakar (2001): Geography of Chhattisgarh, Shardaprakashan, Aazad Nagar , Bilaspur.
6. Verma ,L.N. (2017): Geography of Chhattisgarh, Madhya Pradesh Hindi Granth Akadmi, Bhopal

SECTION A

MAP READINGS AND INTERPRETATION

(M.M. 20)

- Unit I** Graphical Representation: Band graph, Climograph, Square root, Cube-root.
- Unit II** Topographical Sheets: Classification and numbering system (National and International), Interpretation of Topographical Sheets with respect to cultural and physical features.
- Unit III** Satellite Imageries: Describing the Marginal Information, Image interpretation: Visual Methods – Landuse /Landcover Mapping, Use and Application of GIS.

SECTION B

SURVEYING AND FIELD REPORT

(M.M.20)

- Unit IV** Surveying: Plane Table Survey, Basic Principles of plane table surveying, Plane table survey including intersection and resection.
- Unit V** Field work and field report: physical, social and economic survey of a micro-region.

PRACTICAL RECORD AND VIVA VOCE

(M.M.10)

Books Recommended:

1. Archer, J.E. and Dalton, T.H. (1968): *Field Work in Geography*. William Clowes and Sons Ltd. London and Beccles.
2. Bolton, T. and Newbury, P.A. (1968): *Geography through Fieldwork*. Blandford Press, London.
3. Campell, J. B. (2003): *Introduction to Remote Sensing*. 4th edition. Taylor and Francis, London.
4. Chaunial, D. D. (2004): *Remote Sensing and Geographical Information System*(in Hindi), Sharda Pustak Bhawan, Allahabad
5. Cracknell, A. and Ladson, H. (1990): *Remote Sensing Year Book*. Taylor and Francis, London.
6. Curran, P.J. (1985): *Principles of Remote Sensing*. Longman, London.
7. Davis, R.E. and Foote, F.S. (1953): *Surveying*, 4th edition, McGraw Hill Publication, New York
8. ' '
9. Deekshatulu, B.L. and Rajan, Y.S. (ed.) (1984): *Remote Sensing*. Indian Academy of Science, Bangalore.
10. Floyd, F. and Sabins, Jr. (1986): *Remote Sensing: Principles and Interpretation*. W.H. Freeman, New York.
11. Gautam, N.C. and Raghavswamy, V. (2004). *Land Use/ Land Cover and Management Practices in India*. B.S. Publication., Hyderabad.

B.A. /B.Sc. Part II

PAPER - I

ECONOMIC AND RESOURCES GEOGRAPHY

Max. Marks: 50

(Paper Code-0187)

- Unit I** Meaning, scope and approaches to economic geography; Main concepts of economic geography; Resource: concept and classification; Natural resources: soil, forest and water.
- Unit II** Mineral resources: iron ore and bauxite; Power resources: coal, petroleum and hydro electricity; Resource conservation; Principal crops: wheat, rice, sugarcane and tea
- Unit III** Agricultural regions of the world (Derwent Whittlesey); Theory of agricultural location (Von Thunen); Theory of industrial location (Weber); Major industries: iron and steel, textiles, petrochemical and sugar; industrial regions of the world.
- Unit IV** World transportation: major trans-continental railways, sea and air routes; International trade: patterns and trends; Major trade blocks: LAFTA, EEC, ASEAN; Effect of globalization on developing countries.
- Unit V** Conservation of resources; evolution of the concept, principles, philosophy, and approach to conservation, resources conservation and practices. Policy making and sustainable development.

Books Recommended:

1. Alexander, J. W. (1988): Economic Geography. Prentice-Hall, New Delhi.
2. Bryson, J., Henry, N., Keeble, D. and Martin, R. (eds.) (1999): The Economic Geography Reader: Producing and Consuming Global Capitalism. John Wiley and Sons, Inc, New York.
3. Clark, G. L., Gertler, M. S. and Feldman, M. P. (eds.) (2000): The Oxford Handbook of Economic Geography. Oxford University Press, USA.
4. Coe, N. (2007): Economic Geography: A Contemporary Introduction. Blackwell Publishers, Inc., Massachusetts.
5. Gautam, A. (2006): *Aarthik Bhugol Ke Mool Tattava*, Sharda Pustak Bhawan, Allahabad.
6. Guha, J. S. and Chattoraj, P.R. (2002): A New Approach to Economic Geography: A Study of Resources. The World Press Private Limited, Kolkata.
7. Hanink, D. M. (1997): Principles and Applications of Economic Geography: Economy, Policy, Environment. John Wiley and Sons, Inc, New York.
8. Hartshorne, T. A. and Alexander, J. W. (1988): Economic Geography (3rd revised edition) Englewood Cliff, New Jersey, Prentice Hall
9. Hudson, R. (2005): Economic Geographies: Circuits, Flows and Spaces. Sage Publications, London.
10. Knowles, R, Wareing, J. (2000): Economic and Social Geography Made Simple, Rupa and Company, New Delhi.

Dr. S. K. Das
27.5.19

Dr. R. Sharma
27.5.19

Dr. R. Sharma
27.5.19
VSD
27/5/19

B.A. /B.Sc. Part II
PAPER - II
GEOGRAPHY OF INDIA
Max. Marks: 50
(Paper Code-0188)

- Unit I** Physical Features: Structure, Relief, Climate, Physiographic Regions, Drainage, Climate-origin and mechanism of monsoon, and regional and Seasonal variation.
- Unit II** Natural Resources: Soils - types, their distribution and characteristics. Water Resources (major irrigation and hydel power projects); Forests-types, distribution, economic significance and conservation. Mineral and Power resources-Iron-ore, Manganese, Copper, Coal, Petroleum and Natural gas, Non conventional sources of energy.
- Unit III** Cultural Features : Population - Growth, Density and Distribution. Agriculture - Major crops, impact of Green Revolution and Agricultural regions.
- Unit IV** Industries Localization, Development & Production - Iron and steel, Cotton Textile, Cement, Sugar, Transport, Foreign Trade. Industrial Region.
- Unit V** Detailed Study of the following regions of India : Kashmir Valley, North- East Region, Chhota Nagpur Plateau, Thar Desert, Islands of India.

Books Recommended:

1. Chauhan, P.R. and Prasad, M. (2003): *Bharat Ka Vrihad Bhugol*, Vasundhara Prakashan, Gorakhpur.
2. Farmer, B.H. (1983): *An Introduction to South Asia*. Methuen, London
3. Gautam, A. (2006): *Advanced Geography of India*, Sharda Pustak Bhawan, Allahabad
4. Johnson, B.L.C. (1963): *Development in South Asia*. Penguin Books, Harmondsworth
5. Krishnan, M.S. (1982): *Geology of India and Burma*, CAS Publishers and Distributors, Delhi.
6. Khullar, D.R. (2007): *India: A Comprehensive Geography*, Kalyani Publishers, New Delhi
7. Nag, P. and Gupta, S. S. (1992): *Geography of India*, Concept Publishing Company, New Delhi.
8. Rao, B.P. (2007): *Bharat ke Bhaugolik Sameeksha*, Vasundhara Prakashan, Gorakhpur.
9. Sharma, T.C. and Coutinho, O. (2003): *Economic and Commercial Geography of India*, Vikas Publishing House Private Ltd. New Delhi.
10. Singh, J. (2003): *India: A Comprehensive Systematic Geography*. Gyanodaya Prakashan, Gorakhpur
11. Singh, J. (2001): *Bharat: Bhougolik Aadhar Avam Ayam*, Gyanodaya Prakashan, Gorakhpur.
12. Singh, R.L. (ed.) (1971): *India: A Regional Geography*. National Geographical Society of India, Varanasi.
13. Spate, O.H. K., Learmonth A. T. A. and Farmer, B. H. (1996): *India, Pakistan and Sri Lanka*. Methuen, London, 7th edition.
14. Sukhwai, B.L. (1987): *India: Economic Resource Base and Contemporary Political Patterns*. Sterling Publication, New Delhi
15. Tiwari, R.C. (2007): *Geography of India*, Prayag Pustak Bhawan, Allahabad.
16. Wadia, D. N. (1959): *Geology of India*. Mac-Millan and Company, London and student edition, Madras.

VSQ
27/11/17

B.A. /B.Sc. Part II
PAPER - III
PRACTICAL GEOGRAPHY
Max. Marks: 50

SECTION A

MAP INTERPRETATION, PROJECTIONS AND STATISTICAL METHODS (M.M. 25)

- Unit I** Distribution Maps: Dot Map, Choropleth Map and Isopleth Map.
Unit II Map Projections: Definition and classification; Conical, Zenithal, and Cylindrical Projections.
Unit III Interpretation of Weather Maps: Use of Meteorological Instruments.
Unit IV Statistical Methods: Quartile: Mean Deviation, Standard Deviation and Quartile Deviation; Relative Variability and Co-efficient of Variation.

SECTION B

SURVEYING (M.M. 15)

- Unit V** Surveying: Whole Circle Bearing and Reduced Bearing, Methods of Prismatic Compass Survey.

PRACTICAL RECORD AND VIVA VOCE (M.M. 10)

Books Recommended:

1. Alvi, Z. 1995 : Statistical Geography: Methods and Applications, Rawat Pub. New Delhi: .
2. Davis, R.E. and Foote, F.S. (1953): Surveying, 4th edition, McGraw Hill Publication, New York
3. Kanetker, T.P. and Kulkarni, S.V.(1967): Surveying and Levelling, Vol I and II V.G. Prakashan, Poona.
4. Natrajan, V. (1976): Advanced Surveying, B.I. Publications., Mumbai.
5. Pal, S.K. 1999 : Statistics for Geoscientists, Concept publishing Company, New Delhi
6. Punmia, B.C.(1994): Surveying, Vol I, Laxmi Publications Private Ltd, New Delhi.
7. Raisz, E. (1962): General Cartography. John Wiley and Sons, New York. 5th edition
8. Sarkar, A. K. (1997): Practical Geography: A Systematic Approach. Orient Longman, Kolkata.
9. Sharma, J. P. (2001): *Prayogik Bhugol.*, Rastogi Publication, Meerut 3rd. edition.
10. Silk, J. 1979 : Statistical techniques in Geography, George Allen and Unwin, London
11. Singh, R.L. and Singh, Rana P.B. (1993): Elements of Practical Geography. (Hindi and English editions). Kalyani Publishers, New Delhi,.
12. Singh, L.R. (2006): Fundamentals of Practical Geography, Sharda Pustak Bhawan, Allahabad.
13. Venkatramaiah, C. (1997): A Text Book of Surveying, Universities Press, Hyderabad.

MICROBIOLOGY

BSc-2nd

Paper- I: Molecular Biology and Genetic Engineering

UNIT-1: FUNDAMENTALS OF MOLECULAR BIOLOGY

History and scope of molecular biology, concept and mechanism of heredity. DNA as genetic material- experimental evidences. DNA replication- mechanism, process and enzymes/proteins involved in replication.

UNIT-2: CENTRAL DOGMA OF PROTEIN SYNTHESIS

Transcription- initiation, elongation, termination, RNA polymerases and sigma factor. Transcription inhibitors (antibiotics, drugs). Translation- initiation, elongation and termination. Factors involved in translation. Genetic code.

UNIT-3: MUTATION AND DNA REPAIR MECHANISM

Introduction and Types of Gene mutations- Base substitution, frame shift mutation (Insertion, deletion, miss-sense, nonsense mutation.) mutagens - physical and chemical. Reverse mutation in bacteria. DNA repair mechanism (mismatch repair, photo-reactivation, excision and SOS repair). Beneficial and harmful effect of mutation.

UNIT-4: GENE REGULATION

Concept of gene- Cistron, Recon, Muton. Operon Concept- lac Operon, tryptophan Operon, His Operon. Activator, Co-activator and Repressor. Introduction to Bioinformatics- Elementary genome Database.

UNIT-5: GENETIC ENGINEERING

Basic concept of Genetic Engineering. DNA modifying enzymes Restriction endonuclease, DNA ligase, terminal transferase. Vectors- pBR322, pUC19, BAC and YAC. Phage based vectors, expression of vector. Transformation - physical and chemical method. Bacterial Host. Screening of recombinant vector Blue white Screening. Colony Hybridization.

