



# ISF College of Pharmacy (An Autonomous College)

[NAAC Accredited "A" Grade College]

GT Road, Ghal-Kalan, MOGA – 142 001 (Punjab) INDIA

Approve by AICTE, PCI & Govt. of Punjab

Affiliated to IK Gujral Punjab Technical University, Jalandhar (Pb.)



## COURSE OUTCOMES

Course Outcomes contain complete information about the core subjects of Pharmacy such as Pharmaceutics, Pharmaceutical Chemistry, Pharmacology, and Pharmacognosy.

**Program Name: Diploma in Pharmacy**

Course Title	Course Outcome
<b>First Year</b>	
Pharmaceutics-I	<ul style="list-style-type: none"><li>• To understand various dosage forms, their uses, different ayurvedic formulations, immunological products.</li><li>• In addition, they will gain a deep knowledge regarding various systems of weight measurement, percentage calculation, the importance of packing, the various aseptic techniques used for pharmaceutical preparation and the importance of pharmaceutics in the field of pharmacy.</li></ul>
Pharmaceutical Chemistry -I	<ul style="list-style-type: none"><li>• To understand different reactions of inorganic compounds, the importance of physiological balance and the cations and anions which are used to regulate them, the importance of radiopharmaceuticals, different methods which are used to control the quality of dosage forms, impurities in pharmaceuticals and limit tests.</li><li>• Able to identify various inorganic compounds and apply limit test for sulfate, arsenic, iron and heavy metals.</li></ul>
Pharmacognosy	<ul style="list-style-type: none"><li>• To explain the role of natural products as the source of many drugs and pharmaceutical ingredients, their common adulterations and quality control parameters.</li><li>• To study various drugs morphological characters, and perform physical and chemical test evaluation.</li></ul>

<p>Biochemistry &amp; Clinical Pathology</p>	<ul style="list-style-type: none"> <li>• To recognize how fundamental chemical principles and reactions are utilized in biochemical processes and must be able to write and speak clearly on chemical and biochemical topics.</li> <li>• They should recognize how biochemical reactions are not special, but follow fundamental chemical principles to achieve viability.</li> <li>• Students should be able to judge whether a proposed or hypothetical reaction is consistent with the general framework of catabolic and anabolic metabolism.</li> <li>• After completion of course, students should generate ability to work with clinicians, to determine the role of the laboratory in specific situations to optimize patient safety, to do various laboratory diagnostic characterizations of blood and urine samples.</li> <li>• They are able to give injections through various routes.</li> <li>• After completion of course, students should generate ability to work with clinicians, to determine the role of the laboratory in specific situations to optimize patient safety.</li> </ul>
<p>Human Anatomy And Physiology</p>	<ul style="list-style-type: none"> <li>• Students can recognize and define a variety of terms specific to the human body.</li> <li>• Students can analyze and describe the structures and functions of human anatomy and physiology from a regional perspective for the following regions: head and neck, thoracic, abdominopelvic, and upper and lower extremities.</li> <li>• From a regional viewpoint, demonstrate competency in identifying the major skeletal muscles, their actions, origins, insertions, and peripheral nerves.</li> <li>• Demonstrate competency in identifying the major structures and functions of the gross anatomy of the central nervous system and plexuses.</li> <li>• Students can discuss in depth about the anatomy and physiology of the nervous, musculoskeletal, respiratory, digestive, urinary and cardiovascular systems.</li> <li>• Students can describe briefly about the basic components and functions of the cell, tissues blood and endocrine systems, understand</li> </ul>

	<p>body physiological systems, examining blood films for various blood counts and analyze various parameters of body system.</p> <ul style="list-style-type: none"> <li>Students will be able to determine blood clotting time, erythrocyte sedimentation rate and haemoglobin value.</li> </ul>
Health Education & Community Pharmacy	<ul style="list-style-type: none"> <li>Understand the concepts of health, nutritional values, first aids and family planning.</li> <li>Understand the basic principles of diagnosis and management of several communicable and noncommunicable diseases.</li> </ul>
<b>Second year</b>	
Pharmaceutics- II	<ul style="list-style-type: none"> <li>To understand about compounding and dispensing of different pharmaceutical formulations based on different dosage form, about dispensing pharmacy, prescription, parts and handling of prescription, types of incompatibility in prescription, posology, factors which effects dose of drugs and different methods which are used to control the quality of different dosage forms.</li> <li>To understand various dosage forms, their formulation design, their packaging, labeling.</li> </ul>
Pharmaceutical Chemistry-II	<ul style="list-style-type: none"> <li>To name a medicinal drug according to IUPAC system. They will make a bridge between basic and more advanced pharmaceutical chemistry knowledge.</li> <li>It also makes connection from chemical principles to the structures and functions of biological molecules.</li> <li>They should recognize the medicinal on the basis of structure and official preparation.</li> <li>After completion of course, students should generate ability to speak and write about pharmacological property of medicinal drugs, prepare organic compounds and do elemental and functional group analysis by the help of various detection tests.</li> <li>They able to identify certain groups of drugs like barbiturates, sulfonamides, phenothiazines etc. included in I.P with the help of official tests.</li> </ul>
Pharmacology & Toxicology	<ul style="list-style-type: none"> <li>Students can tell which drug is used in what type of ailment and what are the side effects or unintentional actions of the drug.</li> </ul>

	<ul style="list-style-type: none"> <li>• He also must be able to deal with the toxicity of drugs i.e. what should be done immediately if poisoning access.</li> <li>• Evaluate the pharmacological effects of drugs using computer based softwares.</li> <li>• Select suitable animals in the pharmacological experiments.</li> </ul>
Pharmaceutical Jurisprudence	<ul style="list-style-type: none"> <li>• Understand pharmaceutical legislation in India.</li> <li>• Students may get deep knowledge about professional and pharmaceutical code and ethics, about pharmacist's oath, about constituent and functions pharmacy council of India and state pharmacy council, about general study of the Schedules according to drug and cosmetics act and also come to know about objectives, offences and penalties, functions of the drug and magic remedies (objectionable advertisement) act, narcotic drugs and psychotropic substances act, latest drugs (price control) order, poisons act, medicinal and toilet preparations (excise duties) act, medical termination of pregnancy act.</li> </ul>
Drug store & Business Management	<ul style="list-style-type: none"> <li>• Increase the selling efforts and intensity by dealers as well as sales personnel.</li> <li>• Call the attention to new products. Inform the buyers about the new brand and new packaging. Perform cost of reaching an audience.</li> </ul>
Hospital & Clinical Pharmacy	<ul style="list-style-type: none"> <li>• Students will be able to understand about various function of hospital and hospital pharmacy, various in-patient and out-patients services, manufacturing within hospital and special precautions related to sterile manufacturing process, different surgical instrument and surgical dressing used in hospital, data collection data storage, various parts of prescription, drug interaction and adverse drug reactions, toxicity due to insecticides, heavy metals, poisons, narcotic drugs and barbiturates.</li> <li>• In addition, they will gain a deep knowledge regarding to various diseases their causative agents, diseases cycle, laboratory protocols for detection and finally the methods of control and presentation of diseases. Prepare transfusion fluids, evaluation of surgical materials, and handling of data processing equipments.</li> </ul>

