1st Semester
(HERBAL CHEMISTRY) M.Sc. Previous
PHYSICAL CHEMISTRY
Paper – M-101

Time: 3Hours Full Marks:70

The paper will consist of seven questions divided into three sections.

Group A: Question No. 1 will be compulsory comprising ten objective type questions (two from each Unit) each carrying two marks (10x2=20 marks)

Group B: Question No.2 will be compulsory comprising five short answer type questions (One from each Unit) any four to be answered. (4x5=20)

Group C: Five long answer type questions are to be set (one from each Unit) of which any three to be answered (3x10=30 marks)

UNIT – I : Solid State

(a) Crystal symmetry. Determination of lattice type and unit cell dimensions of NaCl and KCl crystals. Structure factor and crystal analysis of cubic crystal system.

(b) Imperfection in solid substances.

(c) Energy band theory of metals and their electronic properties. Super conductors and photoelectric effect.

(d) Classification of materials based on magnetic properties.

UNIT – II : Quantum Chemistry

(a) Postulates of Quantum mechanics. Different types of operators and their properties Angular momentum operators, their Eigen function and Eigen values.

(b) Linear Harmonic vibrations, Hermite differential equation and its solution through recursion relation.

(c) Separation of r, θ and Φ equations for hydrogen and hydrogen like atoms. Laggurre and Associated Laggurre Polynomials.

Legendre differential equation. Probability density, atomic orbitals and spin orbitals.

UNIT – III : Chemical Thermodynamics

(a) Partial Molar Properties: Free energy, entropy, enthalpy, volume, etc in ideal gas mixture Variation of chemical potential with temperature and pressure. Determination of chemical potential. Gibbs – Duhem equation. Fugacity and activity, the variation with T and P. Fugacity of a gas mixture. Lewis – Randall rule and its significance.

(b) Thermodynamics of ideal and non-ideal solutions. Duhem – Margules equation and its application. Colligative properties using the concept of chemical potential.

(c) Entropy and Thermodynamic Probability. Boltzmann – Planck equation. Concept of energy distribution. Boltzmann distribution law. Partition function and its significance Relation between thermodynamic functions and partition functions. Sakur – Tetrode equation.

UNIT – IV : Chemical kinetics

(a) Mechanism and consecutive, opposing and side reactions.

(b) Evaluation of activation parameters (ΔE^*, ΔH^*. ΔG^*, ΔS^*, etc.) Activated complex. Theories of Unimolecular reactions.

(c) Mechanism and kinetic of photolysis of scetaldehyde acetone and photo dimerisation of anthrasene

UNIT – V : Electrochemistry

(a) Electrode potential in terms of chemical potential and activity; thermodynamics of cell reaction.

(b) Debye – Huckel – Onsager treatment and its extension, ion solvent interactions, Debye – Huckel – Jerum mode.

(c) Over potential, exchange current density. Derivation of Butler – volume equations, Tafel – plot.

(d) Polarography theory, Ilkovic equation, half wave potential and its significance.

1st Semester
(HERBAL CHEMISTRY) M.Sc. Previous
INORGANIC CHEMISTRY
Paper – M-102

Time: 3Hours Full Marks:70

The paper will consist of seven questions divided into three sections.

Group A: Question No. 1 will be compulsory comprising ten objective type questions (two from each Unit) each carrying two marks (10x2=20 marks)

Group B: Question No.2 will be compulsory comprising five short answer type questions (One from each Unit) any four to be answered. (4x5=20)

Group C: Five long answer type questions are to be set (one from each Unit) of which any three to be answered (3x10=30 marks)

UNIT – I: Stereochemistry and Bonding of compounds

VSEPR Theory, dπ – pπ bond, Bent rule, M.O. diagram for CO_2, NO_2, CO_3 and Xenon fluoride. Some simple reactions of covalently bonded molecules, electron deficiency and structural aspects of boranes, carboranes, Wade's rule. Metal – Metal multiple bonding.

UNIT – II: Coordination compounds

(a) Crystal field theory. Splitting of d-orbitals in cubic and non-cubic fields. Measurement of 10 Dq and factors affecting it.
Splitting of S,P,D and F terms in Octahedral and Tetrahedral Symmetry.
Limitation of C.F.T.

(b) M.O. theory of octahedral complexes with o and π – bonding ligands using symmetry arguments. Magnetic property and charge transfer spectra on the basis of M.O. model.

(c) Selection rules for d – d transitions.
Electronic spectra of d^1, d^2, d^8 and d^9 system.
Johan – Teller distortion theory.