Text Books Recommended:

1. Gene Cloning by T.A. Brown.
2. General Microbiology by Power and Daganiwala.
3. Zinssers Microbiology by KJ Wolfgang. McGraw- Hill Company.
4. Microbial Genetics by RM Stanley, F David and EC John.
5. Bacteriological Techniques by FJ Baker.
6. Molecular Biology of the Cell; 3rd Edition; Bruce Alberts ,et.al; Garland Publishing.
7. Cell biology; C.B. Powar; Himalaya Publishing House; Fifth edition
8. Cell & Molecular Biology; Gerald Karp; Fourth edition
9. A Textbook of Microbiology; Dubey&Maheshwari; S.chand& Sons.
10. Cell biology & Genetics; P. K. Gupta
11. Introduction to Bioinformatics; T K Atwood and D J Parry-Smith; Pearson Education Ltd

Phd
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Phd
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Paper- II: Bioinstrumentation and Biostatistics

UNIT-1: MICROSCOPY AND CENTRIFUGATION

Simple and compound light microscope, Bright field, Dark field, Phase contrast and Electron microscope. Centrifugation- principle and types of centrifuges (analytical and preparatory), types of centrifugation- differential and rate zonal centrifugation.

UNIT-2: pH metry and chromatography

Principle of pH meter, types of electrodes, factors affecting pH measurements, and application of pH meter. Chromatography- principle, types- paper, TLC and column chromatography, HPLC.

UNIT-3: SPECTROPHOTOMETRY

Electromagnetic spectrum, Beers-Lambert's law, Types (Principles, working and application)- colorimeter, UV - Vis Spectrophotometry and IR- Spectrophotometry, Turbidometry.

UNIT-4: Electrophoresis and X-Ray Diffraction

Principle of electrophoresis, instrumentation and Application, types of Paper, Gel electrophoresis and Immunoelectrophoresis. X-ray diffraction- principle and application.

UNIT-5: Biostatistics

Data- Types, characteristics, presentation and distribution. Data analysis- central tendency (Mean, Median and Mode), Deviation (variance SD and SE). Concept of probability.

Text Books Recommended:

1. Introduction to Instrumental analysis by Robert Braun.
2. Instrumental Techniques by Upadhyay and Upadhyay.
3. Instrumental Methods of Chemical Analysis by BK Sharma.
4. Bio statistics: Sunder Rao
5. Statistical Methods; S. P. Gupta; Sultan Chand & Sons

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PRACTICAL

M. M. 50

Determination of antibiotic resistance by plating method.
 Assaying of microbial enzymes; Catalase, Proteases, Peroxidases,
 Cellulase, Cellobioases, Amylase, Diastase.
 Exercise on paper, thin layer, column chromatography.
 Exercise on paper and gel electrophoresis.
 determination of pH of various water and soil sample.
 testing of Lambert Beer's law.
 Determination of λ_{max} of dye by spectrophotometer
 Isolation of resistant bacteria from soil and water sample

Scheme of Practical Examination

Time - 4 hours

M.M. 50

1. Exercise on spectrophotometer/ pH meter	10
2. Exercise on chromatography	10
3. Exercise on genetics	05
4. Spotting (1-5)	10
5. Viva-Voce	05
6. Sessional	10

Total 50

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Ampt
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Hemchand Yadav Vishwavidyala, Durg (C.G.)

Zoology

B.Sc. Part – II (2019-20)

Paper – I

(Anatomy and Physiology)

Comparative Anatomy of various organ systems of vertebrates:

Unit: I

- Integument and its derivatives: structure of scales, hair and feathers
- Alimentary canal and digestive glands in vertebrates
- Respiratory organs : Gills and lung , air-sac in birds

Unit: II

- Endoskeleton: (a) Axial Skeleton- Skull and Vertebrae, (b) Appendicular Skeleton
Limbs and girdles
- Circulatory System: Evolution of heart and aortic arches
- Urinogenital System: Kidney and excretory ducts

Unit: III

- Nervous System: General plan of brain and spinal cord
- Ear and Eye: structure and function
- Gonads and genital ducts

Unit: IV

- Digestion and absorption of dietary components
- Physiology of heart, cardiac cycle and ECG
- Blood Coagulation
- Respiration: mechanism and control of breathing

Unit: V

- Excretion: Physiology of excretion, osmoregulation
- Physiology of muscle contraction
- Physiology of nerve impulse, Synaptic transmission

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Zoology
B.Sc. Part – II (2019-20)

Paper-II
**VERTEBRATE ENDOCRINOLOGY, REPRODUCTIVE BIOLOGY
BEHAVIOUR, EVOLUTION AND APPLIED ZOOLOGY**

Unit: I

- Structure and function of Endocrine glands
- Hormone receptor
- Biosynthesis and secretion of thyroid, adrenal, ovarian and testicular hormones
- Endocrine disorder of pituitary, thyroid, adrenal and pancreas

Unit:II

- Reproductive cycle in vertebrates
- Menstruation, lactation and pregnancy
- Mechanism of parturition
- Hormonal regulation of gametogenesis

Unit: III

- Evidences of organic evolution.
- Theories of organic evolution.
- Variation, Mutation, Isolation and Natural selection.
- Evolution of Horse

Unit:IV

- Introduction to Ethology: Branches and concept of ethology.
- Patterns of Behaviour, Taxes, Reflexes, Drives and Stereotyped behaviour.
- Reproductive behavioural patterns.
- Drugs and behavior, Hormones and behaviour

Unit:V

- Prawn Culture
- Sericulture
- Apiculture
- Pisciculture
- Poultry keeping
- Elements of Pest Control: Chemical & Biological Control

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Zoology
B.Sc. Part II (2019-20)
Practical

The practical work in general shall be based on the syllabus prescribed and the students will be required to show the knowledge of the following:

- Study of the representative examples of the different chordates (Classified characters).
- Dissection of various systems of scoliodon-Afferent and Efferent branchial cranial nerves, internal ear.

Alternative methods: By Clay/Thermacol/ Drawing/ Model etc.)

- Simple microscopic technique through unstained or stained permanent mount.
- Study of prepared slides histological, as per theory papers.
- Study of limb girdles and vertebrae of Frog, Varanus, Fowl and Rabbit.
- Identification of species and individual of honey bee.
- Life cycle of honey bee and silkworm.
- Exercise based on Evolution and Animal behavior.

Scheme of Practical Exam

Time: 3:30hrs

• Major dissection (Cranial nerves/efferent branchial vessel)	10
• Exercise based on evolution	05
• Exercise based on applied zoology	05
• Exercise based on animal behavior	04
• Spotting-8 (slides-4,bones-2,specimen-2)	16
• Viva	05
• Sessional marks.	05

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B.Sc.-II (BOTANY) PAPER-I

(PLANT TAXONOMY, ECONOMIC BOTANY, PLANT ANATOMY AND EMBRYOLOGY)

UNIT-I

Bentham and Hooker system of classification. Binomial Nomenclature, International Code of Nomenclature for Algae, Fungi, and plants (IUCN), Typification, numerical Taxonomy and chemotaxonomy. Preservation of Plant material and Herbarium techniques. Important botanical gardens and herbaria of India, Kew Botanical garden, England.

UNIT-II

Systematic position, distinguishing characters and economic importance of the following families, Ranunculaceae, Magnoliaceae, Brassicaceae, Rosaceae, Papaveraceae, Caryophyllaceae, Rutaceae, Cucurbitaceae, Apiaceae, Rubiaceae, Apocynaceae, Asclepiadaceae, Solanaceae, Malvaceae, Convolvulaceae, Orchidaceae, Acanthaceae, verbenaceae, Lamiaceae, Asteraceae, Fabaceae, Euphorbiaceae, Poaceae and Liliaceae.

UNIT-III

Economic Botany: Botanical name, family, part used and uses of the following economically important plants, fiber yielding plants; Cotton, jute, sun, hemp, coir. Timber yielding plants: Sal, Teak, Shisham and Pine. Medicinal plants: Kalmegh, Ashwagandha, Ghritkumari, Giloy, Brahmi, sarpgandha, ---of medicinal plants of C.G. Food plants: Pearl millet, Buck of wheat, Sorghum, Soyabean, gram, Ground nut, Sugarcane and Potato. Fruit plants: Pear, Peach, Litchi. Spices: Cinnamon, Turmeric, Ginger, Asafoetida and Cumin. Beverages : Tea, Coffee Rubber Cultivation of important flowers: Chrysanthemum, Dahelia, Biodiesel plants Jatropa, Pongamia Ethnobotany in context of Chhattisgarh.

UNIT-IV

Plant Anatomy: Root and shoot apical meristems theories of root and shoot apex organization, permanent tissues, anatomy of root, stem and leaf of dicot and monocot, secondary growth in root and stem, Anatomical anomalies in the primary structure of stems (Nyctanthes, Boerhaavia, Casuarina), Anamolous secondary growth in Dracaena, Bignonia, Laptadenia.

UNIT-V

Embryology: Flower as a reproductive organ, anther, microsporogenesis, types of ovules, megasporogenesis, development of male and female gametophyte, pollination, mechanisms, self incompatibility, fertilization, endosperm, embryo, polyembryonoy, apomixes and parthenocarpy.

Books Recommended:

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B.Sc.-II (BOTANY) PAPER-II
(ECOLOGY AND PLANT PHYSIOLOGY)

UNIT-I

Introduction and scope of ecology, environmental and ecological factors, Soil formation and soil profile, Liebig's law of minimum, Shelford's law of tolerance, morphological and anatomical adaptations in hydrophytes, xerophytes and epiphytes.

UNIT-II

Population and community characteristics, Raunkiaer's life forms, population interactions (e.g. Symbiosis, Amensalism etc.), succession, ecotone and edge effect, ecological niches, ecotypes, ecads, keystone species

Concept of ecosystem, trophic levels, flow of energy in ecosystem, food chain and food web, concept of ecological pyramids

Biogeochemical cycles: carbon cycle, nitrogen cycle and phosphorus cycle

UNIT-III

Plant water relations: Diffusion, permeability, osmosis, imbibitions, plasmolysis, osmotic potential and water potential, Types of soil water, water holding capacity, wilting, Absorption of water, theories of Ascent of sap, Mineral nutrition and absorption, Deficiency symptoms, Transpiration, stomatal movement, significance of transpiration, Factors affecting transpiration, guttation.

UNIT-IV

Photosynthesis: Photosynthetic apparatus and pigments, light reaction mechanism of ATP synthesis. C₃, C₄ CAM pathway of carbon reduction, photorespiration, factors affecting photosynthesis.

Respiration: Aerobic and anaerobic respiration, Glycolysis, Krebs's cycle, factors affecting respiration, R.Q.

UNIT-V

Plant growth hormones: Auxin, Gibberellin, Cytokinin, Ethylene and Abscisic acid. Physiology of flowering, Florigen concept, Photoperiodism and Vernalization. Seed dormancy and germination, plant movement.

Books Recommended:

Koromondy, E.J. *Concepts of Ecology*, Prentice Hall, USA

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

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

Hopkins, WG and Huner, PA. *Introduction to Plant Physiology*, John Wiley and Sons.

Pandey SN and Sinha BK, *Plant Physiology*, Vikas Publishing, New Delhi

Taiz, L and Zeiger. E. *Plant Physiology*, 5th edition, Sinauer Associates Inc. M.A, USA

Srivastava, HS *Plant Physiology and Biotechnology*, Rastogi Publications, Meerut

B.Sc. II (BOTANY)

Practical

1. Taxonomy: Detailed description and identification of locally available plants of the families as prescribed in the theory paper.
2. Economic Botany: Identification and comment on the plants and plant products belonging to different economic use categories
3. Preparation of Herbarium of local wild plants.
4. Quantitative vegetation analysis of a grassland ecosystem.
5. Anatomical characteristics of hydrophytes and xerophytes.
6. Demonstration of root pressure.
7. Demonstration of transpiration.
8. Demonstration of evolution of O₂ in photosynthesis, factors affecting of photosynthesis.
9. Comparison of R.Q. of different respiratory substrates.
10. Demonstration of fermentation.
11. Determination of BOD of a water body.
12. Demonstration of mitosis.

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THERMODYNAMICS, KINETIC THEORY AND STATISTICAL PHYSICS

Unit-1 The laws of thermodynamics : The Zeroth law, first law of thermodynamics, internal energy as a state function, reversible and irreversible change, Carnot's cycle, Carnot theorem, second law of thermodynamics. Clausius theorem inequality. Entropy, Change of entropy in simple cases (i) Isothermal expansion of an ideal gas (ii) Reversible isochoric process (iii) Free adiabatic expansion of an ideal gas. Concept of entropy, Entropy of the universe. Entropy change in reversible and irreversible processes, Entropy of Ideal gas, Entropy as a thermodynamic variable, S-T diagram, Principle of increase of entropy. The thermodynamic scale of temperature, Third law of thermodynamics, Concept of negative temperature.