## Course Outcomes

Program Name: B. Pharmacy

Course Title	Course Outcome
<b>First semester</b>	
Human Anatomy and Physiology-I	<ul style="list-style-type: none"><li>• Explain the gross morphology, structure and functions of various organs of the human body.</li><li>• Describe the various homeostatic mechanisms and their imbalances.</li><li>• Identify the various tissues and organs of different systems of human body.</li><li>• Perform the various experiments related to special senses and nervous system.</li><li>• Appreciate coordinated working pattern of different organs of each system.</li><li>•</li></ul>
Pharmaceutical Analysis-I	<ul style="list-style-type: none"><li>• Understand the principles of volumetric and electro chemical analysis.</li><li>• Carryout various volumetric and electrochemical titrations.</li><li>• Develop analytical skills.</li><li>• Ability to check the purity and strength of the drug formulations</li><li>• Ability to perform analysis of drugs using Fluorimetry, nepheloturbidimetry and flame photometry.</li><li>• Understand the different separation techniques and their applications in analysis of drugs</li></ul>
Pharmaceutics- I	<ul style="list-style-type: none"><li>• Know the formulation aspects of different dosage forms.</li><li>• Do different pharmaceutical calculation involved in formulation.</li><li>• Formulate different types of dosage forms.</li><li>• Appreciate the importance of good formulation for effectiveness.</li><li>• Know about the pharmacopoeias and the role of pharmacist.</li><li>• Understand about pharmacy and brief about the dosage forms.</li><li>• Know various additives and technical terms commonly used in the field of pharmacy.</li><li>• Know the method of preparation of extracts and principle of infusion, decoction etc.</li></ul>
Pharmaceutical Inorganic Chemistry	<ul style="list-style-type: none"><li>• Know the sources of impurities and methods to determine the impurities in inorganic drugs and pharmaceuticals.</li><li>• Understand the medicinal and pharmaceutical importance of inorganic compounds</li></ul>
Communication Skills	<ul style="list-style-type: none"><li>• Understand the behavioral needs for a Pharmacist to function effectively in the areas of pharmaceutical operation.</li><li>• Communicate effectively (Verbal and Non Verbal).</li><li>• Effectively manage the team as a team player.</li><li>• Develop interview skills.</li></ul>

	<ul style="list-style-type: none"> <li>• Develop Leadership qualities and essentials.</li> </ul>
Remedial Biology	<ul style="list-style-type: none"> <li>• Know the classification and salient features of five kingdoms of life.</li> <li>• Understand the basic components of anatomy and physiology of plant.</li> <li>• Know understand the basic components of anatomy and physiology animal with special reference to human.</li> </ul>
Remedial Mathematics	<ul style="list-style-type: none"> <li>• Know the theory of mathematics and their application in Pharmacy.</li> <li>• Solve the different types of problems by applying theory.</li> <li>• Appreciate the important application of mathematics in Pharmacy.</li> </ul>
<b>Second Semester</b>	
Human Anatomy and Physiology II	<ul style="list-style-type: none"> <li>• Explain the gross morphology, structure and functions of various organs of the human body.</li> <li>• Describe the various homeostatic mechanisms and their imbalances.</li> <li>• Identify the various tissues and organs of different systems of human body.</li> <li>• Perform the hematological tests like blood cell counts, haemoglobin estimation, bleeding/clotting time etc and also record blood pressure, heart rate, pulse and respiratory volume.</li> <li>• Appreciate coordinated working pattern of different organs of each system.</li> <li>• Appreciate the interlinked mechanisms in the maintenance of normal functioning (homeostasis) of human body.</li> </ul>
Pharmaceutical Organic Chemistry-I	<ul style="list-style-type: none"> <li>• Write the structure, name and the type of isomerism of the organic compound.</li> <li>• Write the reaction, name the reaction and orientation of reactions.</li> <li>• Account for reactivity/stability of compounds.</li> <li>• Identify/confirm the identification of organic compound.</li> <li>• General methods of preparation and reactions of compounds</li> <li>• To emphasize on definition, types, classification, principles/mechanisms, applications, examples and differences.</li> </ul>
Biochemistry	<ul style="list-style-type: none"> <li>• Understand the catalytic role of enzymes, importance of enzyme inhibitors in design of new drugs, therapeutic and diagnostic applications of enzymes.</li> <li>• Understand the metabolism of nutrient molecules in physiological and pathological conditions.</li> <li>• Understand the genetic organization of mammalian genome and functions of DNA in the synthesis of RNAs and proteins.</li> </ul>
Pathophysiology	<ul style="list-style-type: none"> <li>• Describe the etiology and pathogenesis of the selected disease states.</li> <li>• Name the signs and symptoms of the diseases.</li> <li>• Mention the complications of the diseases.</li> </ul>

Computer Applications in Pharmacy	<ul style="list-style-type: none"> <li>• Apply the knowledge of MS office, Excel, Power point and Access for pharmaceutical and clinical studies.</li> <li>• To develop programs to calculate simple and arithmetic expressions</li> <li>• Ability to know computer programming, data analysis, calculation and graphing using formulae and function.</li> </ul>
Environmental Sciences	<ul style="list-style-type: none"> <li>• Create the awareness about environmental problems among learners.</li> <li>• Impart basic knowledge about the environment and its allied problems.</li> <li>• Develop an attitude of concern for the environment.</li> <li>• Motivate learner to participate in environment protection and environment improvement.</li> <li>• Acquire skills to help the concerned individuals in identifying and solving environmental problems.</li> <li>• Strive to attain harmony with Nature.</li> </ul>
<b>Third Semester</b>	
Pharmaceutical Organic Chemistry –II	<ul style="list-style-type: none"> <li>• Write the structure, name and the type of isomerism of the organic compound</li> <li>• Write the reaction, name the reaction and orientation of reactions.</li> <li>• Account for reactivity/stability of compounds.</li> <li>• Prepare organic compounds.</li> </ul>
Physical Pharmaceutics-I	<ul style="list-style-type: none"> <li>• Understand various physicochemical properties of drug molecules in the designing the dosage forms.</li> <li>• 2. Know the principles of chemical kinetics and to use them for stability testing and determination of expiry date of formulations.</li> <li>• Demonstrate use of physicochemical properties in the formulation development and evaluation of dosage forms.</li> </ul>
Pharmaceutical Microbiology	<ul style="list-style-type: none"> <li>• Understand methods of identification, cultivation and preservation of various microorganisms.</li> <li>• Importance of sterilization in microbiology and pharmaceutical industry.</li> <li>• Learn sterility testing of pharmaceutical products.</li> <li>• Microbiological standardization of Pharmaceuticals.</li> <li>• Understand the cell culture technology and its applications in pharmaceutical industries.</li> </ul>
Pharmaceutical Engineering	<ul style="list-style-type: none"> <li>• To know various unit operations used in Pharmaceutical industries.</li> <li>• To understand the material handling techniques.</li> <li>• To perform various processes involved in pharmaceutical manufacturing process.</li> <li>• To carry out various test to prevent environmental pollution.</li> <li>• To appreciate and comprehend significance of plant lay out design for optimum use of resources.</li> <li>• To appreciate the various preventive methods used for corrosion control in Pharmaceutical industries.</li> </ul>