(d) Stepwise and overall stability constants. Determination of stability constant by Bjerrum and Job's continuous variation method.

(e) Liability and inertness of complexes. Dissociation and Association. Mechanism of substitution reaction in octahedral Co (III) complexes. SNCB reaction mechanism. Theories of transfect. Mechanism of substation reaction in square planar Pt (II) complexes.

UNIT – III: Chemistry of f – Block Elements

Position in periodic table oxidation states and their stability, Lanthanide and actinide contraction, Magnetic and spectral properties, Separation technique (Ion exchange and Solvent extraction).
Transuranic elements, Synthesis and Chemistry of Np and Pu, Separation of Pu from Spent fuel.

UNIT – IV: Symmetry operation and associated symmetry elements

Classification of molecules into point groups. Defining properties of a mathematical group, Symmetry operation of a molecule as elements of mathematical group subgroups, conjugate and class.

UNIT – IV: Matrix representation for symmetry operation

Reducible and Irreducible representations, character. The Great orthogonality theorem (activation not required). Consequences of orthogonality theorem, character table construction of character table for C_2v and C_3v. Direct product, reduction formula.

1st Semester
(HERBAL CHEMISTRY) M.Sc. Previous
ORGANIC CHEMISTRY
Paper – M-103

Time: 3Hours Full Marks:70

The paper will consist of seven questions divided into three sections.

Group A: Question No. 1 will be compulsory comprising ten objective type questions (two from each Unit) each carrying two marks (10x2=20 marks)

Group B: Question No.2 will be compulsory comprising five short answer type questions (One from each Unit) any four to be answered. (4x5=20)

Group C: Five long answer type questions are to be set (one from each Unit) of which any three to be answered (3x10=30 marks)

UNIT – I: Nature of Bonding in Organic Chemistry

Delocalized chemical bonding – conjugation, cross conjugation, resonance, hyper – conjugation, bonding in fullerenes, tautomerism.

Aromaticity in benzenlod and non benzenold compounds, alternant and non-alternant hydrocarboris, Huckel's rule, energy level or π molecular orbitals, annulenes anti-aromaticity, PMO approach.

Bonds weaker than covalent – addition compounds and crown ether complexes.

UNIT – II: Stereochemistry

Conformational analysis of cycloalkanes, decalins, effect of conformation on reactivity, steric strain due to unavoidable crowding.

Elements of symmetry, chirality, molecules with more than one chiral center, threo and erythro isomers, methods of resolution, optical purity enantlotopic and diastereotopic synthesis. Optical activity in the absence of chiral carbon (biphenyl, allenes and spiranes), chirality due to helical shape.

Stereochemistry of the compoiunds containing nitrogen, sulphur and phosphorus.

Elementary idea of optical rotator dispersion and circular dichroism.

UNIT – III: Reaction Mechanism: Structure and Reactivity

Types of mechanism, types of reactions, thermodynamic and kinetic requirements, kinetic and thermodynamic control, Hammond's postulate, Curtin Hammett principle, Potential energy diagram, transition states and intermediates, methods of determining mechanisms, isotope effect, Hard and Soft acids and bases. Generation, structure, stability and reactivity of carbocations, carbanions, free radicals, carbenes and nitrenes. Effect of structure on reactivity, resonance and field effects, steric effect. The Hammet equation and linear free energy relationship, substituent and reaction constants.

UNIT – IV: Aromatic substitution

The arenmium ion mechanism, orientation and reactivity, energy profile diagram, the o/p ratio, orientation in other ring systems. The S_NAr, S_N1, benzyne mechanisms. Reactivity – effect of substrate structure, leaving group and attacking nucleophile. The Von Richter, Sommelet – Hauser and Smiles rearrangement.

UNIT – V: Free radical reactions

Free radical substitution mechanism, mechanism at an aromatic substrate, reactivity for aliphatic and aromatic substrates at bridgehead. The effect of solvent on reactivity. Allylic halogenations. Osidation of aldehydes to carbpxylic acids. Coupling of alkynes and arylation of aromatic compounds and active alkenes by diazonium salts, sandmeyer reaction, Hunsdiecker reaction.

UNIT – VI: Addition to C=C and C≡ C bonds

Mechanistic and stereochemical aspects of addition reactions involving electrophile, nucleophile and free radicals, regio-selectivity, orientation and reactivity. Addition to cyclopropane ring. Hydrogenation of double and triple bonds, Hydroboration, Michael Addition.