Unit-2 Thermodynamic functions, Internal energy, Enthalpy, Helmholtz function and Gibb's free energy, Maxwell's thermodynamical equations and their applications, TdS equations, Energy and heat capacity equations Application of Maxwell's equation in Joule-Thomson cooling, adiabatic cooling of a system, Van der Waals gas, Clausius-Clapeyron heat equation. Blackbody spectrum, Stefan-Boltzmann law, Wien's displacement law, Rayleigh-Jean's law, Planck's quantum theory of radiation.

Unit-3 Maxwellian distribution of speeds in an ideal gas: Distribution of speeds and velocities, experimental verification, distinction between mean, rms and most probable speed values. Doppler broadening of spectral lines. Transport phenomena in gases: Molecular collisions mean free path and collision cross sections. Estimates of molecular diameter and mean free path. Transport of mass, momentum and energy and interrelationship, dependence on temperature and pressure.
Behaviour of Real Gases: Deviations from the Ideal Gas Equation. The Virial Equation. Andrew's Experiments on CO₂ Gas. Critical Constants.

Unit-4 The statistical basis of thermodynamics: Probability and thermodynamic probability, principle of equal a priori probabilities, statistical postulates. Concept of Gibb's ensemble, accessible and inaccessible states. Concept of phase space, γ phase space and μ phase space. Equilibrium between two systems in thermal contact, probability and entropy, Boltzmann entropy relation. Boltzmann canonical distribution law and its applications, law of equipartition of energy.

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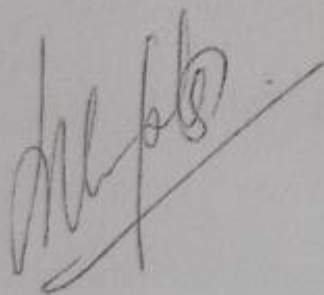
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Transition to quantum statistics: 'h' as a natural constant and its implications, cases of particle in a one-dimensional box and one-dimensional harmonic oscillator.

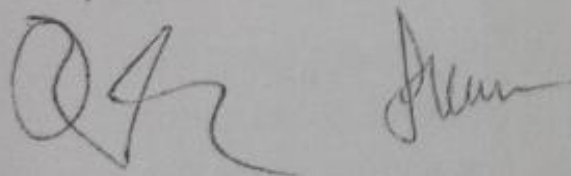
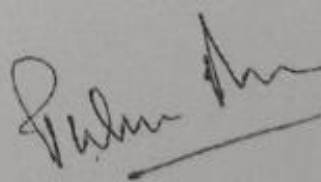
Unit-5 Indistinguishability of particles and its consequences, Bose-Einstein & Fermi-Dirac conditions, Concept of partition function, Derivation of Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac Statistics, Limits of B-E and F-D statistics to M-B statistics. Application of B-E statistics to black body radiation, Application of F-D statistics to free electrons in a metal.

TEXT AND REFERENCE BOOKS:

1. B.B. Laud, "Introduction to Statistical Mechanics" (Mcmillan 1981)
2. F. Reif: "Statistical Physics" (Mcgraw-Hill, 1998).
3. K. Haug: "Statatistical Physics" (Wiley Eastern, 1988).
4. Thermal and statistical Physics: R.K. Singh, Y.M. Gupta and S. Sivraman.
5. Statistical Physics: Berkeley Physics Course, Vol. 5
6. Physics (Part-2): Editor, Prof. B.P. Chandra, M.P. Hindi Granth Academy.
7. Heat and Thermodynamics: K.W. Zeemansky.
8. Thermal Physics: B.K. Agarwal.
9. Heat and Thermodynamics: Brij Lal and N. Subramanyam.
10. Heat and Thermodynamics: Dayal, Verma and Pandey.
11. A Treatise on Heat: M.N. Saha and B.N. Srivastava.



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Session 2019-20

PHYSICS

Paper-II

WAVES, ACOUSTICS AND OPTICS

Unit-1 Waves in media: Speed of transverse waves on uniform string, speed of longitudinal waves in a fluid, energy density and energy transmission in waves. Waves over liquid surface: gravity waves and ripples. Group velocity and phase velocity and relationship between them. Production and detection of ultrasonic and infrasonic waves and applications.

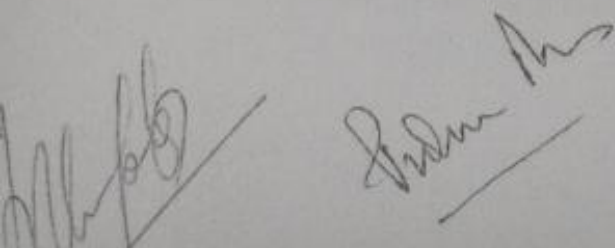
Reflection, refraction and diffraction of sound : Acoustic impedance of a medium, percentage reflection & refraction at a boundary, impedance matching for transducers, diffraction of sound, principle of a sonar system, sound ranging.

Unit-2 Fermat's Principle of extremum path, the aplanatic points of a sphere and other applications. Cardinal points of an optical system, thick lens and lens combinations. Lagrange equation of magnification, telescopic combinations, telephoto lenses. Monochromatic aberrations and their reductions; aspherical mirrors and Schmidt corrector plates, aplanatic points, oil immersion objectives, meniscus lens.

Optical instruments: Entrance and exit pupils, need for a multiple lens eyepiece, common types of eyepieces. (Ramsdon and Hygen's eyepieces).

Unit-3 Interference of light: The principle of superpositions, two slit interference, coherence requirement for the sources, optical path retardations, Conditions for sustained interference, Theory of interference, Thin films. Newton's rings and Michelson interferometer and their applications, its application for precision determinations of wavelength, wavelength difference and the width of spectral lines. Multiple beam interference in parallel film and Fabry-Perot interferometer. Rayleigh refractometer, Twyman-Green interferometer and its uses.

Unit-4 Diffraction, Types of Diffraction, Fresnel's diffraction, half-period zones, phasor diagram and integral calculus methods, the intensity distribution, Zone plates, diffraction due to straight edge, Fraunhofer diffraction due to a single slit and double slit, Diffraction at N-Parallel slit, Plane Diffraction grating, Rayleigh criterion, resolving power of grating, Prism, telescope.

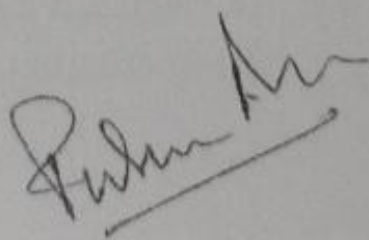


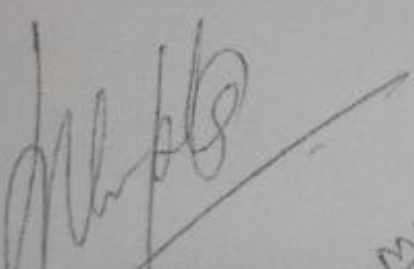
Polarized light and its mathematical representation, Production of polarized light by reflection, refraction and scattering. Polarization by double refraction and Huygen's theory, Nicol prism, Retardation plates, Production and analysis of circularly and elliptically polarized light. Optical activity and Fresnel's theory, Biquartz polarimeter.

Unit-5 Laser system: Basic properties of Lasers, coherence length and coherence time, spatial coherence of a source, Einstein's A and B coefficients, Spontaneous and induced emissions, conditions for laser action, population inversion, Types of Laser : Ruby and, He-Ne laser, and. Applications of laser : Application in communication, Holography and Basics of non linear optics and Generation of Harmonic.

TEXT AND REFERENCE BOOKS:

1. A.K. Ghatak, 'Physical Optics'
2. D.P. Khandelwal, 'Optical and Atomic Physics' (Himalaya Publishing House, Bombay, 1988)
3. K.D. Moltev; 'Optics' (Oxford University Press)
4. Sears: 'Optics'
5. Jenkins and White: 'Fundamental of Optics' (McGraw-Hill)
6. B.B. Laud: 'Lasers and Non-linear Optics' (Wiley Eastern 1985)
7. Smith and Thomson: 'Optics' (John Wiley and Sons)
8. Berkely Physics Courses: Vol.-III, 'Waves and Oscillations'
9. I.G. Main, 'Vibrations and Waves' (Cambridge University Press)
10. H.J. Pain: 'The Physics of Vibrations and Waves' (MacMillan 1975)
11. Text Book of Optics: B.K. Mathur
12. B.Sc. (Part III) Physics: Editor: B.P. Chandra, M.P. Hindi Granth Academy.
13. F. Smith and J.H. Thomson, Manchester Physics series: optics (John wiley, 1971)
14. Born and Wolf : 'Optics'.
15. Physical Optics: B. K. Mathur and T. P. Pandya.
16. A textbook of Optics: N. Subrahmanyam, Brijlal and M. N. Avadhanulu.
17. Geometrical and Physical Optics: Longhurst.
18. Introduction to Modern Optics: G. R. Fowels.
19. Optics: P. K. Srivastav.




M.K. Ghatak
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PRACTICALS

Minimum 16 (Eight from each group)

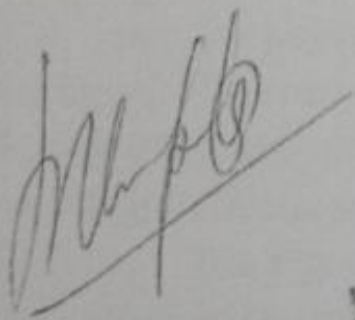
Experiments out of the following or similar experiments of equal standard

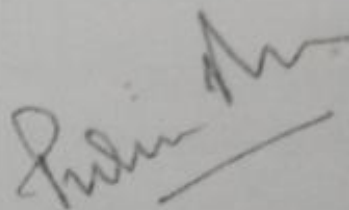
1. Study of Brownian motion.
2. Study of adiabatic expansion of a gas.
3. Study of conversion of mechanical energy into heat.
4. Heating efficiency of electrical kettle with varying voltage.
5. Study of temperature dependence of total radiation.
6. Study of temperature dependence of spectral density of radiation.
7. Resistance thermometry.
8. Thermo emf thermometry.
9. Conduction of heat through poor conductors of different geometries.
10. Experimental study of probability distribution for a two-option system using a coloured dice.
11. Study of statistical distribution on nuclear disintegration data (GM counter used as a black box).
12. Speed of waves on a stretched strings.
13. Studies on torsional waves in a lumped system.
14. Study of interference with two coherent source of sound.
15. Chlandi's figures with varying excitation and loading points.
16. Measurements of sound intensities with different situations.
17. Characteristics of a microphone-loudspeakers system
18. Designing an optical viewing system.
19. Study of monochromatic defects of images.
20. Determining the principle point of a combination of lenses.
21. Study of interference of light (biprism or wedge film).
22. Study of diffraction at a straight edge or a single slit.
23. Study of F-P etalon fringes.
24. Study of diffraction grating and its resolving power.
25. Resolving power of telescope system.
26. Polarization of light by reflection; also cos-squared law.
27. Study of optical rotation for any system.
28. Study of laser as a monochromatic coherent source.
29. Study of a divergence of laser beam.
30. Calculation of days between two dates of a year.
31. To check if triangle exists and the type of a triangles.
32. To find the sum of the sine and cosines series and print out the curve.

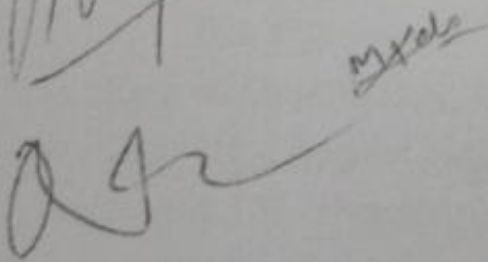
33. To solve simultaneous equation by elimination method.
34. To prepare a mark-list of polynomials.
35. Fitting a straight line or a simple curve
36. Convert a given integer into binary and octal systems and vice versa .
37. Inverse of a matrix.
38. Spiral array.

TEXT AND REFERENCE BOOKS

1. D.P. Khandelwal, Optics and Atomic physics (Himalaya Publishing house, Bombay 1988).
2. D.P. Khandelwal, A Laboratory Manual for Undergraduate Classes (Vani Publishing House, New Delhi).
3. S. Lipschutz and a Poe, Schaum's outline of theory and Problems of Programming with Fortran (McGraw-hill Book Company 1986).
4. C Dixon, Numerical Analysis .









