



Department of PG Studies and Research in Chemistry and Pharmacy

Programme Offered

1. B. Pharma.
2. M.Sc. Chemistry

B. Pharmacy

PROGRAMME OUTCOMES:

- Gain knowledge on basics of biology, structure & function of various systems of human body, fundamentals & principles of analytical chemistry, basics & preparation of different dosage forms, monographs of inorganic drugs & pharmaceuticals, soft-skills management, and problems solving in pharmacy.
- Able to understand physiology, pathophysiological mechanisms, biochemical processes, diagnosis of various pathological conditions, understand metabolism of bioactive molecules, performing haematological tests & biochemical tests. Basic understanding of organic reactions, identification, preparation, awareness of environmental problems, application of databases in pharmacy.
- Understanding stability, reactivity, standardisation & medicinal uses of organic compounds. Physical, physico-chemical properties & unit operations involved in dosage forms. Basics and pharmaceutical applications of microbiology.
- Gain knowledge on stereochemical aspects, synthesis of organic compounds & derivatives, chemistry, mechanism of action, pharmacology & therapeutic uses of natural & synthetic medicinal compounds. Fundamentals of crude drugs and their medicinal properties, understand & demonstrate chemical kinetics in the formulation of dosage forms.
- Gain knowledge of physico-chemical properties of drug substance, formulation, manufacturing, evaluation and packaging of various solid, liquid and semi-solid dosage forms. Chemistry, preparation, assay, mechanism of action, structure activity relationship, pharmacodynamics, pharmacokinetics of various classes of drugs and their application in treatment of various diseases. Fundamentals, medicinal properties, isolation, characterisation, quality control & evaluation of crude drugs and development of herbal formulations. Indian pharmaceutical acts & laws and regulatory authorities governing the manufacture and sale of pharmaceuticals.
- Gain knowledge in drug design techniques, chemistry, assay, mechanism of action, structure activity relationship & pharmacology of various categories of drugs. Experimental screening models for drug discovery. Biopharmaceutics & pharmacokinetic applications in pharmacotherapy. Learn about raw materials, formulation, quality control, patenting & regulatory requirements of nutraceuticals & herbal cosmetics. Information in techniques, production & uses of biopharmaceuticals. Quality assurance, quality control systems, documentation and validation in pharmaceutical industry.
- Gain knowledge in spectroscopic studies & chromatographic techniques of drugs. Designing & evaluation of novel drug delivery systems. Technology transfer from lab scale to industry, regulatory affairs & quality management systems in pharmaceutical industry. Role of pharmacist in community and hospital. application of knowledge gained in isolation, identification, standardisation, formulation, manufacturing & evaluation of pharmaceuticals.

- Use of statistical principles in research and development of pharmaceuticals. Knowledge of National health programs and pharmacist role. Advanced techniques used in drug design, screening, analysis of pharmaceuticals, cosmetics & nutraceuticals. Methods & importance of reporting adverse drug reactions. knowledge of regulatory science, Pharmaceutical industrial & business management.

PO-1. Critical Thinking: Identifying the assumptions that frame our actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

PO-2. Effective Communication: Read, Write, Speak and listen clearly in English and Hindi (Bilingual).

PO-3. Social Interaction: Provide a social exchange between two or more individuals.

PO-4. Effective Citizenship: Demonstrate social concern and equity centered national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

PO-5. Ethics: Recognize different value and moral systems and correlate them with present system.

PO-6. Environment & Sustainability: To understand the responsibility to conserve natural resources and protect global ecosystems to support health & wellbeing.

PO-7. Self-Directed & Life-long learning: It focuses on the process by which students take control of their own learning, in particular how they set their own learning goals, locate appropriate resources, decide on which learning methods to use and evaluate their progress.

PROGRAMME SPECIFIC OUTCOMES:

PSO-1. Detail understanding of theoretical and practical knowledge of all core and allied subjects of pharmaceutical sciences, which consist of dosage form design, routes of administration of various drugs, their mechanism of action, chemical moiety involved, doses of drugs, patient treatment, patient counseling, drug dispensing, hospital administration, drug manufacturing, QA/QC and regulation etc.

PSO-2. Highlight the concepts and operative components of pharmacovigilance, clinical pharmacy, hospital pharmacy, community pharmacy, pharmaceutical care, pharmacovigilance, pharmacoconomics, clinical research, clinical pharmacokinetics and other related areas for the benefit of academicians, hospital/community pharmacists and industry, emphasizing the consequences of the use of medications.

PSO-3. Rigorous core course-work in biopharmaceutics, drug transport, pharmacokinetics & pharmacodynamics, drug delivery systems, cell and molecular biology, synthetic and macromolecular chemistry, chemical and biomedical engineering, materials science, physiology and pharmacology.

PSO-4. Emphasis on Drug Discovery and Design, Drug Delivery, Drug Action and Clinical Sciences, Drug Analysis, Cost Effectiveness of Medicines (Pharmacoconomics), Drug Regulatory Affairs etc.

SEMESTER-I

PAPER 1 BP101T. HUMAN ANATOMY AND PHYSIOLOGY-I

Course Outcomes

Upon completion of this course the student should be able to

CO-1. Explain the gross morphology, structure and functions of various organs of the human body.

CO-2. Describe the various homeostatic mechanisms and their imbalances.

CO-3. Identify the various tissues and organs of different systems of human body.

CO-4. Perform the various experiments related to special senses and nervous system.