Addition to C = O bons

Mechanism of metal hydride reduction of saturated and unsaturated carbonyl compounds, acids and esters. Witting reaction. Aldol condensation, knoevenagel reaction, claisen reaction, mannich reaction, Benzoin condensation, Perkin reaction and Stobbe reaction.

UNIT – VII: Elimination reactions

The E_1, E_2 and E_1C mechanism, orientation of the double bond, Reactivity- effects of substrate structure, attacking base, the leaving group and the medium, Mechanism and orientation in pyrolytic elimination.

1st Semester
(HERBAL CHEMISTRY) M.Sc. Previous
PHYSICAL CHEMISTRY LAB-COURSE
Paper – M-104

Time: 6Hours Full Marks:70

1. Determination of ebullioscopic constant for water using a solid compound of known molecular weight and then to determine the molecular weight of an unknown compound.
2. Determination of cryoscopic constant of water using compound of known molecular weight and then to determine the molecular weight of unknown compound.
3. Water equivalent of calorimeter and determination of
   (i) Heat of solution of potassium nitrate.
   (ii) Heat of neutralization of strong acid and strong base.
   (iii) Basically of polybasic acids.
4. Determination of rate constant of hydrolysis of methyl acetate in acid medium.
5. To study saponification of ethyl acetate by sodium hydroxide and determination of rate constant.
6. To determine the distribution coefficient of
   (i) Acetic acid (ii) Benzoic acid between water and benzene by partition method.
7. Determination of specific and molecular rotation of sucrose in different concentrations and to determine the concentration of given solution.
8. Determination of rate constant for inversion of cane sugar polarimetrically.
9. Conductometric experiments:
   (i) Dissociation constant of acetic acid.
   (ii) Acid-base titration of NaOH and HCI solutions.
   (iii) Mixture of HCI and CH_3COOH with NaOH.
   (iv) Solubility product of sparingly soluble salt.
10. Potentiometric experiments:
    Determination of
    (i) EMF of concentration cell
    (ii) pH of a given solution using Hydrogen electrode and quinhydrone electrode.
    (iii) Acid base titration.
    (iv) Precipitation titration.

Distribution:

One experiment	-	40 Marks
Record	-	10 Marks
Viva – voce	-	20 Marks

2nd Semester

(HERBAL CHEMISTRY) M.Sc. Previous

MEDICINAL PLANTS AND THEIR USES IN THE TREATMENT OF DIFFERENT DISEASES

Paper – M - 201

Time: 3Hours Full Marks:70

The paper will consist of seven questions divided into three sections.

Group A: Question No. 1 will be compulsory comprising ten objective type questions (two from each Unit) each carrying two marks (10x2=20 marks)

Group B: Question No.2 will be compulsory comprising five short answer type questions (One from each Unit) any four to be answered. (4x5=20)

Group C: Five long answer type questions are to be set (one from each Unit) of which any three to be answered (3x10=30 marks)

UNIT – I

Utilization of Bio-organic and Bio-Inorganic Chemistry in Herbal Medicines and Nutritious foods including fruits, vegetables and cereals as preventives from different ailments.

UNIT – II

Herbals Medicines utilized specifically in the treatment of Cancer and related diseases of different parts of bodies and their chemistry (studies of selected plants to be made).

UNIT – III

Herbal Medicines utilized specifically in the treatment of cold, cough, fever diabetes and heart problems (Studies of selected Herbs e.g. amla, arjuna, aswagandha etc.)

UNIT – IV

Herbals Medicines utilized for kidney and liver problems including the stone formation (Details of some herbs viz. Kurthi etc to be studied)

UNIT – V

Herbals utilized for Nutritious values in our food. Some Herbal plants to be studies chemically as future supplement for Vitamins. Hormones and Mineral supply to the Human Society.
Students will have to go through Aurvedic. Tibbi and Homeopathy Books, Economic Botany and Biodiversity for prominent medicines utilized for above diseases and other purposes under the guidance of teachers for systematic position botanical names, family, parts of the plants used and chemical principles of the plants studied in different units.

UNIT – VI

Plant Pigments: Classification of pigments – Their occurrence, Nomenclature, Isolation, Properties, tests for their indentification, functions in plants and physiochemical utilization as antioxidants etc. Bio-synthesis of chlorophyll, Carotenoids, Flavone, isoflavoness, Flavanol, anthocyanines, anthocyanidins and coumarins.