<b>Fourth Semester</b>		
Pharmaceutical Chemistry III	Organic	<ul style="list-style-type: none"> <li>• Understand the methods of preparation and properties of organic compounds.</li> <li>• Explain the stereo chemical aspects of organic compounds and stereo chemical reactions.</li> <li>• Know the medicinal uses and other applications of organic compounds.</li> </ul>
Medicinal Chemistry I		<ul style="list-style-type: none"> <li>• Understand the chemistry of drugs with respect to their pharmacological activity.</li> <li>• Understand the drug metabolic pathways, adverse effect and therapeutic value of drugs.</li> <li>• Know the Structural Activity Relationship (SAR) of different class of drugs.</li> <li>• Write the chemical synthesis of some drugs.</li> </ul>
Physical Pharmaceutics II		<ul style="list-style-type: none"> <li>• Understand various physicochemical properties of drug molecules in the designing the dosage forms</li> <li>• Know the principles of chemical kinetics and to use them for stability testing and determination of expiry date of formulations</li> <li>• Demonstrate use of physicochemical properties in the formulation development and evaluation of dosage forms.</li> </ul>
Pharmacology I		<ul style="list-style-type: none"> <li>• Understand the pharmacological actions of different categories of drugs.</li> <li>• Explain the mechanism of drug action at organ system/sub cellular/ macromolecular levels.</li> <li>• Apply the basic pharmacological knowledge in the prevention and treatment of various diseases.</li> <li>• Observe the effect of drugs on animals by simulated experiments.</li> <li>• Appreciate correlation of pharmacology with other bio medical sciences.</li> </ul>
Pharmacognosy and Phytochemistry I		<ul style="list-style-type: none"> <li>• To know the techniques in the cultivation and production of crude drugs.</li> <li>• To know the crude drugs, their uses and chemical nature.</li> <li>• Know the evaluation techniques for the herbal drugs.</li> <li>• To carry out the microscopic and morphological evaluation of crude drugs</li> </ul>
<b>Fifth Semester</b>		
Medicinal Chemistry II		<ul style="list-style-type: none"> <li>• Understand the chemistry of drugs with respect to their pharmacological activity.</li> <li>• Understand the drug metabolic pathways, adverse effect and therapeutic value of drugs.</li> <li>• Know the Structural Activity Relationship of different class of drugs.</li> <li>• Study the chemical synthesis of selected drugs.</li> </ul>
Industrial Pharmacy I		<ul style="list-style-type: none"> <li>• Know the various pharmaceutical dosage forms and their manufacturing techniques.</li> </ul>



	<ul style="list-style-type: none"> <li>• Know various considerations in development of pharmaceutical dosage forms.</li> <li>• Formulate solid, liquid and semisolid dosage forms and evaluate them for their quality.</li> </ul>
Pharmacology II	<ul style="list-style-type: none"> <li>• Understand the mechanism of drug action and its relevance in the treatment of different diseases.</li> <li>• Demonstrate isolation of different organs/tissues from the laboratory animals by simulated experiments.</li> <li>• Demonstrate the various receptor actions using isolated tissue preparation.</li> <li>• Appreciate correlation of pharmacology with related medical sciences.</li> </ul>
Pharmacognosy and Phytochemistry II	<ul style="list-style-type: none"> <li>• To know the modern extraction techniques, characterization and identification of the herbal drugs and phytoconstituents.</li> <li>• To understand the preparation and development of herbal formulation.</li> <li>• To understand the herbal drug interactions.</li> <li>• To carryout isolation and identification of phytoconstituents.</li> </ul>
Pharmaceutical Jurisprudence	<ul style="list-style-type: none"> <li>• The Pharmaceutical legislations and their implications in the development and marketing of pharmaceuticals.</li> <li>• Various Indian pharmaceutical Acts and Laws.</li> <li>• The regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals.</li> <li>• The code of ethics during the pharmaceutical practice.</li> </ul>
<b>Sixth Semester</b>	
Medicinal Chemistry III	<ul style="list-style-type: none"> <li>• Understand the importance of drug design and different techniques of drug design.</li> <li>• Understand the chemistry of drugs with respect to their biological activity.</li> <li>• Know the metabolism, adverse effects and therapeutic value of drugs.</li> <li>• Know the importance of SAR of drugs.</li> </ul>
Pharmacology III	<ul style="list-style-type: none"> <li>• Understand the mechanism of drug action and its relevance in the treatment of different infectious diseases.</li> <li>• Comprehend the principles of toxicology and treatment of various poisonings.</li> <li>• Appreciate correlation of pharmacology with related medical sciences.</li> </ul>
Herbal Drug Technology	<ul style="list-style-type: none"> <li>• Understand raw material as source of herbal drugs from cultivation to herbal drug product.</li> <li>• Know the WHO and ICH guidelines for evaluation of herbal drugs.</li> <li>• Know the herbal cosmetics, natural sweeteners, and nutraceuticals.</li> <li>• Appreciate patenting of herbal drugs, GMP.</li> </ul>

Biopharmaceutics and Pharmacokinetics	<ul style="list-style-type: none"> <li>• Understand the basic concepts in biopharmaceutics and pharmacokinetics.</li> <li>• Use plasma data and derive the pharmacokinetic parameters to describe the process of drug absorption, distribution, metabolism and elimination.</li> <li>• Critically evaluate biopharmaceutic studies involving drug product equivalency and to understand the concepts of bioavailability and bioequivalence of drug products and their significance.</li> <li>• Design and evaluate dosage regimens of the drugs using pharmacokinetic and biopharmaceutic parameters.</li> <li>• Understand various pharmacokinetic parameters, their significance &amp; applications</li> </ul>
Pharmaceutical Biotechnology	<ul style="list-style-type: none"> <li>• Understanding the importance of Immobilized enzymes in Pharmaceutical Industries.</li> <li>• Genetic engineering applications in relation to production of pharmaceuticals.</li> <li>• Importance of Monoclonal antibodies in Industries.</li> <li>• Appreciate the use of microorganisms in fermentation technology.</li> </ul>
Quality Assurance	<ul style="list-style-type: none"> <li>• Understand the cGMP aspects in a pharmaceutical industry.</li> <li>• Appreciate the importance of documentation.</li> <li>• Understand the scope of quality certifications applicable to pharmaceutical industries.</li> <li>• Understand the responsibilities of QA &amp; QC departments.</li> </ul>
<b>Seventh Semester</b>	
Instrumental Methods of Analysis	<ul style="list-style-type: none"> <li>• Understand the interaction of matter with electromagnetic radiations and its applications in drug analysis.</li> <li>• Understand the chromatographic separation and analysis of drugs.</li> <li>• Perform quantitative &amp; qualitative analysis of drugs using various analytical instruments.</li> </ul>
Industrial Pharmacy II	<ul style="list-style-type: none"> <li>• Know the process of pilot plant and scale up of pharmaceutical dosage forms.</li> <li>• Understand the process of technology transfer from lab scale to commercial batch.</li> <li>• Know different Laws and Acts that regulate pharmaceutical industry.</li> <li>• Understand the approval process and regulatory requirements for drug products.</li> </ul>
Pharmacy Practice	<ul style="list-style-type: none"> <li>• Know various drug distribution methods in a hospital.</li> <li>• Appreciate the pharmacy stores management and inventory control.</li> <li>• Monitor drug therapy of patient through medication chart review and clinical review.</li> <li>• Obtain medication history interview and counsel the patients.</li> <li>• Identify drug related problems.</li> <li>• Detect and assess adverse drug reactions.</li> </ul>