CO-5. Appreciate coordinated working pattern of different organs of each system

PAPER 2 BP102T. PHARMACEUTICAL ANALYSIS

Course Outcomes

Upon completion of the course student shall be able to

CO-1. understand the principles of volumetric and electro chemical analysis

CO-2. carryout various volumetric and electrochemical titrations

CO-3. develop analytical skills

PAPER 3 BP103T. PHARMACEUTICS- I

Course Outcomes

Upon completion of this course the student should be able to:

CO-1. Know the history of profession of pharmacy

CO-2. Understand the basics of different dosage forms, pharmaceutical incompatibilities and pharmaceutical calculations

CO-3. Understand the professional way of handling the prescription

CO-5. Preparation of various conventional dosage forms

PAPER 4 BP104T. PHARMACEUTICAL INORGANIC CHEMISTRY

Course Outcomes

Upon completion of course student shall be able to

CO-1. know the sources of impurities and methods to determine the impurities in inorganic drugs and pharmaceuticals

CO-2. understand the medicinal and pharmaceutical importance of inorganic compounds

PAPER 5 BP105T.COMMUNICATION SKILLS

Course Outcomes

Upon completion of the course the student shall be able to

CO-1. Understand the behavioral needs for a pharmacist to function effectively in the areas of pharmaceutical operation

CO-2. Communicate effectively (Verbal and Non-Verbal)

CO-3. Effectively manage the team as a team player

CO-4. Develop interview skills

CO-5. Develop Leadership qualities and essentials

PAPER 6 BP 106RBT.REMEDIAL BIOLOGY

Course Outcomes

Upon completion of the course, the student shall be able to

CO-1. know the classification and salient features of five kingdoms of life

CO-2. understand the basic components of anatomy & physiology of plant

CO-3. know understand the basic components of anatomy & physiology animal with special reference to human

PAPER 7 BP 106RMT.REMEDIAL MATHEMATICS

Course Outcomes

Upon completion of the course the student shall be able to:-

CO-1. Know the theory and their application in Pharmacy

CO-2. Solve the different types of problems by applying theory

CO-3. Appreciate the important application of mathematics in Pharmacy

SEMESTER-II

PAPER 1 BP 201T. HUMAN ANATOMY AND PHYSIOLOGY-II

Course Outcomes

Upon completion of this course the student should be able to:

CO-1. Explain the gross morphology, structure and functions of various organs of the human body.

CO-2. Describe the various homeostatic mechanisms and their imbalances.

CO-3. Identify the various tissues and organs of different systems of human body.

CO-4. Perform the hematological tests like blood cell counts, haemoglobin estimation, bleeding/clotting time etcand also record blood pressure, heart rate, pulse and respiratory volume.

CO-5. Appreciate coordinated working pattern of different organs of each system

PAPER 2 BP202T. PHARMACEUTICAL ORGANIC CHEMISTRY –I

Course Outcomes

Upon completion of the course the student shall be able to

CO-1. write the structure, name and the type of isomerism of the organic compound

- CO-2. write the reaction, name the reaction and orientation of reactions
- CO-3. account for reactivity/stability of compounds,
- CO-4. identify/confirm the identification of organic compound

PAPER 3 BP203 T. BIOCHEMISTRY

Course Outcomes

Upon completion of course student shall be able to

- CO-1. Understand the catalytic role of enzymes, importance of enzyme inhibitors in design of new drugs, therapeutic and diagnostic applications of enzymes.
- CO-2. Understand the metabolism of nutrient molecules in physiological and pathological conditions.
- CO-3. Understand the genetic organization of mammalian genome and functions of DNA in the synthesis of RNAs and proteins.

PAPER 4 BP 204T.PATHOPHYSIOLOGY

Course Outcomes

Upon completion of the subject student shall be able to

- CO-1. Describe the etiology and pathogenesis of the selected disease states;
- CO-2. Name the signs and symptoms of the diseases; and
- CO-3. Mention the complications of the diseases.

PAPER 5 BP205 T. COMPUTER APPLICATIONS IN PHARMACY

Course Outcomes

Upon completion of the course the student shall be able to

- CO-1. know the various types of application of computers in pharmacy
- CO-2. know the various types of databases
- CO-3. know the various applications of databases in pharmacy

PAPER 6 BP 206 T. ENVIRONMENTAL SCIENCES

Course Outcomes

Upon completion of the course the student shall be able to:

- CO-1. Create the awareness about environmental problems among learners.
- CO-2. Impart basic knowledge about the environment and its allied problems.
- CO-3. Develop an attitude of concern for the environment.
- CO-4. Motivate learner to participate in environment protection and environment improvement.
- CO-5. Acquire skills to help the concerned individuals in identifying and solving environmental problems.

SEMESTER III

PAPER 1 PHARMACEUTICAL ORGANIC CHEMISTRY –II

Course Outcomes

Upon completion of the course the student shall be able to

- CO-1. write the structure, name and the type of isomerism of the organic compound
- CO-2. write the reaction, name the reaction and orientation of reactions
- CO-3. account for reactivity/stability of compounds,
- CO-4. prepare organic compounds

PAPER 2 BP302T. PHYSICAL PHARMACEUTICS-I (Theory)

Course Outcomes

Upon the completion of the course student shall be able to

- CO-1. Understand various physicochemical properties of drug molecules in the designing the dosage forms
- CO-2. Know the principles of chemical kinetics & to use them for stability testing nad determination of expirydate of formulations
- CO-3. Demonstrate use of physicochemical properties in the formulation development and evaluation of dosageforms

PAPER 3 BP 303 T. PHARMACEUTICAL MICROBIOLOGY (Theory)

Course Outcomes

Upon completion of the subject student shall be able to;

- CO-1. Understand methods of identification, cultivation and preservation of various microorganisms
- CO-2. To understand the importance and implementation of sterlization in pharmaceutical processing andindustry
- CO-3. Learn sterility testing of pharmaceutical products.
- CO-4. Carried out microbiological standardization of Pharmaceuticals.
- CO-5. Understand the cell culture technology and its applications in pharmaceutical industries.

PAPER 4 BP 304 T. PHARMACEUTICAL ENGINEERING

Course Outcomes

Upon completion of the course student shall be able:

- CO-1. To know various unit operations used in pharmaceutical industries.
- CO-2. To understand the material handling techniques.
- CO-3. To perform various processes involved in pharmaceutical manufacturing process.
- CO-4. To carry out various test to prevent environmental pollution.
- CO-5. To appreciate and comprehend significance of plant lay out design for optimum use of resources.