2nd Semester

(HERBAL CHEMISTRY) M.Sc. Previous

Drug Design & Molecular Modeling Chemistry of Bio-Molecules

Paper – M - 202

Time: 3Hours Full Marks:70

The paper will consist of seven questions divided into three sections.

Group A: Question No. 1 will be compulsory comprising ten objective type questions (two from each Unit) each carrying two marks (10x2=20 marks)

Group B: Question No.2 will be compulsory comprising five short answer type questions (One from each Unit) any four to be answered. (4x5=20)

Group C: Five long answer type questions are to be set (one from each Unit) of which any three to be answered (3x10=30 marks)

Unit – I:

History of the drug design, current trends and future of drug design diseases target validation, Biomolecular interactions. Receptors and enzymes, lead diseoveries and modification, pharmacophores, pharmcokinetics (ADME)

Unit – II:

Enzyme mechanisms, Enzyme Kinetics and inhibition, Enzyme Inhibition, Reversible inhibitors, TSA Irreversible inhibitors, Mechanism based inactivators. Drug-receptor interactions, Pharmacodynamcis.

Unit –III:

Structure based drug design: Theoretical foundations, Docking, FEP. Virtual screening, Medicinal and combinational chemistry. **QSAR**: Theoretical foundations, applications.

Unit IV: INTRODUCTION TO MOLECULAR MODELLING

Introduction to Molecular Modeling. Models used, Areas of application – Single molecule calculation, assemblies of molecules. Reaction of the molecules. Drawbacks of mechanical models as compared to graphical models. Co-ordinate systems two – matrix, potential energy surface.

Unit V: EMPIRICAL FORCE FIELD MODELS

Molecular Mechanisms, energy calculations, Bond stretch, angle bending, torsional term. Electrostatic interaction- Van der waals interactions. Miscellaneous interaction.

Unit VI – MOLECULAR DYNAMICS

Introduction, Molecular Dynamics using simple models. Dynamics with continuous potentials. Constant temperature and constant dynamics. Conformation searching, Systematic search. Applications to protein folding

Unit VII – COMPARATIVE PROTEIN MODELING

Modelling by Homology-the alignment, construction of frame work ,selecting variable regions, side chain placement and refinement, validation of protein models –Ramchandran plot, threading and ab initio modelling.

2nd Semester
(HERBAL CHEMISTRY) M.Sc. Previous
CHEMISTRY OF BIO-MOLECULES
Paper – M - 203

Time: 3Hours Full Marks: 70

The paper will consist of seven questions divided into three sections.

Group A: Question No. 1 will be compulsory comprising ten objective type questions (two from each Unit) each carrying two marks (10x2=20 marks)

Group B: Question No.2 will be compulsory comprising five short answer type questions (One from each Unit) any four to be answered. (4x5=20)

Group C: Five long answer type questions are to be set (one from each Unit) of which any three to be answered (3x10=30 marks)

Unit – 1: Carbohydrate

Conformation of monosaccharides, structure and functions of important derivatives of monosaccharides – Structure determination and chemical sysnthesis (Sucrose, Lactose, Maltose and Cellobiose). Polysaccharides – Structural (Cellulose and Chitin), Storage (Starch and Glycogen). Structure of glucosaminoglycons, Carbohydrates of glycoproteins and glycolipids.

Unit – 2: Lipids

Fatty acids, essential fatty acids, structure and function of triacylgly cerols. Glycerophospholipids, lipoproteins, Biological membrances, lipid metabolism-B-oxidation of fatty acids.

Unit – 3: Amino acids, Peptides and Proteins

Chemical and enzymatic hydrolysis of proteins, amino acid sequencing, secondary structure of proteins, forces responsible for secondary structure of proteins, α-helix, β-sheet, super secondary structure, tertiary structure of proteins – folding and domain structure, quaternary structure.

Unit – 4: Nucleotides and Nucleic acids

Chemical properties of pyrimidine and purine derivatives, chemical synthesis of purine and pyrimidine derivatives, Purine and Pyrimidine bases in nucleic acids, Base pairing via H-bonding, Structure of ribonucleic acid (RNA) and deoxyribonucleic acid (DNA), double helical model of DNA, Chemical and enzymatic hydrolysis of nucleic acids.

Unit – 5: Terpenoids

Introduction, classification. Isoprene rule, Structure determination and synthesis of the following compound – Citral, α-terpineol, linalood and camphor.

Unit – 6: Alkaloids

Introduction, classification, general methods of structure determination, structure determination and synthesis of the following compounds – Nicotine, papaverine, atropine.