HEMCHAND YADAV VISHWAVIDYALAYA, DURG (C.G.)
NEW CURRICULUM OF B.Sc. PART II
SESSION 2019-20
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

CHEMISTRY OF TRANSITION SERIES ELEMENTS

Transition Elements: Position in periodic table, electronic configuration, General Characteristics, viz., atomic and ionic radii, variable oxidation states, ability to form complexes, formation of coloured ions, magnetic moment μ_{so} (spin only) and μ_{eff} and catalytic behaviour. General comparative treatment of 4d and 5d elements with their 3d analogues with respect to ionic radii, oxidation states and magnetic properties.

UNIT-II

A. OXIDATION AND REDUCTION: Redox potential, electrochemical series and its applications, Principles involved in extraction of the elements.

B. COORDINATION COMPOUNDS: Werner's theory and its experimental verification, IUPAC nomenclature of coordination compounds, isomerism in coordination compounds. Stereochemistry of complexes with 4 and 6 coordination numbers. Chelates, polynuclear complexes.

UNIT-III

COORDINATION CHEMISTRY

Valence bond theory (inner and outer orbital complexes), electroneutrality principle and back bonding. Crystal field theory, Crystal field splitting and stabilization energy, measurement of $10 Dq$ (Δ_o), CFSE in weak and strong fields, pairing energies, factors affecting the magnitude of $10 Dq$ (Δ_o , Δ_t). Octahedral vs. tetrahedral coordination.

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UNIT-IV

A. CHEMISTRY OF LANTHANIDE ELEMENTS

Electronic structure, oxidation states and ionic radii and lanthanide contraction, complex formation, occurrence and isolation, lanthanide compounds.

B. CHEMISTRY OF ACTINIDES

General features and chemistry of actinides, chemistry of separation of Np, Pu and Am from uranium, similarities between the latter actinides and the latter lanthanides

UNIT-V

A. ACIDS BASES : Arrhenius, Bronsted-Lowry, conjugate acids and bases, relative strengths of acids and bases, the Lux-flood, Solvent system and Lewis concepts of acids and bases.

B. NON-AQUEOUS SOLVENTS

Physical properties of a solvent, types of solvents and their general characteristics, reaction in non-aqueous solvents with reference to liquid ammonia and liquid sulphur dioxide, HF, H₂SO₄, ionic liquids.

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. Tarr, Prentice Hall.
8. Advanced Inorganic Chemistry, Satya Prakash.
9. Advanced Inorganic Chemistry, Agarwal and Agarwal
10. Advanced Inorganic Chemistry, Puri, Sharma, S. Naginchand
11. Inorganic Chemistry, Madan, S. Chand
12. Aadhunik Akarbanic Rasayan, A. K. Shrivastav & P. C. Jain, Goel Pub
13. Uchchattar Akarbanic Rasayan, satya Prakash & G. D. Tuli, Shyamal Prakashan
14. Uchchattar Akarbanic Rasayan, Puri & Sharma
15. Selected topic in Inorganic Chemistry by Madan Malik & Tuli, S. Chand.

UNIT-I

CHEMISTRY OF ORGANIC HALIDES

Alkyl halides: Methods of preparation, nucleophilic substitution reactions – S_N1 , S_N2 and S_N1' mechanisms with stereochemical aspects and effect of solvent etc.; nucleophilic substitution, elimination reactions.

Aryl halides: Preparation, including preparation from diazonium salts, Nucleophilic Aromatic Substitution; S_NAr , Benzyne mechanism. Relative reactivity of alkyl, allyl/benzyl, vinyl and aryl halides towards nucleophilic substitution reactions.

UNIT-II

ALCOHOLS

A. Alcohols: Nomenclature, preparation, properties and relative reactivity of 1° , 2° , 3° alcohols, Bouvaelt-Blanc Reduction for the preparation of alcohols, Dihydric alcohols – methods of formation, chemical reactions of vicinal glycols, oxidative cleavage [$Pb(OAc)_4$ and HIO_4] and pinacol-pinacolone rearrangement.

B. Trihydric alcohols - Nomenclature, methods of formation, chemical reactions of glycerol.

PHENOLS

A. Structure and bonding in phenols, physical properties and acidic character, Comparative acidic strength of alcohols and phenols, acylation and carboxylation.

B. Mechanism of Fries rearrangement, Claisen rearrangement, Gatterman synthesis, Hauben-Hoesh reaction, Lederer-Manasse reaction and Reimer-Tiemann reaction.

UNIT-III

ALDEHYDES AND KETONES

A. Nomenclature, structure and reactivity of carbonyl group. General methods of preparation of aldehydes and ketones.

Mechanism of nucleophilic addition to carbonyl groups: Benzoin, Aldol, Perkin and Knoevenagel condensation. Condensation with ammonia and its derivatives, Wittig reaction, Mannich reaction, Beckmann and Benzil- Benzilic rearrangement.

B. Use of acetate as protecting group, Oxidation of aldehydes, Baeyer-Villiger oxidation of ketones, Cannizzaro reaction, MPV, Clemmensen reduction, Wolf-Kishner reaction, $LiAlH_4$ and $NaBH_4$ reduction. Halogenation of enolizable ketones, An introduction to α,β -unsaturated aldehydes and ketones.

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UNIT-IV

A. CARBOXYLIC ACIDS

Preparation, Structure and bonding, Physical and chemical properties including, acidity of carboxylic acids, effects of substituents on acid strength, Hell-Volhard Zeilinsky reaction. Reduction of carboxylic groups, Mechanism of decarboxylation.

Di carboxylic acids: Methods of formation and effect of heat and dehydrating agents, Hydroxyacids.

B. CARBOXYLIC ACID DERIVATIVES

Structure of acid chlorides, esters, amides and acid anhydrides, Relative stability of acyl derivatives.

Physical properties, inter-conversion of acid derivatives by nucleophilic acyl substitution.

Mechanism of acid and base catalyzed esterification and hydrolysis.

UNIT-V

ORGANIC COMPOUNDS OF NITROGEN

A. Preparation of nitroalkanes and nitroarenes. Chemical reactions of nitroalkanes. Mechanism of nucleophilic substitution in nitroarenes and their reduction in acidic, neutral and alkaline medium.

B. Reactivity, structure and nomenclature of amines, physical properties. Stereochemistry of amines. Separation of mixture of primary, secondary and tertiary amines. Structural features affecting basicity of amines. Preparation of alkyl and aryl amines (reduction of nitro compounds and nitriles), reductive amination of aldehydic and ketonic compounds. Gabriel-Phthalimide reaction, Hofmann-Bromamide reaction, Reactions of amines, electrophilic aromatic substitution of aryl amines, Reaction of amines with nitrous acid. Synthetic transformations of aryl diazonium salts, Azo coupling.

REFERENCE BOOKS

1. Organic Chemistry, Morrison and Boyd, Prentice-Hall.
2. Organic Chemistry, L. G. Wade Jr. Prentice Hall.
3. Fundamentals of Organic Chemistry, Solomons, John Wiley.
4. Organic Chemistry, Vol I, II, III S. M. Mukherjee, S. P. Singh and R. P. Kapoor, Wiley Easters (New Age).
5. Organic Chemistry, F. A. Carey, McGraw Hill.
6. Introduction to Organic Chemistry, Struieweisser, Heathcock and Kosover, Macmillan.
7. Organic Chemistry, P. L. Soni.
8. Organic Chemistry, Bahl and Bahl.
9. Organic Chemistry, Joginder Singh.
10. Carbanic Rasayan, Bahl and Bahl.
11. Carbanic Rasayan, R. N. Singh, S. M. I. Gupta, M. M. Bakidia & S. K. Wadhwa.
12. Carbanic Rasayan, Joginder Singh.

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UNIT-I

A. THERMODYNAMICS-I

Intensive and extensive variables; state and path functions; isolated, closed and open systems; Zeroth law of thermodynamics, First law: Concept of heat, work, internal energy and statement of first law; enthalpy, Relation between heat capacities, calculations of q , w , U and H for reversible, irreversible and free expansion of gases under isothermal and adiabatic conditions. Joule-Thomson expansion, inversion temperature of gases, expansion of ideal gases under isothermal and adiabatic condition

B. THERMO CHEMISTRY

Thermochemistry, Laws of Thermochemistry, Heats of reactions, standard states; enthalpy of formation of molecules and ions and enthalpy of combustion and its applications; calculation of bond energy, bond dissociation energy and resonance energy from thermochemical data, effect of temperature (Kirchhoff's equations) and pressure on enthalpy of reactions, Adiabatic flame temperature, explosion temperature.

UNIT-II

A. THERMODYNAMICS-II

Second Law of Thermodynamics: Spontaneous process, Second law, Statement of Carnot cycle and efficiency of heat engine, Carnot's theorem, thermodynamic state of temperature. Concept of entropy: Entropy change in a reversible and irreversible process, entropy change in isothermal reversible expansion of an ideal gas, entropy change in isothermal mixing of ideal gases, physical signification of entropy, Molecular and statistical interpretation of entropy.

B. Gibbs and Helmholtz free energy, variation of G and A with pressure, volume, temperature, Gibbs-Helmholtz equation, Maxwell relations, Elementary idea of Third law of Thermodynamics, concept of residual entropy, calculation of absolute entropy of molecule.

UNIT III

A CHEMICAL EQUILIBRIUM

Criteria of thermodynamic equilibrium, degree of advancement of reaction, chemical equilibria in ideal gases. Concept of Fugacity, Thermodynamic derivation of relation between Gibbs free energy of reaction and reaction quotient. Coupling of exergonic and endergonic reactions. Equilibrium constants and their quantitative dependence on temperature, pressure and concentration. Thermodynamic derivation of relations between the various equilibrium constants K_p , K_c and K_x . Le Chatelier principle (quantitative treatment). Equilibrium between ideal gas and a pure condensed phase.

B IONIC EQUILIBRIA

Ionization of weak acids and bases, pH scale, common ion effect; dissociation constants of mono protic acids (exact treatment). Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts. Buffer solutions; derivation of Henderson equation and its applications. Solubility and solubility product of sparingly soluble salts – applications of solubility product principle.

UNIT-IV

PHASE EQUILIBRIUM

A. Phase rule, Phase, component and degree of freedom, derivation of Gibbs phase rule, Clausius-Claperon equation and its applications to Solid-Liquid, Liquid-Vapor and Solid-Vapor, limitation of phase rule, applications of phase rule to one component system: Water system and sulphur system.

Application of phase rule to two component system: Pb-Ag system, desilverization of lead, Zn-Mg system, Ferric chloride-water system, congruent and incongruent melting point and eutectic point.

Three component system: Solid solution liquid pairs.

B. Nernst distribution law, Henry's law, application, solvent extraction

B.Sc.-II

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INORGANIC CHEMISTRY

Qualitative semimicro analysis of mixtures containing 5 radicals. Emphasis should be given to the understanding of the chemistry of different reactions. The following radicals are suggested:

CO_3^{2-} , NO_2^- , S^{2-} , SO_3^{2-} , $\text{S}_2\text{O}_3^{2-}$, CH_3COO^- , F^- , Cl^- , Br^- , I^- , NO_3^- , BO_3^{3-} , $\text{C}_2\text{O}_4^{2-}$, PO_4^{3-} , NH_4^+ , K^+ , Pb^{2+} , Cu^{2+} , Cd^{2+} , Bi^{3+} , Sn^{2+} , Sb^{3+} , Fe^{3+} , Al^{3+} , Cr^{3+} , Zn^{2+} , Mn^{2+} , Co^{2+} , Ni^{2+} , Ba^{2+} , Sr^{2+} , Ca^{2+} , Mg^{2+} .

Mixtures should preferably contain one interfering anion, or insoluble component (BaSO_4 , SrSO_4 , PbSO_4 , CaF_2 or Al_2O_3) or combination of anions e.g. CO_3^{2-} and SO_3^{2-} , NO_2^- and NO_3^- , Cl^- , Br^- , and I^- .