SEMESTER IV

PAPER 1 BP401T. PHARMACEUTICAL ORGANIC CHEMISTRY –III

Course Outcomes

At the end of the course, the student shall be able to

- CO-1. understand the methods of preparation and properties of organic compounds
- CO-2. explain the stereo chemical aspects of organic compounds and stereo chemical reactions
- CO-3. know the medicinal uses and other applications of organic compounds

PAPER 2 BP402T. MEDICINAL CHEMISTRY – I

Course Outcomes

Upon completion of the course the student shall be able to

- CO-1. understand the chemistry of drugs with respect to their pharmacological activity
- CO-2. understand the drug metabolic pathways, adverse effect and therapeutic value of drugs
- CO-3. know the Structural Activity Relationship (SAR) of different class of drugs
- CO-4. write the chemical synthesis of some drugs

PAPER 3 BP 403 T. PHYSICAL PHARMACEUTICS-II

Course Outcomes

Upon the completion of the course student shall be able to

- CO-1. Understand various physicochemical properties of drug molecules in the designing the dosage forms
- CO-2. Know the principles of chemical kinetics & to use them for stability testing and determination of expiry date of formulations
- CO-3. Demonstrate use of physicochemical properties in the formulation development and evaluation of dosage forms.

PAPER 4 BP 404 T. PHARMACOLOGY-I

Course Outcomes

Upon completion of this course the student should be able to

- CO-1. Understand the pharmacological actions of different categories of drugs
- CO-2. Explain the mechanism of drug action at organ system/sub cellular/ macromolecular levels.
- CO-3. Apply the basic pharmacological knowledge in the prevention and treatment of various diseases.
- 4. Observe the effect of drugs on animals by simulated experiments
- CO-4. Appreciate correlation of pharmacology with other bio medical sciences

PAPER 5 BP 405 T. PHARMACOGNOSY AND PHYTOCHEMISTRY I

Course Outcomes

Upon completion of the course, the student shall be able

- CO-1. to know the techniques in the cultivation and production of crude drugs
- CO-2. to know the crude drugs, their uses and chemical nature
- CO-3. know the evaluation techniques for the herbal drugs
- CO-4. to carry out the microscopic and morphological evaluation of crude drugs

SEMESTER V

PAPER 1 BP501T. MEDICINAL CHEMISTRY – II

Course Outcomes

Upon completion of the course the student shall be able to

- CO-1.** Understand the chemistry of drugs with respect to their pharmacological activity
- CO-2.** Understand the drug metabolic pathways, adverse effect and therapeutic value of drugs
- CO-3.** Know the Structural Activity Relationship of different class of drugs
- CO-4.** Study the chemical synthesis of selected drugs

PAPER 2 BP 502 T. Industrial Pharmacy - I

Course Outcomes

Upon completion of the course the student shall be able to

- CO-1.** Know the various pharmaceutical dosage forms and their manufacturing techniques.
- CO-2.** Know various considerations in development of pharmaceutical dosage forms
- CO-3.** Formulate solid, liquid and semisolid dosage forms and evaluate them for their quality

PAPER 3 BP 503 T. PHARMACOLOGY-II

Course Outcomes

Upon completion of this course the student should be able to

- CO-1.** Understand the mechanism of drug action and its relevance in the treatment of different diseases 2. Demonstrate isolation of different organs/tissues from the laboratory animals by simulated experiments
- CO-2.** Demonstrate the various receptor actions using isolated tissue preparation
- CO-3.** Appreciate correlation of pharmacology with related medical sciences.

PAPER 4 BP504 T. PHARMACOGNOSY AND PHYTOCHEMISTRY II

Course Outcomes

Upon completion of the course, the student shall be able.

- CO-1.** to know the modern extraction techniques, characterization and identification of the herbal drugs and phytoconstituents
- CO-2.** to understand the preparation and development of herbal formulation.
- CO-3.** to understand the herbal drug interactions.
- CO-4.** to carryout isolation and identification of phytoconstituents.

PAPER 5 BP 505 T. PHARMACEUTICAL JURISPRUDENCE

Course Outcomes

Upon completion of the course, the student shall be able to understand:

- CO-1. The Pharmaceutical legislations and their implications in the development and marketing of pharmaceuticals.
- CO-2. Various Indian pharmaceutical Acts and Laws
- CO-3. The regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals
- CO-4. The code of ethics during the pharmaceutical practice

SEMESTER VI

PAPER 1 BP601T. MEDICINAL CHEMISTRY – III.

Course Outcomes

Upon completion of the course student shall be able to

- CO-1. Understand the importance of drug design and different techniques of drug design.
- CO-2. Understand the chemistry of drugs with respect to their biological activity.
- CO-3. Know the metabolism, adverse effects and therapeutic value of drugs.
- CO-4. Know the importance of SAR of drugs.

PAPER 2 BP602 T. PHARMACOLOGY-III

Course Outcomes

Upon completion of this course the student should be able to:

- CO-1. understand the mechanism of drug action and its relevance in the treatment of different infectious diseases
- CO-2. comprehend the principles of toxicology and treatment of various poisonings and
- CO-3. appreciate correlation of pharmacology with related medical sciences.

PAPER 3 BP 603 T. HERBAL DRUG TECHNOLOGY

Course Outcomes

Upon completion of this course the student should be able to:

- CO-1. understand raw material as source of herbal drugs from cultivation to herbal drug product
- CO-2. know the WHO and ICH guidelines for evaluation of herbal drugs
- CO-3. know the herbal cosmetics, natural sweeteners, nutraceuticals
- CO-4. appreciate patenting of herbal drugs, GMP.

PAPER 4 BP 604 T. BIOPHARMACEUTICS AND PHARMACOKINETICS

Course Outcomes

Upon completion of the course student shall be able to:

- CO-1. Understand the basic concepts in biopharmaceutics and pharmacokinetics and their significance.
- CO-2. Use of plasma drug concentration-time data to calculate the pharmacokinetic parameters to describe

the kinetics of drug absorption, distribution, metabolism, excretion, elimination.

CO-3. To understand the concepts of bioavailability and bioequivalence of drug products and their significance.

CO-4. Understand various pharmacokinetic parameters, their significance & applications.