2nd Semester
(HERBAL CHEMISTRY) M.Sc. Previous
HERBO INORGANIC CHEMISTRY (PRACTICAL)
Paper – M - 204

Time: 6Hours Full Marks: 70

1. Extraction of juice from Herbal Plants and Fruits of Medicinal value and their Qualitative analysis for at least two cations and two anions with special reference to Na^{+}, K^{+}, Cu^{++}, As^{+++}, Fe^{+++} (ic), Co^{++}, Mn^{++}, Cr^{+++}, Ag^{+}, PO_4^{---}, F^{-}, Cl^{-}, Br^{-}, I^{-}, NO^{-}_3, SO_4^{--}, etc.

2. Extraction of juice from Root, Stem and Leaves and Fruits of different plants having medicinal value and then

   i. Estimate the amount of Ca^{++} and Mg^{++} ion. Using E.D.T.A.

   ii. Cu^{++} ion by Iodometric titration.

   iii. Fe^{+3} (ic) ion by dichromate or permagnate titration.

   iv. Ag^{+} ion by argentometric titration.

   v. Cr and Zn gravimetrically.

3. Preparation of complex compounds:

   i. Renick's salt

   ii. Potassium cobaltinitrite.

   iii. Potassium trioxalato ferrate.

   iv. Hexamine Ni (II) chloride.

4. Viva

5. Record

3rd Semester
(HERBAL CHEMISTRY) M.Sc. Final
SEPARATION TECHNIQUES & SPECTROSCOPY
Paper – M - 301

Time: 3Hours Full Marks: 70

The paper will consist of seven questions divided into three sections.

Group A: Question No. 1 will be compulsory comprising ten objective type questions (two from each Unit) each carrying two marks (10x2=20 marks)

Group B: Question No.2 will be compulsory comprising five short answer type questions (One from each Unit) any four to be answered. (4x5=20)

Group C: Five long answer type questions are to be set (one from each Unit) of which any three to be answered (3x10=30 marks)

Unit – 1

Solvent Extraction (i.e. liquid – liquid extraction) method of separation, Principle, Types of extraction systems, classification, mechanism; Extraction by chelation, Ion pair formation, Selectivity of Extraction, Recovery of extracted substance and extraction technique (e.g. separation of amino acids) and examples of more application to Herbs Applied.

Unit – 2: Rotational Spectra

Classification of molecules, rigid rotor model, non-rigid rotators, quantization of rotational energy level, fine structure of rotational spectra, isotope effect, Stark effect, nuclear and electron spin interaction, bond length calculation.

Unit – 3: Vibrational-rotational spectra

Schrodinger equation applied to harmonic oscillator, quantization of vibrational energy level, vibrational energies of diatomic molecules, zero point energy, force constant and bond strength, selection rules for IR and Raman spectra., group frequencies, overtones, polyatomic molecules, normal modes of vibration, finger print region, symmetry and shapes of AB_2, AB_3, AB_4, AB_5, and AB_6, Anharmonic oscillator.

Unit – 4: Application of Spectroscopy

UV and Visible Spectroscopy – Various electronic transitions, Beer – Lambert law, effect of solvent on electronic transition, Fieser – Woodward rules for conjugated dienes and carbonyl compound, UV spectra of aromatic and heterocyclic compounds, steric effects in biphenyls.

IR Spectroscopy – Characteristic vibrational frequencies of organic functional groups, detailed study of vibrational frequencies of carbonyl compounds, effect of H-bonding and solvent effect on vibrational frequencies.

NMR Spectroscopy – Shielding mechanism, Chemical shift values and correlation for protons bonded to carbon and other nuclei, chemical exchange, spin – spin interaction, Interpretation of PMR spectra of organic compounds.

Carbon – 13 NMR Spectra – General considerations, Chemical shift (aliphatic, olefinic, alkyne, aromatic, heteroaromatic and carbonyl carbons), Coupling constant.

Mass Spectrometry – Ion production, factors affecting fragmentation, ion analysis, ion abundance, Mass spectral Fragmentatuioin of organic compounds, common functional groups, molecular ion peak, metastable peak, Mc Lafferty rearrangement, Examples of mass spectral fragmentation of organic compounds with respect to their structure determination.

Electron Spin Resonance Spectroscopy: Theory, Instrumentation and Important analytical application.

Electron Spectroscopy: Theory, Instrumentation and applications of Electron Spectroscopy (ESCA and Auger), Scanning electron microscopy (SEM), Scanning tunneling microscopy (STM) and Atomic force microscopy (AFM).

