



बिलासपुर विश्वविद्यालय, बिलासपुर (छत्तीसगढ़)

SEMESTER SYLLABUS

M.Sc. CHEMISTRY

SCHEME OF EXAMINATION & DISTRIBUTION OF MARKS

SEMESTER - I

Paper No.	Title of the Paper (s)	Internal Assessment	Term End Exam	Practical	Total Marks
1.	Inorganic Chemistry	20	80		100
2.	Organic Chemistry, Stereochemistry & Pericyclic Reaction	20	80		100
3.	Physical Chemistry- I	20	80		100
4.	Spectroscopy And Mathematics/Biology For Chemists	20	80		100
LAB-I	Organic Chemistry				100
LAB-II	Analytical Chemistry				100
TOTAL					600

SEMESTER - II

Paper No.	Title of the Paper (s)	Internal Assessment	Term End Exam	Practical	Total Marks
1.	Inorganic Chemistry	20	80		100
2.	Organic Chemistry	20	80		100
3.	Physical Chemistry	20	80		100
4.	Spectroscopy, Diffraction Methods & Computer For Chemists	20	80		100
LAB-I	Inorganic Chemistry				100
LAB-II	Physical Chemistry				100
TOTAL					600

SEMESTER - III

Paper No.	Title of the Paper (s)	Internal Assessment	Term End Exam	Practical	Total Marks
COMPULSORY FOR GROUP A, B & C					
1.	Applications Of Spectroscopy	20	80		100
2.	Chemistry Of Bio-Inorganic & Bio-Organic	20	80		100
LAB-I	General (Compulsory)			200	200
OPTIONAL GROUP-A INORGANIC					
3.	Organotransition Metal Chemistry	20	80		100
4.	Photo inorganic Chemistry	20	80		100
OPTIONAL GROUP- B ORGANIC					
3.	Physical Organic Chemistry	20	80		100
4.	Chemistry Of Heterocyclic Compounds	20	80		100
OPTIONAL GROUP-C PHYSICAL					
3.	Chemistry Of Materials	20	80		100
4.	Advanced Quantum Chemistry	20	80		100
TOTAL					600



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SEMESTER - IV

Paper No.	Title of the Paper (s)	Internal Assessment	Term End Exam	Practical	Total Marks
COMPULSORY FOR GROUP A, B & C					
1.	Photochemistry & Solid State Chemistry	20	80		100
2.	Bio-Physical & Environmental Chemistry	20	80		100
OPTIONAL GROUP-A INORGANIC					
3.	Bioinorganic Chemistry & Supra-Molecular Chemistry	20	80		100
4.	Analytical Chemistry	20	80		100
LAB-I	Special			200	200
OPTIONAL GROUP- B ORGANIC					
3.	Medicinal Chemistry	20	80		100
4.	Chemistry Of Natural Product	20	80		100
LAB-I	Special			200	200
OPTIONAL GROUP-C PHYSICAL					
3.	Liquid States	20	80		100
4.	Computation Chemistry	20	80		100
LAB-I	Special			200	200
TOTAL					600
GRAND TOTAL					2400



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SEMESTER – IV

PAPER – I

COMPULSORY FOR GROUP - A, B & C

PHOTOCHEMISTRY & SOLID STATE CHEMISTRY

A – PHOTOCHEMISTRY

UNIT – I

Photochemistry Reaction: Interaction of electromagnetic radiation with matter, Types of excitation, Fate of excited molecule. Quantum yield. Transfer of excitation energy.

Determination of reaction mechanism: Rate constant and life time of reactive energy states, determination of rate constant of reaction. Effect of light intensity on the rate of photochemical reactions. Types of photo-chemical reactions. Photo-dissociation.

UNIT – II

Photochemistry of Alkenes: Intermolecular reactions of olefinic bond, geometrical isomerism. Cyclisation reaction, Rearrangement of 1,4 and 1,5-dienes.

Photochemistry of Carbonyl compounds: Intra-molecular reaction of Carbonyl compounds, saturated cyclic and acyclic, β,γ - unsaturated and α,β - unsaturated compounds, cyclohexadienone. Inter-molecular cyclo addition reactions. Dimerization and Oxitane formation.

UNIT – III

Photochemistry of Aromatic compounds: Isomerisation, Addition, Substitution.