Volumetric analysis

- Determination of acetic acid in commercial vinegar using NaOH.
 - Determination of alkali content-antacid tablet using HCl.
 - Estimation of calcium content in chalk as calcium oxalate by permanganometry.
 - Estimation of hardness of water by EDTA.
 - Estimation of ferrous & ferric by dichromate method.
 - Estimation of copper using thiosulphate.
- Principles involved in chromatographic separations. Paper chromatographic separation of following metal ions: i. Ni (II) and Co (II) ii. Fe (III) and Al (III)

ORGANIC CHEMISTRY

- Detection of elements (X, N, S).
- Qualitative analysis of unknown organic compounds containing simple functional groups (alcohols, carboxylic acids, phenols, nitro, amine, amide, and carbonyl compounds, carbohydrates)
- Preparation of Organic Compounds:
 - m*-dinitrobenzene, (ii) Acetanilide, (iii) Bromo/Nitro-acetanilide, (iv) Oxidation of primary alcohols-Benzoic acid from benzylalcohol, (v) azo dye.

UNIT V

PHOTOCHEMISTRY

Characteristics of electromagnetic radiation, Interaction of radiation with matter, difference between thermal and photochemical processes, Lambert-Beer's law and its limitations, physical significance of absorption coefficients. Laws of photochemistry: Grothus-Draper law, Stark-Einstein law, quantum yield, actinometry, examples of low and high quantum yields, Photochemical equilibrium and the differential rate of photochemical reactions, Quenching, Role of photochemical reaction in biochemical process.

Jablonski diagram depicting various process occurring in the excited state, qualitative description of fluorescence, phosphorescence, non-radiative processes (internal conversion, intersystem crossing), photosensitized reactions, energy transfer processes {simple examples}, photostationary states, Chemiluminescence.

REFERENCE BOOKS

1. Physical Chemistry, G. M. Barrow, International student edition, McGraw Hill.
2. University General Chemistry, C. N. R. Rao, Macmillan.
3. Physical Chemistry, R. A. Alberty, Wiley Eastern.
4. The elements of physical chemistry, Wiley Eastern.
5. Physical Chemistry through problems, S. K. Dogra & S. Dogra, Wiley Eastern.
6. Physical Chemistry, B. D. Khosla,.
7. Physical Chemistry, Puri & Sharma.
8. Bhautik Rasayan, Puri, Sharma and Pathania, Vishal Publishing Company.
9. Bhautik Rasayan, P. L. Soni.
10. Bhautik Rasayan, Bahl and Tuli.
11. Physical Chemistry, R. L. Kapoor, Vol I-IV .
12. Chemical kinetics, K. J. Laidler, Pearson Educations, New Delhi (2004).

PHYSICAL CHEMISTRY

Transition Temperature

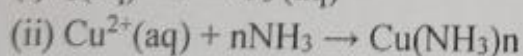
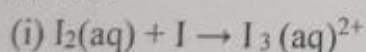
- Determination of the transition temperature of the given substance by thermometric/dialometric method (e.g. $\text{MnCl}_2 \cdot 4\text{H}_2\text{O}/\text{SrBr}_2 \cdot 2\text{H}_2\text{O}$).

Thermochemistry

- Determination of heat capacity of a calorimeter for different volumes using change of enthalpy data of a known system (method of back calculation of heat capacity of calorimeter from known enthalpy of solution or enthalpy of neutralization).
- Determination of heat capacity of the calorimeter and enthalpy of neutralization of hydrochloric acid with sodium hydroxide.
- To determine the solubility of benzoic acid at different temperature and to determine ΔH of the dissolution process.
- To determine the enthalpy of neutralization of a weak acid/ weak base versus strong base/ strong acid and determine the enthalpy of ionization of the weak acid/ weak base.
- To determine the enthalpy of solution of solid calcium chloride and calculate the lattice energy of calcium chloride from its enthalpy data using Born Haber cycle.

Phase Equilibrium

- To study the effect of a solute (e.g. NaCl, Succinic acid) on the critical solution temperature of two partially miscible liquids (e.g. phenol-water system) and to determine the concentration of that solute in the given phenol-water system.
- To construct the phase diagram of two component system (e.g. diphenylamine-benzophenone) by cooling curve method.
- Distribution of acetic/ benzoic acid between water and cyclohexane.
- Study the equilibrium of at least one of the following reactions by the distribution method:



Molecular Weight Determination

Determination of molecular weight by Rast Camphor and Landsburger method.

Note: Experiments may be added/ deleted subject to availability of time and facilities.

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MICROBIOLOGY

BSc-1st

Paper- I: General Microbiology & Basic Technique

UNIT-1: Fundamental, History & Developments

Introduction to major groups of microorganisms and fields of Microbiology; Historical development, Contributions of Pioneers (Louis Pasteur, Edward Jenner, Anton Von Leewenhoek and Alexander Flemming). Beneficial and harmful microbes and its role in daily life.

UNIT-2: Basic Microbial Techniques

Methods of studying microorganism; Sterilization Techniques (Physical & Chemical Sterilization). Pure culture isolation Technique: Streaking, Waksman serial dilution and plating methods. cultivation, maintenance and preservation of pure cultures. Culture media & conditions for microbial growth. Staining technique: simple staining, Differential (gram staining), negative staining and acid fast staining.

UNIT-3: Virology & Bacteriology

Diversity of microbial world; Principle and classification of Viruses and Bacteria. Structure, Multiplication and Economic importance of viruses (TMV, Influenza virus & T₄-Phage). Structure & Functional organization of Bacteria, Cell wall of Gram Positive & Gram Negative bacteria; Economic importance of Bacteria.

UNIT-4: Mycology

General characteristics and classification of Fungi; Structure and Reproduction of fungi (*Rhizopus*, *Penicillium*, *Aspergillus*, *Yeast* & *Agaricus*). Common fungal disease of crops (Late & Early blight of potato, Smut of Rice, Tikka and Red rot of Sugarcane). Structure, reproduction and economic aspect of Lichens.

UNIT-5: Phycology & Protozoology

General characteristics and classification of Algae and Protozoa; General account & economic importance of Cyanobacteria (*Microcystis*, *Ocellularia*, *Nostoc* & *Anabaena*) and Protozoa (*Amoeba*, *Paramoecium*, *Euglena* and *plasmodium*).

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Text Books Recommended:

1. General microbiology; Vol I & II, Powar C. B. and Dagainawala H. I., Himalaypub.house, Bombay.
2. A textbook of Microbiology; Dubey & Maheshwari.
3. Microbiology: An Introduction; G. Tor tora, B. Funke, C. Benjamin Cummings.
4. General Microbiology; Seventh edition by Hans G Schlegel, Cambridge University Press.
5. Practical Microbiology; Dubey and Maheshwari.
6. Handbook of Microbiology; Bisen P.S., Varma K., CBS Publishers and Distributors, Delhi. General Microbiology by Brock.
7. General Microbiology by Pelzar et al.
8. Introduction on Microbial Techniques by Gunasekaran.

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Paper- II: Biochemistry and Physiology

UNIT-1: CARBOHYDRATES AND PROTEINS

Structure, classification and properties of Carbohydrates – Monosaccharide, Oligosaccharides (Disaccharides) and Polysaccharides. Structure, classification and properties of Protein - Amino acids, peptides and Proteins (Primary, Secondary, Tertiary and Quaternary structure).

UNIT-2: LIPIDS AND NUCLEIC ACIDS

Structure, classification and properties of Lipids; Saturated and Unsaturated fatty acids. Structure and properties of Nucleotides. Structure and forms of DNA; Replication of DNA. Types, Structure and Function of RNA.

UNIT-3: ENZYMES

Structure, Nomenclature, Classification and Properties of Enzymes. Mechanism of enzyme action. Enzyme kinetic: Michaelis-Menten Equation & derivation, Enzyme inhibition, Lineweaver-Burk Plot (LB plot). Co-enzymes and their role; Allosteric enzymes and Isoenzyme. Extracellular enzymes and their role.

UNIT-4: MICROBIAL METABOLISM

Bacterial photosynthesis and Chemosynthesis; Glycolysis, TCA cycle and Oxidative Phosphorylation. Anaerobic catabolism of glucose; Fat Biosynthesis, alpha and beta oxidation of fatty acids. Deamination, trans-amination and Urea cycle.

UNIT-5: GROWTH PHYSIOLOGY & TRANSPORT SYSTEM

Bacterial cell division, Genome replication and Growth Phases, Conditions for growth. Plasma membrane & Transport system, type of transport (Passive and active). Diffusion (simple & facilitated), Concept of Uniport, Antiport and Symport;

Text Books Recommended:

1. General Biochemistry by A.C. Deb.
2. Biochemistry by Lehninger (Kalyani publication)
3. Biochemistry by U. Satyanarayan.
4. Microbiology by Anantanarayan and Panikar.
5. Fundamentals of Biochemistry; J L Jain, Sunjay Jain, Nitin Jain; S. Chand & Company Ltd
6. Practical Biochemistry: Principles and Techniques; 5th Edition; Keith Wilson and John Walker
7. Biophysical Biochemistry: Principles and Techniques; Avinash Upadhyay, Kakoli Upadhyay and Nirmalendu Nath; Himalaya Publishing House.

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PRACTICAL

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- Basic information about autoclave, hot air oven, laminar air flow and other laboratory instruments
- Preparation of solid/liquid culture media.
- Isolation of single colonies on solid media.
- Enumeration of bacterial numbers by serial dilution and plating.
- Simple and differential staining.
- Measurement of microorganism (micrometry) and camera Lucida drawing of isolated organism.
- Determination of bacterial growth by optical density measurement.
- General and specific qualitative test for carbohydrates
- General and specific qualitative test for amino acids
- General and specific qualitative test for lipids
- Estimation of protein
- Estimation of blood glucose
- Assay of the activity of amylases
- Assay of the activity of Phosphates
-

Scheme of Practical Examination

Time - 4 hours

M.M. 50

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|--|----|
| 1. Exercise on Microbiological methods | 10 |
| 2. Exercise on Biochemical tests | 10 |
| 3. Exercise on staining method | 05 |
| 4. Spotting (1-5) | 10 |
| 5. Viva-Voce | 05 |
| 6. Sessional | 10 |

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B.Sc.- I (BOTANY) PAPER-I

BACTERIA, VIRUSES, FUNGI, LICHENS AND ALGAE

UNIT-I

VIRUSES: General characteristics, types of viruses based on structure and genetic material. Multiplication of viruses (General account), Lytic and Lysogenic cycle. Economic importance. Structure and multiplication of Bacteriophages. General account of Viroids, Virusoids, Prions, and Cyanophages. Mycorrhiza-Types and Significance.

UNIT-II

BACTERIA: General characteristics and classification (on the basis of morphology), fine structure of bacterial cell, Gram positive and Gram negative bacteria, mode of nutrition and reproduction vegetative, asexual and recombination (Conjugation, transformation and transduction), Economic importance. Microbial Biotechnology, *Rhizobium*, *Azotobacter*, *Anabena*.

UNIT-III

FUNGI: General account of habit and habitat, structure (range of thallus organization), cell wall composition, nutrition and reproduction in fungi. Heterothallism and Parasexuality. Outlines of classification of fungi. Economic importance of fungi. Life cycles of *Saprolegnia*, *Albugo*, *Aspergillus*, *Peziza*, *Agaricus*, *Ustilago*, *Puccinia*, *Alternaria* and *Cercospora*. VAM Fungi

UNIT-IV

ALGAE: Algae: General characters, range of thallus organization, Gaidukov phenomenon, reproduction, life cycle patterns and economic importance. Classification, Systematic position, occurrence, structure and life cycle of following genera : *Nostoc*, *Gloeocapsa*, *Volvox*, *Oedogonium*, *Vaucheria*, *Chara*, *Ectocarpus*, *Polysiphonia*.

UNIT-V

Lichens- General account, types, structure, nutrition, reproduction and economic importance. Mycoplasma: Structure and importance. Blue Green Algae (BGA) in nitrogen economy of soil and reclamation of Ushar land. Mushroom Biotechnology

Books Recommended:

- Dubey R.C. and Maheshwari D.K. *A text book of Microbiology*, S. Chand Publishing, New Delhi
Presscott, L. Harley, J. and Klein, D. *Microbiology*, 7th edition, Tata Mc Graw-Hill Co. New Delhi.
Sharma P.D., *Microbiology and Plant pathology*, Rastogi Publication. New Delhi.