Plasma Emission Spectroscopy: Theory, Instrumentation and Analytical applications of inductively coupled plasma emission spectroscopy (ICPE).

3rd Semester
(HERBAL CHEMISTRY) M.Sc. Final
CHEMICAL STANDARDIZATION OF HERBAL DRUGS
Paper – M - 302

Time: 3Hours Full Marks: 70

The paper will consist of seven questions divided into three sections.

Group A: Question No. 1 will be compulsory comprising ten objective type questions (two from each Unit) each carrying two marks (10x2=20 marks)

Group B: Question No.2 will be compulsory comprising five short answer type questions (One from each Unit) any four to be answered. (4x5=20)

Group C: Five long answer type questions are to be set (one from each Unit) of which any three to be answered (3x10=30 marks)

Unit – 1: Quality Parameters and Methods Followed

Systematic study of Crude Drugs: Origine, common names, scientific nomenclature and family, geographical source and history cultivation, collection, preservation and storage, Macroscopical, Microscopical and sengorty (organoleptic) characters; chemical composition where possible; identity, purity, strength and assay, substitute and adulterants etc.

Unit – 2: Foreign Matter and Determination of Foreign Matter

Determination of total Ash Acid insoluble ash, water soluble ash, sulphated ash; Determination of Alcohol Soluble Extractive; water soluble extractive; determination of ether soluble extractive (Fixed oil content), Determination of Moisture content, Determination of volatile oil in Drugs; Estimation of Fatty oils, Alkaloids etc.

Unit – 3:

Determination of Powder fineness, Refractive index, weight per milliliter and specific gravity, melting range, boiling range, optical rotation viscosity.

Uniformity of weight (Toblets); Total solids in Asava / Aristha; Determination of saponification value, iodine value, Acid value, Peroxide value, Unsaponifiable metter, Detection of Mineral oil, Rancidity Test Determination of Reichert Meissel and polenski value, Determination of Alcohol Content.

Unit – 4:

Limit test for heavy metals, Arsenic, lead, Determination of Heavy metals by atomic absorption spectrophotometer inductively coupled plasma mass spectrometry Quantitative analysis for pesticide residue, Test for Aflatoxins, microbial limit tests and tests for specified micro organisms.

Books Recommended: Quality Control Manual for Ayurvedic, Siddha and Urani Medicine by Govt. of India, Department of AYUSH, GHAZIABAD.

3rd Semester
(HERBAL CHEMISTRY) M.Sc. Final
ENVIRONMENTAL CHEMISTRY & ANALYTICAL CHEMISTRY
Paper – M - 303

Time: 3Hours Full Marks: 70

The paper will consist of seven questions divided into three sections.

Group A: Question No. 1 will be compulsory comprising ten objective type questions (two from each Unit) each carrying two marks (10x2=20 marks)

Group B: Question No.2 will be compulsory comprising five short answer type questions (One from each Unit) any four to be answered. (4x5=20)

Group C: Five long answer type questions are to be set (one from each Unit) of which any three to be answered (3x10=30 marks)

Group – A (Environmental Chemistry)

Unit – 1: Environment: Introduction, composition of atmosphere, vertical temperature, vertical stability, biogeochemical cycle of C, N, P, S and O, Biodistribution of the elements.

Unit – 2: Hydrosphere: Chemical composition of water bodies, Hydrological cycles, Aquatic pollution – inorganic, organic, pesticide, agricultural, industrial and sewage, detergents, oil spills, water quality parameters – dissolved oxygen, biochemical oxygen demand, solid metals, contents of cholorides, sulphate, phosphate, nitrate and microorganisms, water quality standards. Analytical methods for measuring BOD, DO, COD, F, oils, metals (As, Cd, Cr, Hg, Pb, Se) residual chloride and chlorine demand, Purification and treatment of water.

Unit – 3: Soils: Composition, micro and macro nutrients, pollution – fertilizers, pesticides, plastics and metals, waste treatment.

Unit – 4: Atmosphere: Chemical composition of atmosphere – particles, ions, radicals and their formation, chemical and photochemical reactions in atmosphere, smog formation, oxides of N, C, S green house effect, acid rain, air pollution – controls and their chemistry. Analytical methods for measuring air pollutants.

Unit – 5: Industrial Pollution: Cement, Sugar, Distillery, Drug, paper and pulp, thermal power plants, metallurgy, polymers, Disposal of industrial waste and their management.