	<ul style="list-style-type: none"> <li>• Interpret selected laboratory results (as monitoring parameters in therapeutics) of specific disease states.</li> <li>• Know pharmaceutical care services.</li> <li>• Do patient counseling in community pharmacy.</li> <li>• Appreciate the concept of rational drug therapy.</li> </ul>
Novel Drug Delivery System	<ul style="list-style-type: none"> <li>• To understand various approaches for development of novel drug delivery systems.</li> <li>• To understand the criteria for selection of drugs and polymers for the development of Novel drug delivery systems, their formulation and evaluation</li> </ul>
Practice School	<ul style="list-style-type: none"> <li>• Students acquire a skill to perform a project work.</li> <li>• Ability to compile data collected at their research work.</li> <li>• Ability to exhibit their presentation skills.</li> <li>• Ability to work in a team.</li> <li>• Students acquire skills to handle real time projects.</li> <li>• Ability to undertake assignments to perform in a team.</li> <li>• Develop necessary skills for presentations.</li> </ul>
<b>Eighth Semester</b>	
Biostatistics & Research Methodology	<ul style="list-style-type: none"> <li>• Know the operation of M.S. Excel, SPSS, R and MINITAB®, DoE (Design of Experiment).</li> <li>• Know the various statistical techniques to solve statistical problems.</li> <li>• Appreciate statistical techniques in solving the problems.</li> </ul>
Social & Preventive Pharmacy	<ul style="list-style-type: none"> <li>• Acquire high consciousness/realization of current issues related to health and pharmaceutical problems within the country and worldwide.</li> <li>• Have a critical way of thinking based on current healthcare development.</li> <li>• Evaluate alternative ways of solving problems related to health and pharmaceutical issues.</li> </ul>
Pharmaceutical Regulatory Science	<ul style="list-style-type: none"> <li>• Know about the process of drug discovery and development</li> <li>• Know the regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals</li> <li>• Know the regulatory approval process and their registration in Indian and international markets</li> </ul>
Advanced Instrumentation Techniques	<ul style="list-style-type: none"> <li>• Understand the advanced instruments used and its applications in drug analysis.</li> <li>• Understand the chromatographic separation and analysis of drugs.</li> <li>• Understand the calibration of various analytical instruments</li> <li>• Know analysis of drugs using various analytical instruments.</li> </ul>
Dissertation on Project Work	<ul style="list-style-type: none"> <li>• Students acquire a skill to perform a project work.</li> <li>• Ability to compile data collected at their research work.</li> <li>• Ability to exhibit their presentation skills.</li> <li>• Ability to work in a team.</li> </ul>

**Program: Pharm D**

Course Title	Course Outcome
<b>First Year</b>	
Human Anatomy and Physiology	<ul style="list-style-type: none"> <li>• To describe the structure (gross and histology) and functions of various organs of the human body.</li> <li>• Describe the various homeostatic mechanisms and their imbalances of various systems.</li> <li>• Identify the various tissues and organs of the different systems of the human body.</li> <li>• Perform the hematological tests and also record blood pressure, heart rate, pulse and Respiratory volumes.</li> <li>• Appreciate coordinated working pattern of different organs of each system.</li> <li>• Appreciate the interlinked mechanisms in the maintenance of normal functioning (homeostasis) of human body.</li> </ul>
Pharmaceutics	<ul style="list-style-type: none"> <li>• Know the formulation aspects of different dosage forms.</li> <li>• Do different pharmaceutical calculation involved in formulation.</li> <li>• Formulate different types of dosage forms.</li> <li>• Appreciate the importance of good formulation for effectiveness.</li> </ul>
Medicinal Biochemistry	<ul style="list-style-type: none"> <li>• Understand the catalytic activity of enzymes and importance of isoenzymes in diagnosis of diseases.</li> <li>• Know the metabolic process of biomolecules in health and illness (metabolic disorders)</li> <li>• Understand the genetic organization of mammalian genome; protein synthesis; replication; mutation and repair mechanism.</li> <li>• Know the biochemical principles of organ function tests of kidney, liver and endocrine gland.</li> <li>• Do the qualitative analysis and determination of biomolecules in the body fluids.</li> </ul>
Pharmaceutical Organic Chemistry	<ul style="list-style-type: none"> <li>• Some important physical properties of organic compounds.</li> <li>• Free radical/ nucleophilic [alkyl/ acyl/ aryl] /electrophilic substitution, free radical/ nucleophilic / electrophilic addition, elimination, oxidation and reduction reactions with mechanism, orientation of the reaction, order of reactivity, stability of compounds.</li> <li>• Some named organic reactions with mechanisms; and e. Methods of preparation, test for purity, principle involved in the assay, important medicinal uses of some important organic compounds.</li> </ul>
Pharmaceutical Inorganic Chemistry	<ul style="list-style-type: none"> <li>• Understand the principles and procedures of analysis of drugs and also regarding the application of inorganic pharmaceuticals.</li> <li>• Know the analysis of the inorganic pharmaceuticals their applications.</li> <li>• Appreciate the importance of inorganic pharmaceuticals in</li> </ul>