PAPER 5 BP 605 T. PHARMACEUTICAL BIOTECHNOLOGY

Course Outcomes

Upon completion of the subject student shall be able to;

CO-1. Understanding the importance of Immobilized enzymes in Pharmaceutical Industries

CO-2. Genetic engineering applications in relation to production of pharmaceuticals

CO-3. Importance of Monoclonal antibodies in Industries

CO-4. Appreciate the use of microorganisms in fermentation technology

PAPER 6 BP606 T: PHARMACEUTICAL QUALITY ASSURANCE

Course Outcomes

Upon completion of the course student shall be able to:

CO-1. understand the CGMP aspects in a pharmaceutical industry

CO-2. appreciate the importance of documentation

CO-3. understand the scope of quality certifications applicable to pharmaceutical industries

CO-4. understand the responsibilities of QA & QC departments

SEMESTER VII

PAPER 1 BP701T. INSTRUMENTAL METHODS OF ANALYSIS

Course Outcomes

Upon completion of the course the student shall be able to

CO-1. Understand the interaction of matter with electromagnetic radiations and its applications in drug analysis

CO-2. Understand the chromatographic separation and analysis of drugs.

CO-3. Perform quantitative & qualitative analysis of drugs using various analytical instruments.

PAPER 2 BP 702 T. INDUSTRIAL PHARMACYII

Course Outcomes

Upon completion of the course, the student shall be able to:

CO-1. Know the process of pilot plant and scale up of pharmaceutical dosage forms

CO-2. Understand the process of technology transfer from lab scale to commercial batch

CO-3. Know different Laws and Acts that regulate pharmaceutical industry

CO-4. Understand the approval process and regulatory requirements for drug products

PAPER 3 BP 703T. PHARMACY PRACTICE

Course Outcomes

Upon completion of the course, the student shall be able to

- CO-1.** Know various drug distribution methods in a hospital
- CO-2.** Appreciate the pharmacy stores management and inventory control
- CO-3.** Monitor drug therapy of patient through medication chart review and clinical review
- CO-4.** Obtain medication history interview and counsel the patients
- CO-5.** Identify drug related problems

PAPER 4 BP 704T: NOVEL DRUG DELIVERY SYSTEMS

Course Outcomes

Upon completion of the course student shall be able

- CO-1.** To understand various approaches for development of novel drug delivery systems.
- CO-2.** To understand the criteria for selection of drugs and polymers for the development of Novel drug delivery systems, their formulation and evaluation

SEMESTER VIII

PAPER 1 BP801T. BIostatistics AND RESEARCH METHODOLOGY

Course Outcomes

Upon completion of the course the student shall be able to

- CO-1.** Know the operation of M.S. Excel, SPSS, R and MINITAB®, DoE (Design of Experiment)
- CO-2.** Know the various statistical techniques to solve statistical problems
- CO-3.** Appreciate statistical techniques in solving the problems.

PAPER 2 BP 802T SOCIAL AND PREVENTIVE PHARMACY

Course Outcomes

After the successful completion of this course, the student shall be able to:

- CO-1.** Acquire high consciousness/realization of current issues related to health and pharmaceutical problems within the country and worldwide.
- CO-2.** Have a critical way of thinking based on current healthcare development.
- CO-3.** Evaluate alternative ways of solving problems related to health and pharmaceutical issues

PAPER 3 BP803ET. PHARMA MARKETING MANAGEMENT

Course Outcomes

The course aims to provide an understanding of marketing concepts and techniques and their applications in the pharmaceutical industry.

PAPER 4 BP804 ET: PHARMACEUTICAL REGULATORY SCIENCE

Course Outcomes

Upon completion of the subject student shall be able to;

- CO-1.** Know about the process of drug discovery and development
- CO-2.** Know the regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals
- CO-3.** Know the regulatory approval process and their registration in Indian and international markets

PAPER 5BP 805T: PHARMACOVIGILANCE

Course Outcomes

At completion of this paper, it is expected that students will be able to (know, do, and appreciate):

- CO-1.** Why drug safety monitoring is important?
- CO-2.** History and development of pharmacovigilance
- CO-3.** National and international scenario of pharmacovigilance
- CO-4.** Dictionaries, coding and terminologies used in pharmacovigilance
- CO-5.** Detection of new adverse drug reactions and their assessment

PAPER 6 BP 806 ET. QUALITY CONTROL AND STANDARDIZATION OF HERBALS

Course Outcomes

Upon completion of the subject student shall be able to;

- CO-1.** know WHO guidelines for quality control of herbal drugs
- CO-2.** know Quality assurance in herbal drug industry
- CO-3.** know the regulatory approval process and their registration in Indian and international markets
- CO-4.** appreciate EU and ICH guidelines for quality control of herbal drugs

PAPER 7 BP 807 ET. COMPUTER AIDED DRUG DESIGN

Course Outcomes

Upon completion of the course, the student shall be able to understand

- CO-1.** Design and discovery of lead molecules
- CO-2.** The role of drug design in drug discovery process
- CO-3.** The concept of QSAR and docking
- CO-4.** Various strategies to develop new drug like molecules.
- CO-5.** The design of new drug molecules using molecular modeling software

PAPER 8 BP808ET: CELL AND MOLECULAR BIOLOGY (Elective subject)

Course Outcomes

Upon completion of the subject student shall be able to;

- CO-1.** Summarize cell and molecular biology history.
- CO-2.** Summarize cellular functioning and composition.

CO-3. Describe the chemical foundations of cell biology.

CO-4. Summarize the DNA properties of cell biology.

CO-5. Describe protein structure and function.

PAPER 9 BP809ET. COSMETIC SCIENCE

Course Outcomes

CO-1. Classification of cosmetic and cosmeceutical products Definition of cosmetics as per Indian and EU regulations, Evolution of cosmeceuticals from cosmetics, cosmetics as quasi and OTC drugs

CO-2. Cosmetic excipients: Surfactants, rheology modifiers, humectants, emollients, preservatives. Classification and application

CO-3. Skin: Basic structure and function of skin. Hair: Basic structure of hair.