Group – B (Analytical Chemistry)

Unit – 1: Analysis of Water pollution: Origin of waste water, water pollutions and their effects, Sources of water pollution, Parameters for analysis colour, turbidity, total solids, conductivity, acidity, alkalinity, hardness, different anions, different forms of nitrogen, Heavy metal pollution.

Unit – 2: DTA: Basic Principles, Instrumentation, application, DTG, MDTA

Unit – 3: Colourimetry: Basic principle, Beer-Lambert law, Photoelectric colorimeter, its application for the estimation of carbohydrates, ascorbic acid and proteins.

Unit – 4: Chromatography: Classification, Chromatography terminology (R_f value), Development of Chromatograph.

Books recommended

Environmental Chemistry – Sharma and Kaur – Krishna Publishers

Environmental Chemistry – AK DE, Wiley Eastern

Environmental Pollution Analysis – SM Khopkar, Wiley Eastern Analytical Chemistry

Principle & Techniques – LG Hargis, Prentice Hall.

Principles of Instrumental analysis – DA Skoog and JL Loary.

3rd Semester
(HERBAL CHEMISTRY) M.Sc. Final
ORGANIC CHEMISTRY (PRACTICAL)
Paper – M - 304

Time: 6 Hours Full Marks: 70

Lab Course 270 Hrs.

1. Identification of Single compounds using TLC and Chemical Tests.
2. Organic Synthesis (One step synthesis)
3. Any of the following experiments:
   a) Determination of COD & BOD of water sample
   b) Estimation of amino / Phenolic – OH using Bromate – Bromide solution.
   c) Determination of iodine or saponification values of oil
4. Note Book
5. Viva – Voce

4th Semester
(HERBAL CHEMISTRY) M.Sc. Final
MEDICO BOTANICAL SCIENCE
Paper – M - 401

Time: 3Hours Full Marks: 70

The paper will consist of seven questions divided into three sections.

Group A: Question No. 1 will be compulsory comprising ten objective type questions (two from each Unit) each carrying two marks (10x2=20 marks)

Group B: Question No.2 will be compulsory comprising five short answer type questions (One from each Unit) any four to be answered. (4x5=20)

Group C: Five long answer type questions are to be set (one from each Unit) of which any three to be answered (3x10=30 marks)

Unit – 1: Medico – Botanical Science:

(a) Introduction to Medicinal Plants (studies of some plants already being used in Aurvedic, Tibbi, Chinese and Homeopath medicine), their occurrence in different areas of the World and ecological studies.

(b) Morphological studies of medicinal plants.

(c) Important identifying characters like appearance colour, smell season of flowering etc.

(d) Useful Parts and their specific characters, properties and uses. Season and method of collection of different parts viz. root, stem, bark leaves, flowers, fruits, seeds and exudates.

Unit – 2

Application and theoretical aspects (both modern and traditional) of Herbs and Herbal Extracts in different purposes as.

(a) Medicines (ii) Dyes (iii) cosmetics (iv) Chemicals (v) Essence / perfumes, (vi) Preservatives (vii) Polymers / Macromolecules (viii) Herbicides (ix) Food Technology (x) Diet and nutrition and (xi) Plant Hormones.

[Students should visit different Botanical / Medicinal Plants Gardens/ Aurvedic medicinal Production Plants in the vicinity of Local areas in the guidance of Teachers.

For the theoretical aspects they should have seminars/ symposium with the experts from different laboratories like CDRI, Lucknow etc. in the supervision of teachers.]

4th Semester
(HERBAL CHEMISTRY) M.Sc. Final
INSTRUMENTATION & COMPUTING
Paper – M - 402

Time: 3Hours Full Marks: 70

The paper will consist of seven questions divided into three sections.

Group A: Question No. 1 will be compulsory comprising ten objective type questions (two from each Unit) each carrying two marks (10x2=20 marks)

Group B: Question No.2 will be compulsory comprising five short answer type questions (One from each Unit) any four to be answered. (4x5=20)

Group C: Five long answer type questions are to be set (one from each Unit) of which any three to be answered (3x10=30 marks)

Unit I:

Applications and Theoretical aspects of different Instrumental methods of Chromatography: Partition Chromatography, Paper Chromatography, Column Chromatography, High Performance Liquid Chromatography, Thin Layer Chromatography, Gas Chromatography, Ion Exchange Chromatography, Electrophoresis, Exclusion Chromatography, Pyrolysis gas Chromatography, Vapour Phase Chromatography, Affinity Chromatography.