	preventing and curing the disease.
Remedial Mathematics	<ul style="list-style-type: none"> <li>• Know Trigonometry, Analytical geometry, Matrices, Determinant, Integration, Differential equation, Laplace transform and their applications.</li> <li>• Solve the problems of different types by applying theory.</li> <li>• Appreciate the important applications of mathematics in pharmacy.</li> </ul>
Remedial Biology	<ul style="list-style-type: none"> <li>• Know the classification and salient features of five kingdoms of life.</li> <li>• Understand the basic components of anatomy &amp; physiology of plant.</li> <li>• Know understand the basic components of anatomy &amp; physiology animal with special reference to human.</li> </ul>
<b>Second Year</b>	
Pathophysiology	<ul style="list-style-type: none"> <li>• Describe the etiology and pathogenesis of the selected disease states.</li> <li>• Name the signs and symptoms of the diseases.</li> <li>• Mention the complications of the diseases.</li> </ul>
Pharmaceutical Microbiology	<ul style="list-style-type: none"> <li>• Pharmaceutical Microbiology- a. know the anatomy, identification, growth factors and sterilization of microorganisms; b. know the mode of transmission of disease causing microorganism, symptoms of disease, and treatment aspect; c. do estimation of RNA and DNA and there by identifying the source; d. do cultivation and identification of the microorganisms in the laboratory; e. do identification of diseases by performing the diagnostic tests; and f. appreciate the behavior of motility and behavioral characteristics of microorganisms.</li> </ul>
Pharmacognosy & Phytopharmaceuticals	<ul style="list-style-type: none"> <li>• Understand the basic principles of cultivation, collection and storage of crude drugs.</li> <li>• Know the source, active constituents and uses of crude drugs.</li> <li>• Appreciate the applications of primary and secondary metabolites of the plant.</li> </ul>
Pharmacology-I	<ul style="list-style-type: none"> <li>• Understand the pharmacological aspects of drugs falling under the above mentioned chapters.</li> <li>• Handle and carry out the animal experiments.</li> <li>• Appreciate the importance of pharmacology subject as a basis of therapeutics.</li> <li>• Correlate and apply the knowledge therapeutically.</li> </ul>
Community Pharmacy	<ul style="list-style-type: none"> <li>• Know pharmaceutical care services.</li> <li>• Know the business and professional practice management skills in community pharmacies.</li> <li>• Do patient counselling &amp; provide health screening services to</li> </ul>

	<p>public in community pharmacy.</p> <ul style="list-style-type: none"> <li>• Respond to minor ailments and provide appropriate medication.</li> <li>• Show empathy and sympathy to patients.</li> <li>• Appreciate the concept of Rational drug therapy.</li> </ul>
Pharmacotherapeutics	<ul style="list-style-type: none"> <li>• The pathophysiology of selected disease states and the rationale for drug therapy.</li> <li>• The therapeutic approach to management of these diseases.</li> <li>• The controversies in drug therapy.</li> <li>• The importance of preparation of individualised therapeutic plans based on diagnosis.</li> <li>• Needs to identify the patient-specific parameters relevant in initiating drug therapy, and monitoring therapy (including alternatives, time-course of clinical and laboratory indices of therapeutic response and adverse effects).</li> <li>• Describe the pathophysiology of selected disease states and explain the rationale for drug therapy.</li> <li>• Summarise the therapeutic approach to management of these diseases including reference to the latest available evidence.</li> <li>• Discuss the controversies in drug therapy.</li> <li>• Discuss the preparation of individualised therapeutic plans based on diagnosis;</li> <li>• Identify the patient-specific parameters relevant in initiating drug therapy, and monitoring therapy (including alternatives, time-course of clinical and laboratory indices of therapeutic response and adverse effects).</li> </ul>
<b>Third Year</b>	
Pharmacology-II	<ul style="list-style-type: none"> <li>• Understand the pharmacological aspects of drugs falling under the above mentioned chapters.</li> <li>• Carry out the animal experiments confidently.</li> <li>• Appreciate the importance of pharmacology subject as a basis of therapeutics.</li> <li>• Correlate and apply the knowledge therapeutically.</li> </ul>
Pharmaceutical Analysis	<ul style="list-style-type: none"> <li>• Introduction, sources of quality variation, control of quality variation.</li> <li>• Concept of statistical quality control.</li> <li>• Validation methods- quality of equipment, validation of equipment and validation of analytical instruments and calibration.</li> <li>• GLP, ISO 9000.</li> <li>• Total quality management, quality review and documentation.</li> <li>• ICH- international conference for harmonization-guidelines.</li> <li>• Regulatory control.</li> </ul>
Pharmacotherapeutics-II	<ul style="list-style-type: none"> <li>• Know the pathophysiology of selected disease states and the rationale for drug therapy</li> <li>• Know the therapeutic approach to management of these diseases.</li> <li>• Know the controversies in drug therapy.</li> </ul>

	<ul style="list-style-type: none"> <li>• Know the importance of preparation of Individualized therapeutic plans based on diagnosis.</li> <li>• Appreciate the needs to identify the patient-specific parameters relevant in initiating drug therapy, and monitoring therapy (including alternatives, time-course of clinical and laboratory indices of therapeutic response and adverse effects).</li> </ul>
Pharmaceutical Jurisprudence	<ul style="list-style-type: none"> <li>• Practice the Professional ethics.</li> <li>• Understand the various concepts of the pharmaceutical legislation in India.</li> <li>• Know the various parameters in the Drug and Cosmetic Act and rules.</li> <li>• Know the Drug policy, DPCO, Patent and design act.</li> <li>• Understand the labeling requirements and packaging guidelines for drugs and cosmetics.</li> <li>• Be able to understand the concepts of Dangerous Drugs Act, Pharmacy Act and Excise duties Act.</li> <li>• Other laws as prescribed by the Pharmacy Council of India from time to time including International Laws</li> </ul>
Medicinal Chemistry	<ul style="list-style-type: none"> <li>• Modern concept of rational drug design: A brief introduction to Quantitative Structure Activity Relationship (QSAR), prodrug, combinatorial chemistry and computer aided drug design (CADD) and concept of antisense molecules.</li> <li>• A study of the development of the following classes of drugs including SAR, mechanism of action, synthesis of important compounds, chemical nomenclature, brand names of important marketed products and their side effects.</li> </ul>
Pharmaceutical Formulations	<ul style="list-style-type: none"> <li>• Understand the principle involved in formulation of various pharmaceutical dosage forms.</li> <li>• Prepare various pharmaceutical formulation.</li> <li>• Perform evaluation of pharmaceutical dosage forms.</li> <li>• Understand and appreciate the concept of bioavailability and bioequivalence, their role in clinical situations.</li> </ul>
<b>Fourth Year</b>	
Pharmacotherapeutics-III	<ul style="list-style-type: none"> <li>• The pathophysiology of selected disease states and the rationale for drug therapy</li> <li>• The therapeutic approach to management of these diseases.</li> <li>• The controversies in drug therapy.</li> <li>• The importance of preparation of Individualized therapeutic plans based on diagnosis.</li> <li>• Needs to identify the patient-specific parameters relevant in initiating drug therapy, and monitoring therapy (including alternatives, time-course of clinical and laboratory indices of therapeutic response and adverse effects).</li> <li>• Describe the pathophysiology of selected disease states and explain the rationale for drug therapy.</li> <li>• To summarize the therapeutic approach to management of these diseases including reference to the latest available evidence.</li> <li>• To discuss the controversies in drug therapy.</li> </ul>