CO-4. Hair growth cycle. Oral Cavity: Common problem associated with teeth and gums.

PAPER 10 BP810 ET. PHARMACOLOGICAL SCREENING METHODS

Course Outcomes

Upon completion of the course the student shall be able to,

CO-1. Appreciate the applications of various commonly used laboratory animals.

CO-2. Appreciate and demonstrate the various screening methods used in preclinical research

CO-3. Appreciate and demonstrate the importance of biostatistics and research methodology

CO-4. Design and execute a research hypothesis independently

PAPER 11 BP 811 ET. ADVANCED INSTRUMENTATION TECHNIQUES

Course Outcomes

Upon completion of the course the student shall be able to

CO-1. understand the advanced instruments used and its applications in drug analysis

CO-2. understand the chromatographic separation and analysis of drugs.

CO-3. understand the calibration of various analytical instruments

CO-4. know analysis of drugs using various analytical instruments.

PAPER 12 BP 812 ET. DIETARY SUPPLEMENTS AND NUTRACEUTICALS

Course Outcomes

This module aims to provide an understanding of the concepts behind the theoretical applications of dietary supplements. By the end of the course, students should be able to:

CO-1. Understand the need of supplements by the different group of people to maintain healthy life.

CO-2. Understand the outcome of deficiencies in dietary supplements.

CO-3. Appreciate the components in dietary supplements and the application.

CO-4. Appreciate the regulatory and commercial aspects of dietary supplements including health claims.

M.SC. CHEMISTRY

PROGRAMME OUTCOMES:

- To impart knowledge in fundamental aspects of all branches of chemistry.
- To acquire deep knowledge in the study of physical, chemical, electrochemical and magnetic properties, structure elucidation using various techniques and applications of various organic and inorganic materials.
- To acquire basic knowledge in the specialized areas of chemistry and to train the students in various quantitative and qualitative analyses.
- To provide a broad foundation in Chemistry that stresses scientific reasoning and analytical problemsolving with a molecular perspective.
- To make the Department a growing center of excellence in teaching, cutting-edge research, curriculum development and popularizing Chemistry.
- To provide students with the skills required to succeed in M.Sc. the Chemical industry or professional school. To make international collaborations for students and faculty exchange and research cooperation.
- The Department would like to attain worldwide recognition in Chemistry research and teaching.
- To expose the students to a breadth of experimental techniques using modern instrumentation.
- The Department also endeavors to contribute to industry and address problems of societal importance.
- The Department also aims at chemistry outreach in the form of books, online courses, and other chemistry education activities that showcase the role of Chemistry as a central science.

PO-1. Critical Thinking: Identifying the assumptions that frame our actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

PO-2. Effective Communication: Read, Write, Speak and listen clearly in English and Hindi (Bilingual).

PO-3. Social Interaction: Provide a social exchange between two or more individuals.

PO-4. Effective Citizenship: Demonstrate social concern and equity centered national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

PO-5. Ethics: Recognize different value and moral systems and correlate them with present system.

PO-6. Environment & Sustainability: To understand the responsibility to conserve natural resources and protect global ecosystems to support health & wellbeing.

PO-7. Self-Directed & Life-long learning: It focuses on the process by which students take control of their own learning, in particular how they set their own learning goals, locate appropriate resources, decide on which learning methods to use and evaluate their progress.

PROGRAMME SPECIFIC OUTCOMES:

PSO-1. The programme learning outcomes relating to M.Sc. degree programme in chemistry may include the following: After the completion of the M.Sc. Chemistry programme, the students of our department will be able to:

PSO-2. Work in the interdisciplinary and multidisciplinary areas of chemical sciences and its applications.

PSO-3. Analyze the data obtained from sophisticated instruments (like FTIR, NMR, GCMS, HPLC, GCMS, UVVis, Fluorescence, and TGA) for the structure determination and chemical analysis.

PSO-4. Apply green/sustainable chemistry approach towards planning and execution of research in frontier areas of chemical sciences.

SEMESTER I

PAPER 1 CHC-102: Organic Chemistry-I

Course Outcomes:

Upon successful completion of the Course, the students will be able to: Describe chemical bonding, resonance and hyperconjugation.

CO-1. Explain the concept of aromaticity and describe the various types of aromaticity.

CO-2. Perform aliphatic nucleophilic substitution reactions and differentiate the various types of aliphatic nucleophilic substitution.

CO-3. Explain the stereochemistry substitution reaction and identify the stereochemical notations.

CO-4. Explain the concept of UV-Vis. spectroscopy: Electromagnetic radiation, electronic transitions, Beer Lambert law, Fieser-Woodward rules for conjugated dienes and carbonyl compounds.

CO-5. Explain the concept of Describe Optical Rotatory Dispersion and Circular Dichroism, deduction of absolute configuration, octant rule for ketones.

PAPER 2 CHC-103: Physical Chemistry-I

Course Outcomes:

Upon successful completion of the Course, the students will be able to:

CO-1. Explain about Schrodinger equation and the postulates of quantum mechanics.

CO-2. Explain the concept of quantum chemistry, operators, oscillators and numerical

CO-3. Describe the application of perturbation theory to small molecules and applications of variation method and perturbation theory to the helium atom.

CO-4. Discuss about the angular momentum, eigen functions and eigen values of angular momentum.

CO-5. Explain the concept of phase rule and its applications.

PAPER 3 CHC-104: Spectroscopy-I

Course Outcomes

Upon successful completion of the Course, the students will be able to:

CO-1. Describe and understand the basic profile of electromagnetic radiations, scientific notations for absorption, emission, transmission, reflection, dispersion, polarization and Classify electromagnetic spectrum ion of spectra.

CO-2. Explain basic concept of microwave spectroscopy and classify molecules on the basis of structural parameters like moment of inertia and intermolecular distances.

CO-3. Analyse the effect of isotopic substitution and nonrigid bond and polyatomic molecules, determine the: Rotation of molecules, rotational spectra, diatomic molecules and other structural parameters.