Unit II:

Instrumentation and applications of flurometry: Photo Flurometer for the determination of vitamins, quinine, determination of codeine an morphine in a mixture. Flurometric determination of aluminium, cadmium and calcium.

Flame emission instrumentation to be utilized as flame photometer for the determination of alkaloid metal sodium potassium, calcium, magnesium and lithium for routine determination of these elements. Atomic absorption spectrophotometer and its applications for the determination of qualitative and quantative analysis of metals and trace elements in herbs.

Unit III: Computer Applications in Chemistry

1 FORTRAN 77: Types of Constants and Variables in Fortran, Dimension, Data, Type, COMMON and EQUIVALENCE statements, Arithmetic and Logical IF, IF-THEN-ELSE Constructs, DO statement, Various types of I/O statements, Library functions, Statement functions, Function Subprograms and subroutine subprograms. 2 Numerical Methods: Roots of Polynomials, Solution of Linear simultaneous equations, matrix multiplication and inversion. Numerical integration. Statistical treatment of data, variance and correlations.

Introduction to Networking and using Internet for Project work.

4th Semester
(HERBAL CHEMISTRY) M.Sc. Final
DRUG METABOLISM & TOXICITY AND BIOCHEMISTRY
Paper – M - 403

Time: 3Hours Full Marks: 70

The paper will consist of seven questions divided into three sections.

Group A: Question No. 1 will be compulsory comprising ten objective type questions (two from each Unit) each carrying two marks (10x2=20 marks)

Group B: Question No.2 will be compulsory comprising five short answer type questions (One from each Unit) any four to be answered. (4x5=20)

Group C: Five long answer type questions are to be set (one from each Unit) of which any three to be answered (3x10=30 marks)

Unit – 1: Drug Metabolism

Pathways for deactivation. Prodrugs. Drug delivery systems. Pharmacogenomics, Nucleic acid as therapeutics, Proteins as therapeutics.

Unit – 2:

Interactions of herbs with cytochrome P 450. Effect of some hypoglycemic herbs on the activity of phase I and II drug metabolizing enzymes in alloxan induced diabatic rats.

Unit – 3: Natural Oxygen Carrier

Haemoglobin, Myoglobin, Hemicyanin and hemierythritin. Synthetic oxygen carrier-complex of Cobalt and Iron, Cytochrome-P-450, cytochrome-C, Rubredoxins and ferrodoxins, Copper blue proteins, Non haeme proteinsferritin and transferring, metallozymes, fixation of nitrogen. Haeme proteins and oxygen uptake, structure and function of Haemoglobin, myoglobin and hemicyanins.

Unit – 4: Enzymes Properties

Specifity, enzyme kinetics, Michalis-Menten equation, steady state kinetics, inhibition, Transition state theory, orientation and steric effect, Coenzymes-cofactors as derived from Vitamins, prosthetic groups, thiamine pyrophosphate, pyridoxal phosphate, NAD, NADP, FMN, FAD, Lipoic acid and vit B_{12}.

Unit – 5: Bioenergetics

STd. Free energy change in biochemical reactions, hydrolysis of ATP, Synthesis of ATP, entropy change in biological process.

Unit – 6: Carbohydrate Metabolism

Calvin cycle, Krebs cycle, Glycolysis, glucogenesis, glycogenolysis, gluconegensis, biosynthesis of disaccharides and polysaccharides. Pentose phosphate pathway.

4th Semester

(HERBAL CHEMISTRY) M.Sc. Previous

HERBAL CHEMISTRY (LAB. COURSE) & PROJECT WORK (FIELD WORK)

Paper – M - 404

Time: 12Hours Full Marks: 70

Herbal Chemistry Lab Course

1. Extraction of different constituents of Herbs by Solvent Extraction Process (using soxhlets) and separation of atleast one component by chromatography (i) Alkaloid (ii) Terpenes (iii) Steroids (iv) Protein (v) Plant Pigments (vi) Vitamins (vii) Perfume or cosmetic component.

2. Identification and separation of possible constituents of the extracts of Herbs by TLC or paper or coloumn chromatography or GLC etc.

3. Spectrophotometric (UV / VIS) / Electrophoretic methods for the estimations of

   (i) Amino Acids

   (ii) Proteins

   (iii) Carbohydrates

   (iv) Cholesterol

   (v) Ascorbic Acid

   (vi) Aspirin

   (vii) Caffeine

4. Project work & Field Work

   Each Student will make project on one specific plant after collection of the specimen of medicinal plant.

5. Viva – Voce