	<ul style="list-style-type: none"> <li>• To discuss the preparation of Individualized therapeutic plans based on diagnosis.</li> <li>• Identify the patient-specific parameters relevant in initiating drug therapy, and monitoring therapy (including alternatives, time-course of clinical and laboratory indices of therapeutic response and adverse effects).</li> </ul>
Hospital Pharmacy	<ul style="list-style-type: none"> <li>• Know various drug distribution methods.</li> <li>• Know the professional practice management skills in hospital pharmacies.</li> <li>• Provide unbiased drug information to the doctors.</li> <li>• Know the manufacturing practices of various formulations in hospital set up.</li> <li>• Appreciate the practice based research methods.</li> <li>• Appreciate the stores management and inventory control.</li> </ul>
Clinical Pharmacy	<ul style="list-style-type: none"> <li>• Monitor drug therapy of patient through medication chart review and clinical review.</li> <li>• Obtain medication history interview and counsel the patients</li> <li>• Identify and resolve drug related problems.</li> <li>• Detect, assess and monitor adverse drug reaction.</li> <li>• Interpret selected laboratory results (as monitoring parameters in therapeutics) of specific disease states</li> <li>• Retrieve, analyse, interpret and formulate drug or medicine information.</li> </ul>
Biostatistics & Research Methodology	<ul style="list-style-type: none"> <li>• Types of clinical study designs: Case studies, observational studies, interventional studies.</li> <li>• Designing the methodology.</li> <li>• Sample size determination and Power of a study Determination of sample size for simple comparative experiments, determination of sample size to obtain a confidence interval of specified width, power of a study.</li> <li>• Report writing and presentation of data</li> </ul>
Biopharmaceutics & Pharmacokinetics	<ul style="list-style-type: none"> <li>• Absorption of drugs from gastrointestinal tract.</li> <li>• Drug Distribution.</li> <li>• Drug Elimination.</li> <li>• Introduction to Pharmacokinetics.</li> <li>• Mathematical model</li> <li>• Drug levels in blood.</li> <li>• Pharmacokinetic model</li> <li>• Compartment models</li> <li>• Pharmacokinetic study.</li> <li>• One compartment open model.</li> <li>• Intravenous Injection (Bolus)</li> <li>• Intravenous infusion.</li> </ul>
Clinical Toxicology	<ul style="list-style-type: none"> <li>• General principles involved in the management of poisoning.</li> <li>• Antidotes and the clinical applications.</li> <li>• Supportive care in clinical Toxicology.</li> <li>• Gut Decontamination.</li> <li>• Elimination Enhancement.</li> <li>• Toxicokinetics.</li> </ul>



	<ul style="list-style-type: none"> <li>• Clinical symptoms and management of acute poisoning.</li> <li>• Pesticide poisoning.</li> </ul>
<b>Fifth Year</b>	
Clinical Research	<ul style="list-style-type: none"> <li>• Introduction Various Approaches to drug discovery .</li> <li>• Pharmacological</li> <li>• Toxicological</li> <li>• IND Application</li> <li>• Drug characterization</li> <li>• Dosage form.</li> <li>• Introduction to Clinical trials</li> <li>• Various phases of clinical trial.</li> <li>• Methods of post marketing surveillance.</li> <li>• Abbreviated New Drug Application submission.</li> <li>• Good Clinical Practice – ICH, GCP, Central drug standard control organisation (CDSCO) guidelines.</li> <li>• Challenges in the implementation of guidelines.</li> <li>• Ethical guidelines in Clinical Research.</li> <li>• Composition, responsibilities, procedures of IRB / IEC.</li> <li>• Overview of regulatory environment in USA, Europe and India.</li> <li>• Role and responsibilities of clinical trial personnel as per ICH GCP.</li> </ul>
Pharmacoepidemiology and Pharmacoeconomics	<ul style="list-style-type: none"> <li>• Origin and evaluation of pharmacoepidemiology need for pharmacoepidemiology, aims and applications, Outcome measure and drug use measures Prevalence, incidence and incidence rate.</li> <li>• Monetary units, number of prescriptions, units of drugs dispensed, defined daily doses and prescribed daily doses, medication adherence measurement, Measurement of risk, attributable risk and relative risk, time-risk relationship and odds ratio, Includes theoretical aspects of various methods and practical study of various methods with the help of case studies for individual methods Drug utilization review, case reports, case series, surveys of drug use, cross – sectional studies, cohort studies, case control studies, case –cohort studies, meta – analysis studies, spontaneous reporting, prescription event monitoring and record linkage system.</li> </ul>
Clinical Pharmacokinetics & Pharmacotherapeutic Drug Monitoring	<ul style="list-style-type: none"> <li>• Nomograms and Tabulations in designing dosage regimen, Conversion from intravenous to oral dosing, Determination of dose and dosing intervals, Drug dosing in the elderly and pediatrics and obese patients, Pharmacokinetic drug interactions.</li> <li>• Inhibition and Induction of Drug metabolism</li> <li>• Inhibition of Biliary Excretion, Introduction, Individualization of drug dosage regimen (Variability – Genetic, Age and Weight, disease, Interacting drugs). Indications for TDM. Protocol for TDM. Pharmacokinetic/Pharmacodynamic Correlation in drug therapy. TDM of drugs used in the following disease conditions: cardiovascular disease, Seizure</li> </ul>

	disorders, Psychiatric conditions, and Organ transplantations.
Clerkship *	
Project work (Six Months)	<ul style="list-style-type: none"> <li>• Students acquire a skill to perform a project work.</li> <li>• Ability to compile data collected at their research work.</li> <li>• Ability to exhibit their presentation skills.</li> <li>• Ability to work in a team.</li> </ul>
<b>Sixth Year</b>	
Internship or residency training including postings in speciality units.	<ul style="list-style-type: none"> <li>• Students acquire a skill to perform a clinical working.</li> <li>• Ability to collect data for their research work.</li> <li>• Ability to exhibit their presentation skills.</li> <li>• Ability to work in a team.</li> <li>• Ability to handle the patient.</li> </ul>

### Program: M. Pharmacy (Pharmaceutics)

Course Title	Course Outcome
<b>First Semester</b>	
Modern Pharmaceutical Analytical Techniques	To know about: <ul style="list-style-type: none"> <li>• Chemicals and Excipients</li> <li>• The analysis of various drugs in single and combination dosage forms.</li> <li>• Theoretical and practical skills of the instruments</li> </ul>
Drug Delivery System	<ul style="list-style-type: none"> <li>• The various approaches for development of novel drug delivery systems.</li> <li>• The criteria for selection of drugs and polymers for the development of delivering system.</li> <li>• The formulation and evaluation of Novel drug delivery systems.</li> </ul>
Modern Pharmaceutics	<ul style="list-style-type: none"> <li>• The elements of preformulation studies.</li> <li>• The Active Pharmaceutical Ingredients and Generic drug Product development.</li> <li>• Industrial Management and GMP Considerations.</li> <li>• Optimization Techniques &amp; Pilot Plant Scale Up Techniques.</li> <li>• Stability Testing, sterilization process &amp; packaging of dosage forms.</li> </ul>
Regulatory Affair	<ul style="list-style-type: none"> <li>• To know the chemistry, manufacturing controls and their regulatory importance.</li> <li>• To learn the documentation requirements.</li> <li>• The Concepts of innovator and generic drugs, drug development Process.</li> <li>• The Regulatory guidance's and guidelines for filing and approval process.</li> <li>• Preparation of Dossiers and their submission to regulatory agencies in different countries.</li> <li>• Post approval regulatory requirements for actives and drug</li> </ul>