Miscellaneous photochemical reactions: Photo fries rearrangement, Barton reaction, singlet molecular oxygen reactions, photochemical formation of smog.

B – SOLID STATE CHEMISTRY

UNIT –IV

Solid State Reactions: General principles. Experimental procedures methods, kinetics of solid state reactions.

Crystal Defects and Non-stoichiometry : Perfect and imperfect crystals, intrinsic and extrinsic defects, point defects, line and plane defects, Vacancies - Schottky defects and Frenkel defects. Thermodynamics and defect formation, colour centres, non-stoichiometry and defects.

UNIT – V

Electronic properties and Band Theory: Metals, insulators and semiconductors, Electronic structure of solids – band theory – band structure of metals, insulators and semiconductors. Intrinsic and extrinsic semi-conductors, doping semiconductors, p-n junctions, optical properties – Photoconduction, photoelectric effects. Magnetic properties – Classification of materials. Effect of temperature. Calculation of magnetic moment. Magnetic domains. Superconductivity and organic solids, Occurrence, Principle and uses of conventional, organics and New super conductors.

Books suggested:

1. Solid State chemistry and its application – A.R.West, Plenum.
2. Principles of the Solid State, H.V.Keer, Wiley Eastern.
3. Solid State Chemistry, N.B.Hannary
4. Solid State Chemistry, D.K. Chakraborty, New Age International
5. Fundamentals of photochemistry, K.K.RohtagiMukherji, Wiley Eastern.
6. Essentials of molecular photochemistry, A. Gilbert and J. Baggott, Molecular photochemistry, N.J. Turro, W.A. Benjamin.
7. Introductory photochemistry, A. Cox and T. Camp, McGraw-Hill.
8. Photochemistry, R.P.Kundall and Gilbert, Thomson Nelson.
9. Organic Photochemistry, J. Coxon and B. Halton, Cambridge University Press.



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SEMESTER – IV

PAPER – II

COMPULSORY FOR GROUP - A, B & C

BIO-PHYSICAL & ENVIRONMENTAL CHEMISTRY

A. BIO-PHYSICAL CHEMISTRY

UNIT-I

Biological cell and its constituents: Biological cell, structure and functions of proteins, enzymes, DNA and RNA in living systems. Helix coil transition.

Bioenergetics: Standard free energy change in biochemical reactions, exergonic, endergonic. Hydrolysis of ATP, synthesis of ATP from ADP.

Statistical mechanics in biopolymers: Chain configuration of macromolecules, statistical distribution end to end dimensions. Calculation of average dimensions for various chain structures, polypeptide and protein structures, introduction to protein folding problem.

UNIT-II

Biopolymer interactions: Forces involved in biopolymer interactions, Electrostatic changes and molecular expansion, hydrophobic forces, dispersion force interactions. Multiple equilibrium and various types of binding processes in biological systems. Hydrogen ion titration curves.

Thermodynamics of biopolymer solutions: Thermodynamics of biopolymer solutions, osmotic pressure, membrane equilibrium, muscular contraction and energy generation in mechanochemical systems.

Cell Membrane and Transport of Ion: Structure and function of Cell membrane, ions transport through Cell membrane, irreversible thermodynamic treatment of membrane transport. Nerve conduction.

UNIT-III

Biopolymer and their Molecular Weights: Evaluation of size, shape, molecular weight and extent of hydration of biopolymer by various experimental techniques, Sedimentation equilibrium, hydrodynamic methods, diffusion, sedimentation viscosity, electrophoresis and rotational motions.

Diffraction Methods : Light scattering, low angle X-ray scattering X-ray diffraction and photo correlation spectroscopy. ORD.

B. ENVIRONMENTAL CHEMISTRY

UNIT-IV

Environment: Introduction, Composition of atmosphere, vertical temperature, heat budget of the earth atmospheric system, vertical stability atmosphere. Biogeochemical cycles of C, N, P, S, and Bio distribution of elements.

Hydrosphere: Chemical composition of water bodies-lakes, streams, rivers and wet lands etc. Hydrological cycle, Aquatic pollution-inorganic, organic. Pesticide, agricultural industrial and sewage, detergents, oil spills and oil pollutants.