CO-4. Assess linear harmonic oscillator, the vibrating diatomic molecule, the simple harmonic oscillator, the anharmonic oscillator and other supporting models. Analysis of vibrating models for diatomic vibrating rotator, vibration of polyatomic molecules,

CO-5. Describe the overtones and combination frequencies, the influence of rotation on the spectra of polyatomic molecules, the influence of nuclear spin, symmetric top molecules, analysis by Infra-red technique - Group frequencies, outline of technique and instrumentation.

PAPER 4 CHE-101A: Mathematics for Chemist and Computer for Chemist

Course Outcomes:

Upon successful completion of the Course, the students will be able to:

- CO-1. Describe about vectors matrix algebra.
- CO-2. Describe basic rules for integration and applications of integral calculus.
- CO-3. Explain about the elementary differential equations.
- CO-4. Explain about the probability theorems and variance root means square deviation.
- CO-5. Explain the basic and fundamental of computers.

PAPER 5 CHE-101B: Biology for Chemists and Computer for Chemist

Course Outcomes:

Upon successful completion of the Course, the students will be able to:

- CO-1. Function and organization of various bio-molecules present in the living cell.
- CO-2. Structure of amino acid proteins, DNA, RNA, Carbohydrates, Lipids and Vitamins.
- CO-3. Explain about Nucleic Acids i.e. Purine and pyrimidine bases of nucleic acids
- CO-4. Explain about the basic and fundamental of computers.
- CO-5. Describe operating systems, network and language.

SEMESTER II

PAPER 1 CHC-201: Inorganic Chemistry-II

Course Outcomes

Upon successful completion of the Course, the students will be able to:

- CO-1. Describe the formation constant and stability of metal complexes.
- CO-2. Explain reaction mechanism of square planer complexes and trans effect stability of the coordination complexes
- CO-3. Describe the fundamental requirement for interpretation of electronic spectra of metal compound for prediction of their properties.
- CO-4. Describe the studies of metal nitrosyls and its preparation, structures and properties.
- CO-5. Explain the Chemistry of dinitrogen complexes.

PAPER 2 CHC-202: Organic Chemistry-II

Course Outcomes

Upon successful completion of the Course, the students will be able to:

- CO-1. To perform aliphatic and aromatic electrophilic substitution reactions.
- CO-2. To differentiate the various types of aliphatic electrophilic substitution mechanism.
- CO-3. To explain the stereochemistry substitution reaction
- CO-4. To describe various reactions involved in addition to C-C double bond and C-X bond.
- CO-5. To Explain the stereochemical aspects in addition reaction

PAPER 3 CHC-203: Physical Chemistry-II

Course Outcomes

Upon successful completion of the Course, the students will be able to:

- CO-1. Describe and understand the basic principle of unimolecular reactions and fast reaction kinetics
- CO-2. Explain about the adsorption process and its theories
- CO-3. Describe the concept of colloidal material and their stability for many practical uses.
- CO-4. Explain the redox processes in electrochemical systems.
- CO-5. Describe and understand the Debye-Huckel Onsager theory and determination of activity and activity coefficient.

PAPER 4 CHC-204: Spectroscopy-II

Course Outcomes

Upon successful completion of the Course, the students will be able to:

- CO-1. Explain the basic principle of photoacoustic spectroscopy.
- CO-2. Describe and understand the basic methods of X-ray structural analysis of crystals.
- CO-3. Describe the electron diffraction and neutron diffraction and its measurements techniques.
- CO-4. Explain about the structure and functions of biomolecules.
- CO-5. Describe the properties of biopolymer.

PAPER 5 CHC-205: Environmental Chemistry

Course Outcomes:

Upon successful completion of the Course, the students will be able to:

- CO-1. Describe the air, water, pollution by industry, pesticides, microorganism.
- CO-2. Demonstrate knowledge of chemical and biochemical principles of fundamental environmental processes in air, water, and soil.
- CO-3. Recognize different types of toxic substances & responses and analyze toxicological information.
- CO-4. Apply basic chemical concepts to analyze chemical processes involved in different environmental problems (air, water & soil).
- CO-5. Describe experimental methods for analysis of water and soil analysis and pollution awareness to society.

PAPER 6 CHC-206: Inorganic Chemistry-II

Course Outcomes

Upon successful completion of the Course, the students will be able to:

- CO-1. Conduct the experiments for the preparation, characterization of metal complexes
- CO-2. Conduct chemical analyses by qualitative and quantitative analysis of metal complexes
- CO-3. Conduct separation and estimation of amount of metal ions in binary metal ion mixture.
- CO-4. Volumetric and gravimetric analysis.
- CO-5. Interpretation of TG and NMR spectra of some known compounds

PAPER 7 CHC-208: Physical Chemistry-III

Course Outcomes

Upon successful completion of the Course, the students will be able to:

- CO-1. Determination of velocity constant, order of the reaction and energy of activation for saponification.

- CO-2.** Determine the solubility and solubility product of sparingly soluble salts, strength of strong and weak acids, Activity coefficient of zinc ions in the solution of zinc sulphate.
- CO-3.** Determination of strengths of halides in a mixture, valency of mercurous ions potentiometrically.
- CO-4.** Enzyme kinetics -inversion of sucrose, rate constant for hydrolysis/inversion of sugar using a polarimeter

SEMESTER III

PAPER 1 CHC-301: Inorganic Chemistry-III

Course Outcomes:

Upon successful completion of the Course, the students will be able to:

- CO-1.** Describe advanced symmetry concepts of chemical molecules and its applications.
- CO-2.** To identify the axis, plane, center and point group, product of symmetry operation and character table of chemical compounds.
- CO-3.** Chemical application of group theory in spectroscopy.
- CO-4.** Analyze the reaction mechanism of metal complex formation including structure and properties
- CO-5.** Describe the role of metal in biological system and their function.

PAPER 2 CHC-302: Organic Chemistry-III

Course Outcomes:

Upon successful completion of the Course, the students will be able to:

- CO-1.** To describe basics of Nuclear Magnetic Resonance Spectroscopy and its application.
- CO-2.** To describe photochemical reactions and photochemistry of carbonyl compounds.
- CO-3.** To explain the basic concepts of pericyclic reactions.
- CO-4.** To explain sigmatropic rearrangements reactions and to study some important rearrangements reactions in detail.
- CO-5.** To explain various advanced name reactions and their applications.