	<p>products.</p> <ul style="list-style-type: none"> <li>• Submission of global documents in CTD/ eCTD formats.</li> <li>• Clinical trials requirements for approvals for conducting clinical trials.</li> <li>• Pharmacovigilance and process of monitoring in clinical trials.</li> </ul>
<b>Second Semester</b>	
Molecular Pharmaceutics (Nano Tech and Targeted DDS)	<ul style="list-style-type: none"> <li>• The various approaches for development of novel drug delivery systems.</li> <li>• The criteria for selection of drugs and polymers for the development of NTDS</li> <li>• The formulation and evaluation of novel drug delivery systems.</li> </ul>
Advanced Biopharmaceutics & Pharmacokinetics	<ul style="list-style-type: none"> <li>• The basic concepts in biopharmaceutics and pharmacokinetics.</li> <li>• The use raw data and derive the pharmacokinetic models and parameters the best describe the process of drug absorption, distribution, metabolism and elimination.</li> <li>• The critical evaluation of biopharmaceutic studies involving drug product equivalency.</li> <li>• The design and evaluation of dosage regimens of the drugs using pharmacokinetic and biopharmaceutic parameters.</li> <li>• The potential clinical pharmacokinetic problems and application of basics of pharmacokinetic</li> </ul>
Computer Aided Drug Delivery System	<ul style="list-style-type: none"> <li>• History of Computers in Pharmaceutical Research and Development.</li> <li>• Computational Modeling of Drug Disposition.</li> <li>• Computers in Preclinical Development.</li> <li>• Optimization Techniques in Pharmaceutical Formulation.</li> <li>• Computers in Market Analysis.</li> <li>• Computers in Clinical Development.</li> <li>• Artificial Intelligence (AI) and Robotics.</li> <li>• Computational fluid dynamics(CFD).</li> </ul>
Cosmetic and Cosmeceuticals	<ul style="list-style-type: none"> <li>• Key ingredients used in cosmetics and cosmeceuticals.</li> <li>• Key building blocks for various formulations.</li> <li>• Current technologies in the market.</li> <li>• Various key ingredients and basic science to develop cosmetics and cosmeceuticals.</li> <li>• Scientific knowledge to develop cosmetics and cosmeceuticals with desired Safety, stability, and efficacy.</li> </ul>
<b>Third and Fourth Semester</b>	
Research Methodology and Biostatistics	<ul style="list-style-type: none"> <li>• To have knowledge on various kinds of research questions and research designs</li> <li>• To have basic knowledge on qualitative, quantitative and mixed methods research, as well as relevant ethical and philosophical considerations</li> <li>• Able to formulate research questions and develop a sufficiently coherent research design</li> <li>• Able to assess the appropriateness of different kinds of research designs and methodology, for instance in terms of their</li> </ul>

	<p>appropriateness, transparency and quality.</p> <ul style="list-style-type: none"> <li>To develop independent thinking for critically analyzing research reports.</li> </ul>
Journal club	<ul style="list-style-type: none"> <li>To critically appraise the literature.</li> <li>To develop an approach to the analysis of the various types of articles.</li> <li>To understand the basis of hypothesis testing.</li> <li>To understand how results of study can be used in pharmaceutical research</li> </ul>
Research Work	<ul style="list-style-type: none"> <li>Describe the fundamental concepts in pharmaceutical sciences and apply their basic science knowledge to pharmaceutical science applications.</li> <li>Design, implement, and perform independent and original research in an area of pharmaceutical sciences.</li> <li>Analyze and present experimental results of research in pharmaceutical sciences.</li> <li>Identify problems in their research, provide strategy to analyze the problems, and solve the problems.</li> <li>Evaluate relevant literature to identify new approaches in research.</li> <li>Create new knowledge from the existing knowledge in pharmaceutical sciences.</li> <li>Develop effective written communication and oral presentation skills to defend the findings to the pharmaceutical science community.</li> <li>Learn a research topic independently using the scientific literature with the science knowledge they obtained and the skills they developed in the program.</li> </ul>

### M. Pharmacy (Pharmaceutical Chemistry)

Course Title	Course Outcome
<b>First Semester</b>	
Modern Pharmaceutical Analytical Techniques	<p>To know about:</p> <ul style="list-style-type: none"> <li>Chemicals and Excipients</li> <li>The analysis of various drugs in single and combination dosage forms</li> <li>Theoretical and practical skills of the instruments</li> </ul>
Advanced Organic Chemistry	<ul style="list-style-type: none"> <li>The principles and applications of retrosynthesis.</li> <li>The mechanism &amp; applications of various named reactions.</li> <li>The concept of disconnection to develop synthetic routes for small target molecule.</li> <li>The various catalysts used in organic reactions.</li> <li>The chemistry of heterocyclic compounds</li> </ul>
Advanced Medicinal chemistry	<ul style="list-style-type: none"> <li>Different stages of drug discovery.</li> <li>Role of medicinal chemistry in drug research.</li> <li>Different techniques for drug discovery.</li> </ul>