UNIT-V

Water quality parameters - Dissolved oxygen, biochemical oxygen demand, solids, metals, sulphate, phosphate, Nitrate, fluoride Micro-organism and their hazardous effects on life. Water quality standard. Analytical methods for measuring BOD, DO, COD, F oils, metals (As, Cd, Cr, Hg, Pb, Se etc.) Residual chloride and chlorine demand. Purification and treatment of water (Students must be well acquainted with the physiological effects and chemical principles involved in their estimation.)

Industrial pollution : Chemists overview of pollution and its possible solutions caused by industries such as Cement, sugar, distillery, paper and pulp, thermal power plants. Nuclear power plants. Metallurgy, polymers, drugs etc. Radionuclide analysis, Disposal of wastes and their management.



Books Suggested:

1. Bioorganic Chemistry. A Chemical Approach to Enzyme Action, H.Dugas and C. Penny. Springer-verlag.
2. Macromolecules. Structure and Function, F. Word, Prentice Hall
3. Environmental Chemistry. S.E. Manahan. Lewis Publishers.
4. Environmental Chemistry, Sharma and Kaur, Krishna Publishers.
5. Environmental Chemistry, [A.K.De](#). Wiley Eastern.
6. Environmental Pollution Analysis S.M.Khopkar, Wiley Eastern.
7. Standard Method of Chemical Analysis, F.J.Welcher. Vol III, Van Nostrand Reinhold Co.
8. Environmental Toxicology, Ed. J Rose. Gordon and Breach Science Publication.
9. Elemental Analysis of Airborne Particles, Ed. S. Lansberger and M Cretchman. Gordon and Breach Science Publication.
10. Environmental Chemistry, C.Baird, W.H.Freeman.



UNIT - I

Drug Design-

Development of new drugs, procedures followed in drug design, concepts of lead compound and lead modification, concepts of prodrugs and soft drugs, structure activity relationship (SAR), factors affecting bioactivity, resonance, inductive effect, isosterism, bio-isosterism, spatial considerations. Theories of drug activity : occupancy theory, rate theory, induced fit theory. Quantitative structure activity relationship. History and development of QSAR. Concepts of drug receptors. Elementary treatment of drug receptor interactions. Physico-chemical parameters: lipophilicity partition coefficient, electronic ionization constants, steric, Steric and surface activity parameters and redox potentials. Free- Wilson analysis, Hansch analysis, relationship between Free-Wilson and Hansch analysis, LD-50, ED-50 (Mathematical derivations of equations excluded).

UNIT - II

(a) Pharmacokinetics:

Introduction to drug absorption, disposition, elimination using pharmacokinetics, important pharmacokinetic parameters in defining drug disposition and in therapeutics. Mention uses of pharmacokinetic in drug development process.

(b) Pharmacodynamics

Introduction, elementary treatment of enzyme stimulation, enzyme inhibition, sulphonamides, membrane active drugs, drug metabolism, xenobiotics, biotransformation, significance of drug metabolism in medicinal chemistry.

UNIT - III

(a) Antineoplastic Agents:

Introduction, cancer chemotherapy, special problems, role of alkylating agents and antimetabolites in treatment of cancer. Mention of carcinolytic antibiotics and mitotic inhibitors synthesis of mechlorethamine, cyclophosphamide, melphalan, uracil, mustards and 6-mercaptopurine. Recent development in cancer chemotherapy. Hormone and natural products.

Local Anti-infective drugs

Introduction and general mode of action-synthesis of sulphonamides, furazolidone, nalidixic acid, ciprofloxacin, norfloxacin, dapsone, aminosalicylic acid, isoniazid, ethionamide, ethambutol, fluconazole, econazole, griseofulvin, Chloroquin and primaquine.

UNIT-IV

Cardiovascular Drugs:

Introduction, cardiovascular diseases, drug inhibitors of peripheral sympathetic function, central intervention of cardiovascular output. Direct acting arteriolar dilators, synthesis of amyl nitrate, sorbitrate, diltiazem, quinidine, verapamil, methyldopa, atenolol, esmolol.

Cell wall biosynthesis, inhibitors, β -lactam rings, antibiotics inhibiting protein synthesis. Synthesis of penicillin-G, penicillin-V, ampicillin, amoxicillin, chloramphenicol, cephalosporin, tetracycline and streptomycin.