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B.Sc.-I (BOTANY) PAPER -II

(BRYOPHYTES, PTERIDOPHYTES, GYMNOSPERMS AND PALAEOBOTANY)

UNIT -I

BRYOPHYTA: General characteristics, affinities, range of thallus organization, general classification and economic & ecological importance, Systematic position, occurrence, morphology anatomy and reproductive structure in *Riccia*, *Marchantia*, *Pellia*, *Anthoceros*, *Funaria*. Vegetative reproduction in Bryophytes, Evolution of sporophytes.

UNIT-II

PTERIDOPHYTES: General characteristics, affinities, economic importance and classification, Heterospory and seed habit, stellar system in Pteridophytes, Aposory and apogamy, Telome theory, *Azolla* as Biofertilizer.

UNIT-III

Systematic position, occurrence. Morphology, anatomy and reproductive structure of *Psilotum*, *Lycopodium*, *selaginella*, *Equisetum*, *Marsilea*.

UNIT-IV

Gymnosperm: General characteristics, affinities, economic importance and classification, Morphology, anatomy and reproduction in *Cycas*, *Pinus* and *Ephedra*.

UNIT-V

PALAEOBOTANY: Geological time scale, types of fossils and fossilization, Rhynia, study of some fossil gymnosperms. *Lygenopteris*

Books Recommended:

Parihar, N.S. *The Biology and Morphology of Pteridophytes*, Central Book Depot, Allahabad.

Parihar, N.S. *An introduction to Bryophyta Vol.I: Bryophytes* Central Book Depot, Allahabad.

Sambamurty, AVSS, *A textbook of Bryophytes, Pteridophytes, Gymnosperms and Palaeobotany*, IK International Publishers.

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B.Sc. I (BOTANY)

PRACTICAL

Study of external (Morphological) and internal (microscopic/anatomical) features of representative genera given in the theory.

1. Algae: Gloeocapsa, Scytonema, Gloeotrichia, Volvox, Oedogonium, Vaucheria, Chara, Ectocarpus, Sargassum, Batrachospermum
2. Gram staining
3. Fungi: Albugo, Aspergillus, Peziza, Agaricus, Puccinia, Alternaria and Cercospora
4. Bryophyta: Riccia, Marchantia, Pellia, Anthoceros, Sphagnum, Funaria
5. Pteridophyta: Lycopodium, Selaginella, Equisetum, Marsilea.
6. Gymnosperm: Cycas, Pinus, Ephedra.

PRACTICAL SCHEME

TIME: 4 Hrs.

M.M. : 50

1. Algae/Fungi/Gram Staining	10
2. Bryophyta/Pteridophyta	10
3. Gymnosperm	10
4. Spotting	10
5. Viva-Voce	05
6. Sessional	05

(Dr. J.N. Verma)

Proff. & Head

Govt. D.B. Girls PG College

Raipur, (C.G.)

(Dr. Rekha Pimpalgaonkar)

Proff. & Head

Govt. N PG Science College

Raipur, (C.G.)

(Dr. Ranjana Shrivastava)

Proff. & Head

Govt. VYTPG Science College

Raipur, (C.G.)

(Mrs. Sanchal Moghe)

Govt. Bilasa Girls College, Bilaspur

(Mr. Shivakant Mishra)

(Mr. Sudheer Tiwari)

Hemchand Yadav Vishwavidyala, Durg (C.G.)

Zoology

B.Sc. Part I (2019-20)

Paper I

(Cell Biology and Non-chordata)

Unit:I

1. The cell (Prokaryotic and Eukaryotic)
2. Organization of Cell: Extra-nuclear and nuclear Plasma membrane, Mitochondria, Endoplasmic reticulum, Golgi body, Ribosome and Lysosome).
3. Nucleus, Chromosomes, DNA and RNA

Unit:II

1. Cell division (Mitosis and Meiosis).
2. An elementary idea of Cancer cells And Cell transformation.
3. An elementary idea of Immunity: Innate & Acquired Immunity, Lymphoid organs, Cells of Immune System, Antigen, antibody and their interactions

Unit:III

- General characters and classification of Phylum Protozoa, Porifera, and Coelenterata up to order.
2. Protozoa: Type study - Paramecium,
 2. Porifera: Type study - Sycon.
 3. Coelenterata: Type study - Obelia

Unit: IV

- General characters and classification of Phylum Platyhelminthes, Nematelminthes, Annelida and Arthropoda up to order.
2. Platyhelminthes and Nematelminthes: Type Study – Fasciola, Ascaris
 3. Annelida: Type Study - Pheretima.
 4. Arthropoda: Type Study - Palaemone.

Unit:V

- General characters and classification of Phylum Mollusca and Echinodermata up to order.
2. Mollusca: Type Study - Pila.
 3. Echinodermata- Type Study- Asterias (Starfish).

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Zoology
B.Sc. Part I (2019-20)
Paper II
(Chordata and Embryology)

Unit:I

1. Classification of Hemichordata
2. Hemichordata- Type study-Balanoglossus
3. Classification of Chordates upto orders..
4. Protochordata-Type study - Amphioxus.
5. A comparative account of Petromyzon and Myxine.

Unit-II

1. Fishes-Skin & Scales, migration in fishes, Parental care in fish.
2. Amphibia-Parental care and Neoteny.
3. Reptilia- Poisonous & Non-poisonous Snakes, Poison apparatus, snake venom and Extinct Reptiles

Unit-:III

1. Birds- Flight Adaptation, Migration, and Perching mechanism, Discuss-Birds are glorified reptiles.
2. Mammals-Comparative account of Prototheria, Metatheria, Eutheria and Affinities.
3. Aquatic Mammals and their adaptations.

Unit:IV

1. **Fertilization**
2. Gametogenesis, Structure of gamete and Types of eggs
3. Cleavage
4. Development of Frog up to formation of three germ layers.
5. Parthenogenesis

Unit:V

1. Embryonic induction, Differentiation and Regeneration.
2. Development of Chick (a) up to formation of three germ layers, (2) Extra-embryonic membranes.
3. Placenta in mammals.

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Zoology
B.Sc. Part I (2019-20)
Practical

The practical work will, in general be based on the syllabus prescribed in theory and the candidates will be required to show knowledge of the following:-

- Dissection of Earthworm, Cockroach, Palaemon and Pila
- Minor dissection—appendages of Prawn & hastate plate, mouth parts of insects, radulla of Pila.

(Alternative methods: By Clay/Thermacol/drawing/Model etc.)

- Adaptive characters of Aquatic, terrestrial, aerial and desert animals.
- Museum specimen invertebrate
- Slides- Invertebrates, frog embryology, Chick embryology and cytology,

Scheme of Practical Exam

Time: 3hrs

1. Major Dissection	10 Marks
2. Minor Dissection	05 Marks
3. Comments on Exercise based on Adaptation	04 Marks
4. Cytological Preparation	05 Marks
5. Spots-8 (Slides-4, Specimens-4)	16 Marks
6. Sessional	10 Marks

HEMCHAND YADAV VISHWAVIDYALAYA, DURG (C.G.)
NEW CURRICULUM OF B.Sc. PART I
Session 2019-20
CHEMISTRY

The new curriculum will comprise of three theory 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 the UGC norms & conforming to the directives of the Govt. of Chhattisgarh. The theory papers are of 60 hrs each duration and the practical work of 180 hrs duration.

PAPER I
INORGANIC CHEMISTRY

60Hrs. M.M.33

UNIT-I

A. ATOMIC STRUCTURE

Bohr's theory, its limitation and atomic spectrum of hydrogen atom. General idea of de-Broglie matter-waves, Heisenberg uncertainty principle, Schrödinger wave equation, significance of Ψ and Ψ^2 , radial & angular wave functions and probability distribution curves, quantum numbers, Atomic orbital and shapes of s, p, d orbitals, Aufbau and Pauli exclusion principles, Hund's Multiplicity rule, electronic configuration of the elements.

B. PERIODIC PROPERTIES

Detailed discussion of the following periodic properties of the elements, with reference to s and p-block. Trends in periodic table and applications in predicting and explaining the chemical behavior.

- a) Atomic and ionic radii,
- b) Ionization enthalpy,
- c) Electron gain enthalpy,
- d) Electronegativity, Pauling's, Mulliken's, Allred Rochow's scales.
- e) Effective nuclear charge, shielding or screening effect, Slater rules, variation of effective nuclear charge in periodic table.

UNIT-II

CHEMICAL BONDING I

Ionic bond: Ionic Solids - Ionic structures, radius ratio & co-ordination number, limitation of radius ratio rule, lattice defects, semiconductors, lattice energy Born- Haber cycle, Solvation energy and solubility of ionic solids, polarising power & polarisability of ions, Fajans rule, Ionic character in covalent compounds: Bond moment and dipole moment, Percentage ionic character from dipole moment and electronegativity difference, Metallic bond-free electron, Valence bond & band theories.

B.Sc.-I

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UNIT-III

CHEMICAL BONDING II

Covalent bond: Lewis structure, Valence bond theory and its limitations, Concept of hybridization, Energetics of hybridization, equivalent and non-equivalent hybrid orbitals. Valence shell electron pair repulsion theory (VSEPR), shapes of the following simple molecules and ions containing lone pairs and bond pairs of electrons: H_2O , NH_3 , PCl_3 , PCl_5 , SF_6 , H_3O^+ , SF_4 , ClF_3 , and ICl_2^- . Molecular orbital theory. Bond order and bond strength, Molecular orbital diagrams of diatomic and simple polyatomic molecules N_2 , O_2 , F_2 , CO , NO .

UNIT-IV

A. s-BLOCK ELEMENTS

General concepts on group relationships and gradation properties, Comparative study, salient features of hydrides, solvation & complexation tendencies including their function in biosystems and introduction to alkyl & aryls, Derivatives of alkali and alkaline earth metals

B. p-BLOCK ELEMENTS

General concepts on group relationships and gradation properties. Halides, hydrides, oxides and oxyacids of Boron, Aluminum, Nitrogen and Phosphorus. Boranes, borazines, fullerenes, graphene and silicates, interhalogens and pseudohalogens.

UNIT-V

A CHEMISTRY OF NOBLE GASES

Chemical properties of the noble gases, chemistry of xenon, structure, bonding in xenon compounds

B. THEORETICAL PRINCIPLES IN QUALITATIVE ANALYSIS (H_2S SCHEME)

Basic principles involved in the analysis of cations and anions and solubility products, common ion effect. Principles involved in separation of cations into groups and choice of group reagents. Interfering anions (fluoride, borate, oxalate and phosphate) and need to remove them after Group II.

REFERENCE BOOKS:

1. Lee, J. D. Concise Inorganic Chemistry ELBS, 1991.
2. Douglas, B.E. and McDaniel, D.H. Concepts & Models of Inorganic Chemistry Oxford, 1970
3. Atkins, P.W. & Paula, J. Physical Chemistry, 10th Ed., Oxford University Press, 2014.
4. Day, M.C. and Selbin, J. Theoretical Inorganic Chemistry, ACS Publications, 1962.
5. Rodger, G.E. Inorganic and Solid State Chemistry, Cengage Learning India Edition, 2002.
6. Puri, B. R., Sharma, L. R. and Kalia, K. C., Principles of Inorganic Chemistry, Milestone Publishers/ Vishal Publishing Co.; 33rd Edition 2016
7. Madan, R. D. Modern Inorganic Chemistry, S Chand Publishing, 1987.

PAPER: II
ORGANIC CHEMISTRY

UNIT-I BASICS OF ORGANIC CHEMISTRY

Hybridization, Shapes of molecules, Influence of hybridization on bond properties. Electronic Displacements: Inductive, electromeric, resonance and mesomeric effects, hyperconjugation and their applications; Dipole moment. Electrophiles and Nucleophiles; Nucleophilicity and basicity; Homolytic and Heterolytic cleavage, Generation, shape and relative stability of Carbocations, Carbanions, Free radicals, Carbenes and Nitrenes. Introduction to types of organic reactions: Addition, Elimination and Substitution reactions.

UNIT-II INTRODUCTION TO STEREOCHEMISTRY

Optical Isomerism: Optical Activity, Specific Rotation, Chirality/Asymmetry, Enantiomers, Molecules with two or more chiral-centres, Diastereoisomers, meso compounds, Relative and absolute configuration: Fischer, Newmann and Sawhorse Projection formulae and their interconversions; Erythrose and threose, D/L, d/l system of nomenclature, Cahn-Ingold-Prelog system of nomenclature (C.I.P rules), R/S nomenclature. Geometrical isomerism: cis-trans, syn-anti and E/Z notations.