PAPER 3 CHC-303: Physical Chemistry III: Solid State Chemistry

Course Outcomes

Upon successful completion of the Course, the students will be able to:

- CO-1.** Describe the principles and kinetics of solid-state reactions.
- CO-2.** Explain about the stoichiometric crystal defects and non-stoichiometry.
- CO-3.** Describe the electronic properties and band theory
- CO-4.** Explain about the electrically conducting solids.
- CO-5.** Describe the types and theories of liquid crystals:

PAPER 4 CHE-301A (ELECTIVE PAPER I): Molecular Dynamics

Course Outcomes

Upon successful completion of the Course, the students will be able to:

- CO-1. Describe the principles of entropy, enthalpy and Gibb's free energy.
- CO-2. Explain about the theory of isotope effects and solvent effects.
- CO-3. Describe the pharmacokinetics and pharmacodynamics of drug.
- CO-4. Explain about the solvation and solvent effects.
- CO-5. Describe the xenobiotics, biotransformation.

PAPER 5 CHE-301B (ELECTIVE PAPER II): Analytical Chemistry

Course outcome

Upon successful completion of the Course, the students will be able to:

- CO-1. Describe quantitative analysis of errors includes F- test, T- test etc.
- CO-2. Explain principles and application of optical methods like AES, AAS, etc.
- CO-3. Learn about the chromatographic and thermo gravimetric techniques and applications.
- CO-4. Explain the principal, instrumentation and application of High-Performance Liquid Chromatography.
- CO-5. Learn about the principal and instrumentation of AAS and Cyclic voltammetry.

PAPER 6 CHE-301C: (ELECTIVE PAPER III): Photochemistry

Course outcome

Upon successful completion of the Course, the students will be able to:

- CO-1. Describe the photochemical excitation and Jablonski diagram.
- CO-2. Explain about the study of photochemistry of ketone-photo reduction-photo cycloaddition.
- CO-3. Describe pericyclic reactions and cyclo addition and sigmatropic reactions.
- CO-4. Describe stereochemical problems in relation to chemical transformations.
- CO-5. Describe synthetically the processes relevant organic-chemical reactions and be able to discuss the mechanism of these reactions.

PAPER 7 CHE-301D (ELECTIVE PAPER IV): Biochemistry

Course outcome

Upon successful completion of the Course, the students will be able to:

- CO-1. Describe the metal ions and K^+/Na^+ pump, Photosystem I and II, and transport and storage of Dioxygen.
- CO-2. Explain the electron transport processes, Biological nitrogen fixation, and its mechanism, nitrogenase, Chemical nitrogen fixation.
- CO-3. Learn about introduction of enzymes, mechanism of enzymes action, and types of reactions catalyzed by enzymes.
- CO-4. Explain about vitamins, coenzymes, prosthetic groups, apoenzymes. Structure and biological functions of coenzyme A, thiamine pyrophosphate, pyridoxal phosphate, NAD^+ , $NADP^+$, FMN, FAD, lipoic acid, vitamin B12.
- CO-5. Explain the endergonic and exergonic reactions, Hydrolysis of ATP, synthesis of ATP from ADP, Nerve Conduction.

PAPER 8 CHE-302A (ELECTIVE PAPER V): Theoretical Chemistry

Course Outcomes

Upon successful completion of the Course, the students will be able to:

CO-1. Explain the principles of quantum mechanics, Born-Oppenheimer approximation and its breakdown, Hartree-Fock equation.

CO-2. Describe the Maxwell-Boltzmann distribution law of molecular velocities and energies. Bose-Einstein and Fermi-Dirac statistics, Application of Fermi-Dirac and Bose-Einstein statistics.

CO-3. Learn about entropy and probability, Einstein and Debye models, their weaknesses.

CO-4. Explain Onsager's reciprocity relations, electrokinetic phenomena, diffusion, coupled reactions.

CO-5. Fischer's lock and key and Koshland's induced fit hypothesis, concept and identification of active site by the use of inhibitors, affinity labeling and enzyme modification by site-directed mutagenesis. Enzyme kinetics, Michaelis-Menten and Lineweaver-Burk plots, reversible and irreversible inhibition.

PAPER 9 CHE-302B (ELECTIVE PAPER VI): Chemistry of Materials

Course Outcomes

Upon successful completion of the Course, the students will be able to:

CO-1. To demonstrate the understanding of materials, their classifications and applications.

CO-2. Describe the objectives of inorganic nanocomposite materials.

CO-3. Explain the mechanism of formation of nanomaterials, role of surfactants in the synthesis of nonmaterial

CO-4. To describe the Basics of metallic clusters, preparation, properties and applications of metallic clusters.

CO-5. Describe the importance and properties of defects in solids.

PAPER 10 CHE-302C (ELECTIVE PAPER VII): Electrochemistry

Course Outcomes

Upon successful completion of the Course, the students will be able to:

CO-1. The learner should be able to apply theories in electrochemistry to analyze electrode kinetics

CO-2. To understand representing electrochemical cell

CO-3. Explain various over potential involved during the operation the cell.

CO-4. Apply the knowledge to calculate electrochemical cell parameters, over potential, active surface areas.

CO-5. Learn about the methods of determining kinetic parameters for quasi-reversible and irreversible waves.

PAPER 11 CHE-302D (ELECTIVE PAPER VIII): Medicinal Chemistry

Course Outcomes

Upon successful completion of the Course, the students will be able to:

CO-1. Describe the SAR and QSAR of drug compounds.

CO-2. Describe methods of drug development including design and discovery.

CO-3. Explain the synthesis and structure SAR of antibiotics.

CO-4. Explain Antibacterials and anti-malarial drug's its chemical structure and its therapeutic properties.

CO-5. Describe the common methods of preparation and its use of Non-steroidal Anti-inflammatory, Antihistaminic and antiasthmatic drugs.