UNIT-V

Psychoactive Drugs- The Chemotherapy of Mind-

Introduction, neurotransmitters, CNS depressants, general anesthetics, mode of action of hypnotics, sedatives, anti-anxiety drugs, benzodiazepines, buspirone, neurochemistry of mental diseases. Antipsychotic drugs-the neuroleptics, antidepressants, butyrophenones, serendipity and drug development stereochemical aspects of psychotropic drugs. Synthesis of diazepam, oxazepam, chlorazepam, alprazolam, phenytoin, ethosuximide, trimethadione, barbiturates, thiopental sodium. glutethimide.

Book suggested:

1. Introduction to Medicinal Chemistry. A. Gringuage Wiley-VCH
2. Wilson and Gisvolds Text Book of Organic Medicinal and Pharmaceutical Chemistry ED. Robert F. Dorge.
3. An Introduction to drug design, S.S.Pandaya and J.R. Dimmock, New Age International.
4. Burgers Medicinal Chemistry and Drug Discovery, Vol-1 (Chapter-9 and Ch- 14) Ed ME Wolff, John Wiley.
5. Goodman and Gilman's Pharmacological Basis of Therapeutics McGraw-Hill.
6. The Organic Chemistry of Drug and Drug Action, R.B.Silverman Academic Press.
7. Strategies for Organic Drug Synthesis and Design D Lednicer, John Wiley.
8. Drug Design and Medicinal Chemistry by S.N. Pandaya.
9. Medicinal Chemistry by Ashutosh Kar.



SEMESTER-IV

GROUP-B

PAPER-IV

CHEMISTRY OF NATURAL PRODUCT

UNIT - I

Terpenoids-

Classification, nomenclature, occurrence, isolation, general methods of structure determination, Isoprene Rule,

Structure determination, stereochemistry, biosynthesis and synthesis of Citral, Geraniol, α -Terpeneol, Menthol, Camphor, α -pinene, Zingibarene, Phytol, abietic acid.

UNIT -II

Alkaloids-

Definition, nomenclature and physiological action, occurrence, isolation, general method of structure, elucidation, degradation, classification based on nitrogen heterocyclic ring. Role of alkaloids in plants. Structure elucidation, stereochemistry, synthesis and biosynthesis of Ephedrine (+) - coniine, Nicotine, Atropine, Quinine and morphine.

UNIT - III

Steroids and Hormones-

Occurrence, Nomenclature, Basic skeleton, Diels-Hydrocarbon and stereochemistry. Isolation, structure determination and synthesis of cholesterol, bile acids, Androsterone, Testosterone, Ergosterol, Sigmasterol, Oestrone, Progesterone, Aldosterone.

UNIT - IV

Plan pigment-

Occurrence, nomenclature, and general methods of structure determination. isolation and synthesis of Bixin, Quercetin. Daidzein. Cyanin, Pelargonin chloride. Hirustidin.

Biosynthesis of flavonoids, Acetate pathway and shikimic acid pathway.

UNIT - V

(a) Porphyrins & Carotenoids-

Structure and synthesis of Haemoglobin and chlorophyll, spectral properties of porphyrins. Biosynthesis of Porphyrin, Phthalocynin. B-carotene and its relation with Vitamin A. Y carotene.

Book Suggested-

1. Natural Products: Chemistry and Biological Significance, J. Mann, R. S. Davidson, J.B. Hobbs, D.V. Banthorpe and J.B. Harborne, Longman, Essex.
2. Organic Chemistry, Vol 2, I. L. Finar, ELBS.
3. Stereoselective Synthesis : A Practical Approach, M. Nogradi, VCH.
4. Rodd's Chemistry of Carbon Compounds, Ed.S. Coffey, Elsevier.
5. Chemistry, Biological and Pharmacological Properties of Medicinal Plants from the Americas, Ed. Kurt Hostettmann, M.P. Gupta and A. Marston, Harwood Academic publishers.
6. Introduction to Flavonoids, B.A. Bohm, Harwood Academic publishers.
7. New Trends in Natural Product Chemistry, Atta-urRahman and M.I. Choudhary, Harwood Academic Publishers.
8. Insecticides of Natural Origin, SukhDev, Harwood Academic publishers.



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SEMESTER SYLLABUS

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SEMESTER-IV

GROUP-B

LABORATORY COURSE (SPECIAL)

ORGANIC CHEMISTRY

200 marks

Note: Laboratory course with Group 'B' will be of 12 hrs duration spread over two days. The examinee will have to perform three experiments. These experiments will be of 40 marks each. 40 marks each will be allotted for viva-voce and Sessional work.