UNIT-III CONFORMATIONAL ANALYSIS OF ALKANES

Conformational analysis of alkanes, ethane, butane, cyclohexane and sugars. Relative stability and Energy diagrams. Types of cycloalkanes and their relative stability, Baeyer strain theory: Theory of strainless rings, Chair, Boat and Twist boat conformation of cyclohexane with energy diagrams; Relative stability of mono-substituted cycloalkanes and disubstituted cyclohexane.

UNIT-IV CHEMISTRY OF ALIPHATIC HYDROCARBONS

A. Carbon-Carbon sigma (σ) bonds

Chemistry of alkanes: Formation of alkanes, Wurtz Reaction, Wurtz-Fittig Reaction, Free radical substitutions: Halogenation-relative reactivity and selectivity.

B. Carbon-Carbon Pi (π) bonds:

Formation of alkenes and alkynes by elimination reactions, Mechanism of E1, E2, E1cb reactions Saytzeff and Hofmann eliminations.

Reactions of alkenes: Electrophilic additions and mechanisms (Markownikoff/Anti -Markownikoff addition), mechanism of oxymercuration-demercuration, hydroboration-oxidation, ozonolysis, reduction (catalytic and chemical), syn and anti-hydroxylation (oxidation). 1,2-and 1,4-addition reactions in conjugated dienes and, Diels-Alder reaction; Allylic and benzylic bromination and mechanism, e.g. propene, 1-butene, toluene, ethyl benzene.

Reactions of alkynes: Acidity, Electrophilic and Nucleophilic additions. Hydration to form carbonyl compounds, Alkylation of terminal alkynes.

UNIT-V AROMATIC HYDROCARBONS

Aromaticity: Hückel's rule, aromatic character of arenes, cyclic carbocations/ carbanions and heterocyclic compounds with suitable examples. Electrophilic aromatic substitution: halogenation, nitration, sulphonation and Friedel-Craft's alkylation/acylation with their mechanism. Directive effects of the groups.

REFERENCE BOOKS:

1. Morrison, R. N. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd.(Pearson Education).
2. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
3. Finar, I. L. Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
4. Eliel, E. L. & Wilen, S. H. Stereochemistry of Organic Compounds, Wiley: London, 1994.
5. Kalsi, P. S. Stereochemistry Conformation and Mechanism, New Age International, 2005.
6. McMurry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013.
7. Organic Chemistry, Paula Y. Bruice, 2nd Edition, Prentice-Hall, International Edition (1998).
8. A Guide Book of Reaction Mechanism by Peter Sykes.

UNIT-I

MATHEMATICAL CONCEPTS FOR CHEMIST

Basic Mathematical Concepts: Logarithmic relations, curve sketching, linear graphs, Properties of straight line, slope and intercept, Functions, Differentiation of functions, maxima and minima; integrals; ordinary differential equations; vectors and matrices; determinants; Permutation and combination and probability theory, Significant figures and their applications.

UNIT-II

GASEOUS STATE CHEMISTRY

Kinetic molecular model of a gas: postulates and derivation of the kinetic gas equation; collision frequency; collision diameter; mean free path; Maxwell distribution and its use in evaluating molecular velocities (average, root mean square and most probable) and average kinetic energy, law of equipartition of energy, degrees of freedom and molecular basis of heat capacities. Joule Thomson effect, Liquification of Gases.

Behaviour of real gases: Deviations from ideal gas behaviour, compressibility factor (Z), and its variation with pressure and temperature for different gases. Causes of deviation from ideal behaviour. van der Waals equation of state, its derivation and application in explaining real gas behaviour, calculation of Boyle temperature. Isotherms of real gases and their comparison with van der Waals isotherms, continuity of states, critical state, relation between critical constants and van der Waals constants, law of corresponding states.

UNIT-III

A. LIQUID STATE CHEMISTRY

Intermolecular forces, magnitude of intermolecular force, structure of liquids, Properties of liquids, viscosity and surface tension.

B. COLLOIDS and SURFACE CHEMISTRY

Classification, Optical, Kinetic and Electrical Properties of colloids, Coagulation, Hardy Schulze law, flocculation value, Protection, Gold number, Emulsion, micelles and types, Gel, Syneresis and thixotropy, Application of colloids.

Physical adsorption, chemisorption, adsorption isotherms (Langmuir and Freundlich). Nature of adsorbed state. Qualitative discussion of BET.

B.Sc.-I

Handwritten signatures and dates:
Dahi 20.6.2015
Divakar 29.6.13
Nals
S. S. S. S.
V. J. S.

UNIT-IV

SOLID STATE CHEMISTRY

Nature of the solid state, law of constancy of interfacial angles, law of rational indices, Miller indices, elementary ideas of symmetry, symmetry elements and symmetry operations, qualitative idea of point and space groups, seven crystal systems and fourteen Bravais lattices; X-ray diffraction, Bragg's law, a simple account of rotating crystal method and powder pattern method. Crystal defects.

UNIT-V

A. CHEMICAL KINETICS

Rate of reaction, Factors influencing rate of reaction, rate law, rate constant, Order and molecularity of reactions, rate determining step, Zero, First and Second order reactions, Rate and Rate Law, methods of determining order of reaction, Chain reactions.

Temperature dependence of reaction rate, Arrhenius theory, Physical significance of Activation energy, collision theory, demerits of collision theory, non mathematical concept of transition state theory.

B. CATALYSIS

Homogeneous and Heterogeneous Catalysis, types of catalyst, characteristic of catalyst, Enzyme catalysed reactions, Micellar catalysed reactions, Industrial applications of Catalysis.

REFERENCE BOOKS:

1. Atkins, P. W. & Paula, J. de Atkin's Physical Chemistry 10th Ed., Oxford University Press (2014).
2. Ball, D. W. Physical Chemistry Thomson Press, India (2007).
3. Castellan, G. W. Physical Chemistry 4th Ed. Narosa (2004).
4. Mortimer, R. G. Physical Chemistry 3rd Ed. Elsevier: NOIDA, UP (2009).
5. Engel, T. & Reid, P. Physical Chemistry 3rd Ed. Pearson (2013).
6. Puri, B.R., Sharma, L. R. and Pathania, M.S., Principles of Physical Chemistry, Vishal Publishing Co., 47th Ed. (2016).
7. Bahl, A., Bahl, B.S. and Tuli, G.D. Essentials of Physical Chemistry, S Chand Publishers (2010).
8. Rakshit P.C., Physical Chemistry, Sarat Book House Ed. (2014).
9. Singh B., Mathematics for Chemist, Pragati Publications.

PAPER - IV
LABORATORY COURSE

INORGANIC CHEMISTRY

A. Semi-micro qualitative analysis (using H_2S or other methods) of mixtures - not more than four ionic species (two anions and two cations, excluding interfering, insoluble salts) out of the following:

Cations : NH_4^+ , Pb^{2+} , Bi^{3+} , Cu^{2+} , Cd^{2+} , Fe^{3+} , Al^{3+} , Co^{2+} , Ni^{2+} , Mn^{2+} , Zn^{2+} , Ba^{2+} , Sr^{2+} , Ca^{2+} , Na^+

Anions : CO_3^{2-} , S^{2-} , SO_3^{2-} , $S_2O_3^{2-}$, NO_2^- , CH_3COO^- , Cl^- , Br^- , I^- , NO_3^- , SO_4^{2-}

(Spot tests may be carried out wherever feasible)

B. Acid-Base Titrations

- Standardization of sodium hydroxide by oxalic acid solution.
- Determination of strength of HCl solution using sodium hydroxide as intermediate.
- Estimation of carbonate and hydroxide present together in mixture.
- Estimation of carbonate and bicarbonate present together in a mixture.
- Estimation of free alkali present in different soaps/detergents

C. Redox Titrations

- Standardization of $KMnO_4$ by oxalic acid solution.
- Estimation of Fe(II) using standardized $KMnO_4$ solution.
- Estimation of oxalic acid and sodium oxalate in a given mixture.
- Estimation of Fe(II) with $K_2Cr_2O_7$ using internal (diphenylamine, anthranilic acid) and external indicator.

D. Iodo / Iodimetric Titrations

- Estimation of Cu(II) and $K_2Cr_2O_7$ using sodium thiosulphate solution iodimetrically.
- Estimation of (a) arsenite and (b) antimony iodimetrically.
- Estimation of available chlorine in bleaching powder iodometrically.
- Estimation of Copper and Iron in mixture by standard solution of $K_2Cr_2O_7$ using sodium thiosulphate solution as titrants.

ORGANIC CHEMISTRY

1. Demonstration of laboratory Glasswares and Equipments.
2. Calibration of the thermometer. $80^\circ-82^\circ$ (Naphthalene), $113.5^\circ-114^\circ$ (Acetanilide), 133° (Urea), 100° (Distilled Water.)
3. Purification of organic compounds by crystallization using different solvents.
 - Phthalic acid from hot water (using fluted filter paper and stemless funnel).
 - Acetanilide from boiling water.
 - Naphthalene from ethanol.
 - Benzoic acid from water.

4. Determination of the melting points of organic compounds.

Naphthalene 80°–82°, Benzoic acid 121.5°–122°, Urea 132.5°–133° Succinic acid 184.5°–185°, Cinnamic acid 132.5°–133°, Salicylic acid 157.5°–158°, Acetanilide 113.5°–114°, m-Dinitrobenzene 90°, p-Dichlorobenzene 52°, Aspirin 135°.

5. Effect of impurities on the melting point – mixed melting point of two unknown organic compounds.

- Urea – Cinnamic acid mixture of various compositions (1:4, 1:1, 4:1).

6. Determination of boiling point of liquid compounds. (boiling point lower than and more than 100 °C by distillation and capillary method).

- Ethanol 78°, Cyclohexane 81.4°, Toluene 110.6°, Benzene 80°.

i. Distillation (Demonstration)

- Simple distillation of ethanol-water mixture using water condenser.
- Distillation of nitrobenzene and aniline using air condenser.

ii. Sublimation

- Camphor, Naphthalene, Phthalic acid and Succinic acid.

iii. Decolorisation and crystallization using charcoal.

- Decolorisation of brown sugar with animal charcoal using gravity filtrations crystallization and decolorisation of impure naphthalene (100 g of naphthalene mixed with 0.3 g of Congo red using 1 g of decolorizing carbon) from ethanol.

7. Qualitative Analysis

Detection of elements (N, S and halogens) and functional groups (Phenolic, Carboxylic, Carbonyl, Esters, Carbohydrates, Amines, Amides, Nitro and Anilide) in simple organic compounds.

PHYSICAL CHEMISTRY

1. Surface tension measurements.

- Determine the surface tension by (i) drop number (ii) drop weight method.
- Surface tension composition curve for a binary liquid mixture.

2. Viscosity measurement using Ostwald's viscometer.

- Determination of viscosity of aqueous solutions of (i) sugar (ii) ethanol at room temperature.

- Study of the variation of viscosity of sucrose solution with the concentration of solute.
- Viscosity Composition curve for a binary liquid mixture.

3. Chemical Kinetics

- To determine the specific rate of hydrolysis of methyl/ethyl acetate catalysed by hydrogen ions at room temperature.
- To study the effect of acid strength on the hydrolysis of an ester.
- To compare the strengths of HCl & H₂SO₄ by studying the kinetics of hydrolysis of ethyl acetate.

4. Colloids

- To prepare colloidal solution of silver nanoparticles (reduction method) and other metal nanoparticles using capping agents.

Note: Experiments may be added/ deleted subject to availability of time and facilities

Session 2019-20

PHYSICS

B.Sc. Part-I

Paper-I

MECHANICS, OSCILLATIONS AND PROPERTIES OF MATTER

(Paper code 0793)

Unit-1 Cartesian, Cylindrical and Spherical coordinate system, Inertial and non-inertial frames of reference, uniformly rotating frame, Coriolis force and its applications. Motion under a central force, Kepler's laws. Effect of Centrifugal and Coriolis forces due to earth's rotation, Center of mass (C.M.), Lab and C.M. frame of reference, motion of C.M. of system of particles subject to external forces, elastic, and inelastic collisions in one and two dimensions, Scattering angle in the laboratory frame of reference, Conservation of linear and angular momentum, Conservation of energy.

Unit-2 Rigid body motion, rotational motion, moments of inertia and their products, principal moments & axes, introductory idea of Euler's equations. Potential well and Periodic Oscillations, case of harmonic small oscillations, differential equation and its solution, kinetic and potential energy, examples of simple harmonic oscillations: spring and mass system, simple and compound pendulum, torsional pendulum.