PAPER 12 CHC-304: Inorganic Chemistry-III

Course Outcomes

Upon successful completion of the Course, the students will be able to:

- CO-1. Synthesis, separation and purification of following inorganic compounds, and their characterization.
- CO-2. Application of the techniques and their characterization of coordination complexes

PAPER 13 CHC-306: Physical Chemistry-III

Course Outcomes

Upon successful completion of the Course, the students will be able to:

- CO-1. Experimental determination of chemical reactions.
- CO-2. Measurement of various properties.
- CO-3. Determination of activation energy.
- CO-4. Application related experiments for their research work.

SEMESTER IV

PAPER 1 CHC401: Inorganic Chemistry-IV

Course Outcomes

Upon successful completion of the Course, the students will be able to

- CO-1. Describe the ESR spectroscopy basic principles and its applications to transition metal complexes.
- CO-2. Explain Mossbauer spectroscopy basic principles and its applications.
- CO-3. Learn about the application of group theory to spectroscopy.
- CO-4. Describe structure and function of metalloproteins in electron transport process.
- CO-5. Explain metal complexes in transmission of energy.

PAPER 2 CHC-402: Organic Chemistry-IV

Course Outcomes

To impart advanced knowledge of conjoint spectroscopy. To learn about the mass spectrometry by different techniques.

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

- CO-1. Vibrational frequencies of functional groups, λ_{\max} of α , β -unsaturated carbonyl compounds.
- CO-2. Deduction of absolute configuration, Octant rule for ketones.
- CO-3. Structure elucidation of some model organic molecules by UV-Vis, IR, ^1H NMR, ^{13}C NMR and MS.
- CO-4. Learn about the elimination reactions (E2, E1 and E1cB) mechanisms.
- CO-5. Explain about the properties of enzymes and coenzymes.

PAPER 3 CHC-403: Physical Chemistry-IV

Course Outcomes

Upon successful completion of the Course, the students will be able to:

- CO-1. Nuclear spin, nuclear resonance, saturation, J exchange phenomena.

CO-2. Principle of ESR.

CO-3. Photochemistry and photophysical principles, Theory of photoreaction.

CO-4. Steric and Conformational Properties 5. Nucleophilic and Electrophilic Reactivity.

PAPER 4 CHE-401A (ELECTIVE PAPER IX): Organic Synthesis

Course Outcomes

Upon successful completion of the Course, the students will be able to:

CO-1. Explain disconnection Approach with some examples.

CO-2. Describe the important functional group interconversions in alkene synthesis.

CO-3. Explain the concepts of one-, two-group C-C bond disconnections.

CO-4. Describe the preparation of organoboranes and their synthetic applications.

CO-5. Describe the reagents which causes oxidation in various compounds.

PAPER 5 CHE-401B: (ELECTIVE PAPER X): Polymers

Course Outcomes:

Upon successful completion of the Course, the students will be able to:

CO-1. Describes of fundamental concepts of biological macromolecules.

CO-2. Explain the preparation of high polymers, polymerization steps.

CO-3. Describe fundamental of conducting polymers and their various application.

CO-4. Describe the structure properties of polymers.

CO-5. Explain chemical and spectroscopic analysis of polymers.

PAPER 6 CHE-401C (ELECTIVE PAPER XI): Organo Transitional Metal Chemistry Course Outcomes

Upon successful completion of the Course, the students will be able to:

CO-1. Describe the structure and bonding aspects of simple organometallic compounds.

CO-2. Apply different electron counting rules to predict the shape/geometry of organotransition metal compound.

CO-3. Describe the methods of synthesis, properties of mono, di, tri, tetra, penta and hexahaptoorganotransitionmetal compound.

CO-4. Describe the steps of organotransition metal complex catalyzed reaction for value added chemicals.

CO-5. Identify the different types of organotransition metal complexes catalyzed reactions and apply the aboveconcepts to explain different catalytic reactions.

PAPER 7 CHE-401D (ELECTIVE PAPER XII): Solid State Chemistry

Course Outcomes

Upon successful completion of the Course, the students will be able to:

CO-1. Design and development of materials with pre-required properties based on the structure of solids.

CO-2. Analyze the physical-chemical along with unique optical, electrical, magnetic, thermal, and mechanicalproperties of solids that are distinct for compounds in their solution and/or gas phase.

CO-3. Describe solid state phase relations, their chemical synthesis, and thermodynamically and kinetic parameter's reaction kinetics as well as characterization methods.

CO-4. Develop the method to prepare, purify, and crystallize organic and inorganic solids.

CO-5. Use of spectroscopic, diffraction, microscopic, thermal, and magnetic methods to characterize organic and inorganic solids.

PAPER 8 CHE-402B (ELECTIVE PAPER XIV): Physical Organic Chemistry

Course Outcomes

Upon successful completion of the Course, the students will be able to:

CO-1. Describe Hückel molecular orbital theory for olefins.

CO-2. Explain the acids, bases, electrophiles, nucleophiles and catalysis.

CO-3. Describe the nature of non-covalent interactions at the basis of the formation of supramolecular compounds which are held together by intermolecular bonds.

CO-4. Describe the fundamentals of supramoleculars, Supramolecular reactions and catalysis and storage of metals and transport across the membrane.

CO-5. Describe the redox reactions by excited metal complexes.

PAPER 9 CHE-402C (ELECTIVE PAPER XV): Heterocyclic Chemistry

Course Outcomes

Upon successful completion of the Course, the students will be able to:

CO-1. Describe the structures of classes of heterocyclic aromatic organic compounds.

CO-2. Classify simple heterocyclic aromatic compounds as electron deficient or electron rich and explain their reactivity based on these properties.

CO-3. Apply organometallic reactions that applied in heterocyclic chemistry.

CO-4. Explain on a mechanistic level, reactions and synthesis of important electron deficient nitrogen containing heterocycles; pyridines, diazines and their benzo-condensed analogs.

CO-5. Explain on a mechanistic level, reactions and synthesis of important electron rich heterocycles; furans, pyrroles and thiophenes and 1,3-azoles, and benzo-condensed analogs.