Qualitative Analysis

Separation, Purification and identification of the components of a mixture of binary organic compounds & mixture of three organic compounds.

Multi-step synthesis of Organic compounds (Three stage preparations. Preparation of pure crystalline product. By using any two following principals Conformation by melting point determination.)-

The exercises should illustrate the use of organic reagents and may involve purification of the products by chromatographic techniques.

1. Photochemical reaction: Benzophenone- Benzopinacol- Benzpinacolone.
2. Beckmann rearrangement: Benzanilide from benzene, Benzene- benzophenone ,oxime- Benzanilide.
3. Benzilic acid rearrangement : Benzilic acid from benzoin, (Benzoin- Benzil- Benzilic acid)
4. Synthesis of heterocyclic compounds, Skraup synthesis: Preparation of quinoline from aniline, Skraup synthesis: Preparation of 2 phenyl-indole from phenyl hydrazine.
5. Sandmeyer Reaction: Preparation of o chlorobenzoic acid from anthranilic acid.
6. Ultman reaction - Preparation of N-Phenyl anthranilic acid from o-chlorobenzoic acid.
7. Preparation of Acridone from N-Phenyl anthranilic acid.
8. Preparation of p nitro aniline
9. Preparation of p bromo aniline
10. Preparation of methyl orange from aniline via sulphanilic acid.

Extraction of Organic compounds from Natural sources-

1. Isolation of caffeine from tea leaves
2. Isolation of casein from milk
3. Isolation of lactose from milk
4. Isolation of nicotine dipicrate from tobacco
5. Isolation of piperine from black pepper
6. Isolation of lycopene from tomatoes
7. Isolation of b-carotene from carrots.

Paper Chromatography

Separation and identification of the sugars, dyes and amino acids present in the given mixture of sugars, dyes and amino acids by paper chromatography and determination of RF values.

Spectroscopy:

Identification of organic compounds by the analysis of their spectral data (UV. IR. PMR, CMR & M) Spectrophotometric (UV/VIS) Estimations of

1. Amino acids
2. Proteins
3. Carbohydrates
4. Aspi



SEMESTER-IV

GROUP-B

LABORATORY COURSE (SPECIAL)

PHYSICAL CHEMISTRY

1. Study of kinetics of exchange between ethyl iodide and the iodide ion.
2. Determination of the solubility product of lead iodide.
3. Determination of the dissociation constant of barium nitrate.
4. Determination of relative strength of the acids by studying the hydrolysis of an ester.
5. Study the hydrolysis of methyl acetate catalysed by HCl and equimolar urea hydrochloride and hence the degree of hydrolysis of the salt.
6. Investigate the inversion of can-sugar in presence of an acid. Determine also the energy of activation of the reaction.
7. Study in inversion of can-sugar in presence of HCL and H_2SO_4 and hence determine the relative strength of the acids.
8. Study the kinetics of hydrolysis of ethyl acetate by NaOH at two temperatures by conductance measurement, and hence the energy of activation of the reaction.
9. Study the kinetics of hydrolysis of tertiary amyl iodide, and determine the order and energy of activation of the reaction.
10. Investigate the reaction between H_2O_2 and HI.
11. Study the kinetics of decomposition of benzene diazonium chloride at different temperatures.
12. Study the kinetics of reaction between $K_2S_2O_8$ and KI.
 - (a) Determine and rat constant and order of reaction.
 - (b) Study of influence of ionic strength on the rate constant.
13. Investigate the kinetics of autocatalytic reaction between $KMnO_4$ and Oxalic acid.
14. Determination of order of reaction between bromic acid and hydrobromic acids.
15. Determination of concentration f iodine in a given sample (KI) by isotope dilution technique.
16. Determination of effect of-
 - (a) Change of temperature.
 - (b) Change of concentration.
 - (c) Ionic strength of the media on the velocity constant of hydrolysis of an ester.
17. Determination of the primary salt effect on the kinetics of ionic reactions and testing of the Bronsted relationship (iodide ion is oxidised by persulphate ion.)
18. Investigate the adsorption of oxalic acid from aqueous solution by activated charcoal and verify Frenndlish and Langmuir's adospriton isotherms.
19. Determine adsoption isotherms of acetic acid from aqueous solution by charcoal.