Unit-3 Bifilar oscillations, Helmholtz resonator, LC circuit, vibrations of a magnet, oscillations of two masses connected by a spring. Superposition of two simple harmonic motions of the same frequency, Lissajous figures, damped harmonic oscillator, case of different frequencies. Power dissipation, quality factor, examples, driven (forced) harmonic oscillator, transient and steady states, power absorption, resonance.

Unit-4 E as an accelerating field, electron gun, case of discharge tube, linear accelerator, E as deflecting field- CRO sensitivity, Transverse B field, 180° deflection, mass spectrograph, curvatures of tracks for energy determination, principle of a cyclotron. Mutually perpendicular E and B fields: velocity selector, its resolution. Parallel E and B fields, positive ray parabolas, discovery of isotopes, elements of mass spectrography, principle of magnetic focusing lens.

Unit-5 Elasticity: Strain and stress, elastic limit, Hooke's law, Modulus of rigidity, Poisson's ratio, Bulk modulus, relation connecting different elastic- constants, twisting couple of a cylinder (solid and hollow), Bending moment, Cantilever, Young modulus by bending of beam.

Viscosity: Poiseuille's equation of liquid flow through a narrow tube, equations of continuity, Euler's equation, Bernoulli's theorem, viscous fluids, streamline and turbulent flow, Poiseuille's law, Coefficient of viscosity, Stoke's law, Surface tension and molecular interpretation of surface tension, Surface energy, Angle of contact, wetting.

Session 2019-20

PHYSICS

Paper-II

ELECTRICITY, MAGNETISM AND ELECTROMAGNETIC THEORY

Unit-1 Repeated integrals of a function of more than one variable, definition of a double and triple integral. Gradient of a scalar field and its geometrical interpretation, divergence and curl of a vector field, and their geometrical interpretation, line, surface and volume integrals, flux of a vector field. Gauss's divergence theorem, Green's theorem and Stoke's theorem and their physical significance. Kirchoff's law, Ideal Constant-voltage and Constant-current Sources. Thevenin theorem, Norton theorem, Superposition theorem, Reciprocity theorem and Maximum Power Transfer theorem.

Unit-2 Coulomb's law in vacuum expressed in Vector forms, calculations of E for simple distributions of charges at rest, dipole and quadrupole fields. Work done on a charge in a electrostatic field expressed as a line integral, conservative nature of the electrostatic field. Relation between Electric potential and Electric field, torque on a dipole in a uniform electric field and its energy, flux of the electric field. Gauss's law and its application: E due to (1) an Infinite Line of Charge, (2) a Charged Cylindrical Conductor, (3) an Infinite Sheet of Charge and Two Parallel Charged Sheets, capacitors, electrostatic field energy, force per unit area of the surface of a conductor in an electric field, conducting sphere in a uniform electric field.

Unit-3 Dielectric constant, Polar and Non Polar dielectrics, Dielectrics and Gauss's Law, Dielectric Polarization, Electric Polarization vector P, Electric displacement vector D. Relation between three electric vectors, Dielectric susceptibility and permittivity, Polarizability and mechanism of Polarization, Lorentz local field, Clausius Mossotti equation, Debye equation,

Ferroelectric and Paraelectric dielectrics, Steady current, current density J, non-steady currents and continuity equation, rise and decay of current in LR, CR and LCR circuits, decay constants, AC circuits, complex numbers and their applications in solving AC circuit problems, complex impedance and reactance, series and parallel resonance, Q factor, power consumed by an a AC circuit, power factor.

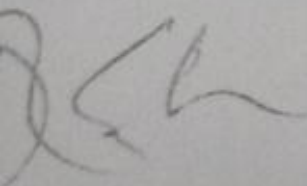
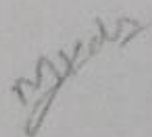
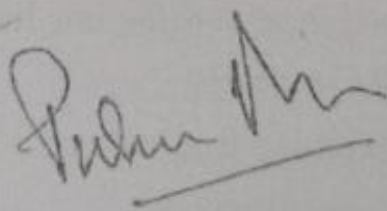
Unit-4 Magnetization Current and magnetization vector M, three magnetic vectors and their relationship, Magnetic permeability and susceptibility, Diamagnetic, paramagnetic and ferromagnetic substances. B.H. Curve, cycle of magnetization and hysteresis, Hysteresis loss.

Biot-Savart's Law and its applications: B due to (1) a Straight Current Carrying Conductor and (2) Current Loop. Current Loop as a Magnetic Dipole and its Dipole Moment (Analogy with Electric Dipole). Ampere's Circuital law (Integral and Differential Forms).

Unit-5 Electromagnetic induction, Faraday's law, electromotive force, integral and differential forms of Faraday's law Mutual and self inductance, Transformers, energy in a static magnetic field. Maxwell's displacement current, Maxwell's equations, electromagnetic field energy density. The wave equation satisfied by E and B, plane electromagnetic waves in vacuum, Poynting's vector.

TEXT AND REFERENCE BOOKS:

1. Berkeley Physics Course, Electricity and Magnetism, Ed. E.M. Purcell (Mc Graw Hill).
2. Halliday and Resnik, Physics, Vol. 2.
3. D J Griffith, Introduction to Electrodynamics (Prentice-Hall of India).
4. Raitz and Milford, Electricity and Magnetism (Addison-Wesley).
5. A S Mahajan and A A Rangwala, Electricity and Magnetism (Tata Mc Graw-hill).
6. A M Portis, Electromagnetic fields.
7. Pugh & Pugh, Principles of Electricity and Magnetism (Addison-Wesley).
8. Panofsky and Phillips, Classical Electricity and Magnetism, (India Book House).
9. S S Atwood, Electricity and Magnetism (Dover).



Session 2019-20

PHYSICS

PRACTICALS

Minimum 16 (Eight from each group)

Experiments out of the following or similar experiments of equal standard

GROUP-A

1. Study of laws of parallel and perpendicular axes for moment of inertia.
2. Moment of inertia of Fly wheel.
3. Moment of inertia of irregular bodies by inertia table.
4. Study of conservation of momentum in two dimensional oscillations.
5. Study of a compound pendulum.
6. Study of damping of a bar pendulum under various mechanics.
7. Study of oscillations under a bifilar suspension.
8. Study of modulus of rigidity by Maxwell's needle.
9. Determination of Y , k , η by Searl's apparatus.
10. To study the oscillation of a rubber band and hence to draw a potential energy curve from it.
11. Study of oscillation of a mass under different combinations of springs.
12. Study of torsion of wire (static and dynamic method).
13. Poisson's ratio of rubber tube.
14. Study of bending of a cantilever or a beam.
15. Study of flow of liquids through capillaries.
16. Determination of surface tension of a liquid.
17. Study of viscosity of a fluid by different methods.

GROUP-B

1. Use of a vibration magnetometer to study a field.
2. Study of magnetic field B due to a current.
3. Measurement of low resistance by Carey-Foster bridge.
4. Measurement of inductance using impedance at different frequencies.
5. Study of decay of currents in LR and RC circuits.
6. Response curve for LCR circuit and response frequency and quality factor.
7. Study of waveforms using cathode-ray oscilloscope.
8. Characteristics of a choke and Measurement of inductance.
9. Study of Lorentz force.
10. Study of discrete and continuous LC transmission line.
11. Elementary FORTRAN programs, Flowcharts and their interpretation.
12. To find the product of two matrices.
13. Numerical solution of equation of motion.
14. To find the roots of quadratic equation.

MICROBIOLOGY

BSc-3rd

Paper- I: Medical Microbiology and Immunology

UNIT-1: AIR BORNE DISEASES

Air borne diseases: Types- Tuberculosis, Pertussis, Diphtheria, Influenza, Small & Chicken pox, Mumps, Measles. Symptoms, treatment and prevention.

UNIT-2: WATER BORNE DISEASES

Concept and cause of water borne diseases; Types, Hepatitis, Dysentery, Diarrhea, Cholera, typhoid. Symptoms treatment and prevention.

UNIT-3: CLINICAL DISEASE AND DIAGNOSIS

Clinical diseases: Diabetes, Asthma, multiple sclerosis, rheumatoid arthritis, cancer. Symptoms, Treatment and prevention.

UNIT-4: BASIC CONCEPT OF IMMUNITY

Immune system: Structure and function of the cells, tissues and organs of immune system. Types of immunity humoral and cell-mediated, innate, acquired immunity. **Antigen- Antibody**: types, properties. Hapten, adjuvant. Immuno-globulins: Structure types, Properties and their function - Theory of antibody production.

UNIT-5: IMMUNO DISEASE DIAGNOSIS

Methods based on Ag-Ab interaction- precipitation, agglutination, ELISA, RIA, Immuno-electrophoresis, PCR based diagnosis method for infectious diseases.

Text Books Recommended:

1. Immunology: Kuby.
2. General Microbiology by Power and Daganawala.
3. Zinssers Microbiology by K. J Wolfgang, McGraw- Hill Company.
4. Medical Microbiology; N. C. Dey and T.K. Dey, Allied agency, Calcutta.
5. Bacteriological Techniques by FJ Baker.
6. A Textbook of Microbiology; Dubey & Maheshwari; S. chand & Sons.
7. Scott's Diagnostic Microbiology by EJ Baron.

Paper- II: Environmental, industrial and Agricultural Microbiology

UNIT-1: AIR MICROBIOLOGY

Basics of Aerobiology. Microbes in atmosphere, source of microorganism in air, droplet nuclei, infectious dust, and bio-aerosol. Factors affecting microbial survival in the air. Sampling, collection and Isolation of microbes from air.

UNIT-2: WATER MICROBIOLOGY

Basic concept, water zonation, eutrophication, microbial community in natural water. Determining the quality of water- bacteriological evidence for fecal pollution, indicator of fecal pollution. Water purification methods. Disinfection of potable water supply.

UNIT-3: SOIL MICROBIOLOGY.

Soil as an environmental culture medium, microbes of soil. Brief account of microbial interactions-symbiosis, mutualism, commensalism, competition, predation, parasitism. Microbiological examination of soil. Rhizosphere-concept and role of microbes, rhizosphere and non-rhizosphere micro-flora. Mycorrhiza.

UNIT-4: INDUSTRIAL MICROBIOLOGY.

Introduction and brief history and scope, important microbes in various industries. Fermentation- definition, types-Aerobic and anaerobic, Batch and SSF. Important products bread, cheese, vinegar, fermented dairy products and oriented fermented food involving microbes. Microbial cells as food. SCP -mushroom cultivation, production of alcohol and fermented beverages, beer and Wine

UNIT-5: AGRICULTURAL MICROBIOLOGY

History of Agricultural Microbiology; Microbes and their importance in maintenance of soil, Biogeochemical cycles, role of microbes in maintaining the fertility of soil. Bio fertilizers -Bacterial, azotobacter and vermiform compost. Soil microorganism -association with vascular plants- phyllosphere, Rhizobium, Rhizoplane associative nitrogen fixation. Bio-fertilizers - Cyanobacterial and Azolla

Text Books Recommended:

1. Hugo, W.B., Russell, A.D, pharmaceutical Microbiology 4th edition. Blackwell scientific publications / O
2. Russell and Ayliffe, G. A .J (1982) Principles and practice of Disinfection, preservation and sterilization
3. Gregory P.H. Microbiology of the atmosphere.2nd edition. Leonard Hill.
4. Food Microbiology by WC Frazier and D Westhoff.
5. Agricultural Microbiology by Bhagyaraj and Rangaswamy.
6. Bioremediation by KH Baker and DS Herson

PRACTICAL

M. M. 50

- Isolation of bacteria from air and soil (crop fields)
- Isolation of fungi from air and soil
- Relationship between OD and CFU measurements.
- Measurement of fungal growth by dry weight and wet weight
- Study of rhizospheric and phyllospheric microbes from economically important plants.
- Biodegradation study of some organic molecules
- Microbial assessment of potable water.
- Determination of BOD, COD and dissolved oxygen.
- Determination of blood group by slide agglutination test./TLC/DLC
- Determination of heamoglobin.
- Determination of quality of milk by MBRT
- Isolation of Rhizobium from root nodules.

Scheme of practical examination

Time	4 hour	MM- 50
1. Exercise on immunological test		10
2. Exercise on water analysis		10
3. Exercise on isolation and characterization of micro organism		05
4. Spotting (1 to 5)		10
5. Viva voce		05
6. Sessional		10
		Total- 50