	<ul style="list-style-type: none"> <li>• Various strategies to design and develop new drug like molecules for biological targets.</li> <li>• Peptidomimetics</li> </ul>
Chemistry of Natural Products	<ul style="list-style-type: none"> <li>• Different types of natural compounds and their chemistry and medicinal importance.</li> <li>• The importance of natural compounds as lead molecules for new drug discovery.</li> <li>• The concept of rDNA technology tool for new drug discovery.</li> <li>• General methods of structural elucidation of compounds of natural origin.</li> <li>• Isolation, purification and characterization of simple chemical constituents from natural source</li> </ul>
<b>Second Semester</b>	
Advanced Spectral Analysis	<ul style="list-style-type: none"> <li>• Interpretation of the NMR, Mass and IR spectra of various organic compounds.</li> <li>• Theoretical and practical skills of the hyphenated instruments.</li> <li>• Identification of organic compounds.</li> </ul>
Advanced Organic Chemistry	<ul style="list-style-type: none"> <li>• The principles and applications of Green chemistry.</li> <li>• The concept of peptide chemistry.</li> <li>• The various catalysts used in organic reactions.</li> <li>• The concept of stereochemistry and asymmetric synthesis.</li> </ul>
Computer Aided Drug Design	<ul style="list-style-type: none"> <li>• Role of CADD in drug discovery.</li> <li>• Different CADD techniques and their applications.</li> <li>• Various strategies to design and develop new drug like molecules.</li> <li>• Working with molecular modeling softwares to design new drug molecules.</li> <li>• The in silico virtual screening protocols.</li> </ul>
Pharmaceutical Process Chemistry	<ul style="list-style-type: none"> <li>• The strategies of scale up process of APIs and intermediates.</li> <li>• The various unit operations and various reactions in process chemistry</li> </ul>
<b>Third and Fourth Semester</b>	
Research Methodology and Biostatistics	<ul style="list-style-type: none"> <li>• To have knowledge on various kinds of research questions and research designs</li> <li>• To have basic knowledge on qualitative, quantitative and mixed methods research, as well as relevant ethical and philosophical considerations</li> <li>• Able to formulate research questions and develop a sufficiently coherent research design</li> <li>• Able to assess the appropriateness of different kinds of research designs and methodology, for instance in terms of their appropriateness, transparency and quality.</li> <li>• To develop independent thinking for critically analyzing research reports.</li> </ul>
Journal club	<ul style="list-style-type: none"> <li>• To critically appraise the literature.</li> <li>• To develop an approach to the analysis of the various types of articles.</li> </ul>

	<ul style="list-style-type: none"> <li>• To understand the basis of hypothesis testing.</li> <li>• To understand how results of study can be used in pharmaceutical research</li> </ul>
Research Work	<ul style="list-style-type: none"> <li>• Describe the fundamental concepts in pharmaceutical sciences and apply their basic science knowledge to pharmaceutical science applications.</li> <li>• Design, implement, and perform independent and original research in an area of pharmaceutical sciences.</li> <li>• Analyze and present experimental results of research in pharmaceutical sciences.</li> <li>• Identify problems in their research, provide strategy to analyze the problems, and solve the problems.</li> <li>• Evaluate relevant literature to identify new approaches in research.</li> <li>• Create new knowledge from the existing knowledge in pharmaceutical sciences.</li> <li>• Develop effective written communication and oral presentation skills to defend the findings to the pharmaceutical science community.</li> <li>• Learn a research topic independently using the scientific literature with the science knowledge they obtained and the skills they developed in the program.</li> </ul>

#### **M. Pharmacy (Pharmaceutical Analysis)**

<b>Course Title</b>	<b>Course Outcome</b>
<b>First Semester</b>	
Modern Pharmaceutical Analytical Techniques	<p>To know about:</p> <ul style="list-style-type: none"> <li>• Chemicals and Excipients</li> <li>• The analysis of various drugs in single and combination dosage forms.</li> <li>• Theoretical and practical skills of the instruments.</li> </ul>
Advanced Pharmaceutical Analysis	<ul style="list-style-type: none"> <li>• Appropriate analytical skills required for the analytical method development.</li> <li>• Principles of various reagents used in functional group analysis that renders necessary support in research methodology and demonstrates its application in the practical related problems.</li> <li>• Analysis of impurities in drugs, residual solvents and stability studies of drugs and biological products.</li> </ul>
Pharmaceutical Validation	<ul style="list-style-type: none"> <li>• Explain the aspect of validation.</li> <li>• Carryout validation of manufacturing processes.</li> <li>• Apply the knowledge of validation to instruments and equipments.</li> <li>• Validate the manufacturing facilities.</li> </ul>
Food Analysis	<p>Able to understand various analytical techniques in the determination of-</p> <ul style="list-style-type: none"> <li>• Food constituents.</li> <li>• Food additives.</li> <li>• Finished food products.</li> </ul>

	<ul style="list-style-type: none"> <li>• Pesticides in food.</li> <li>• And also student shall have the knowledge on food regulations and legislations.</li> </ul>
<b>Second Semester</b>	
Advanced Instrumental Analysis	<ul style="list-style-type: none"> <li>• Interpretation of the NMR, Mass and IR spectra of various organic compounds.</li> <li>• Theoretical and practical skills of the hyphenated instruments.</li> <li>• Identification of organic compounds.</li> </ul>
Modern Bio-Analytical Techniques	<ul style="list-style-type: none"> <li>• Extraction of drugs from biological samples.</li> <li>• Separation of drugs from biological samples using different techniques.</li> <li>• Guidelines for BA/BE studies.</li> </ul>
Quality Control and Quality Assurance	<ul style="list-style-type: none"> <li>• The cGMP aspects in a pharmaceutical industry.</li> <li>• To appreciate the importance of documentation.</li> <li>• To understand the scope of quality certifications applicable to Pharmaceutical industries.</li> <li>• To understand the responsibilities of QA &amp; QC departments.</li> </ul>
Herbal and Cosmetic Analysis	<ul style="list-style-type: none"> <li>• Determination of herbal remedies and regulations.</li> <li>• Analysis of natural products and monographs.</li> <li>• Determination of Herbal drug-drug interaction.</li> <li>• Principles of performance evaluation of cosmetic products.</li> </ul>
<b>Third and Fourth Semester</b>	
Research Methodology and Biostatistics	<ul style="list-style-type: none"> <li>• To have knowledge on various kinds of research questions and research designs.</li> <li>• To have basic knowledge on qualitative, quantitative and mixed methods research, as well as relevant ethical and philosophical considerations.</li> <li>• Able to formulate research questions and develop a sufficiently coherent research design.</li> <li>• Able to assess the appropriateness of different kinds of research designs and methodology, for instance in terms of their appropriateness, transparency and quality.</li> <li>• To develop independent thinking for critically analyzing research reports.</li> </ul>
Journal club	<ul style="list-style-type: none"> <li>• To critically appraise the literature.</li> <li>• To develop an approach to the analysis of the various types of articles.</li> <li>• To understand the basis of hypothesis testing.</li> <li>• To understand how results of study can be used in pharmaceutical research.</li> </ul>
Research Work	<ul style="list-style-type: none"> <li>• Describe the fundamental concepts in pharmaceutical sciences and apply their basic science knowledge to pharmaceutical science applications.</li> <li>• Design, implement, and perform independent and original research in an area of pharmaceutical sciences.</li> <li>• Analyze and present experimental results of research in pharmaceutical sciences.</li> </ul>

	<ul style="list-style-type: none"> <li>• Identify problems in their research, provide strategy to analyze the problems, and solve the problems.</li> <li>• Evaluate relevant literature to identify new approaches in research. • Create new knowledge from the existing knowledge in pharmaceutical sciences.</li> <li>• Develop effective written communication and oral presentation skills to defend the findings to the pharmaceutical science community.</li> <li>• Learn a research topic independently using the scientific literature with the science knowledge they obtained and the skills they developed in the program.</li> </ul>
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### **M. Pharmacy (Pharmaceutical Quality Assurance)**

<b>Course Title</b>	<b>Course Outcome</b>
<b>First Semester</b>	
Modern Pharmaceutical Analytical Techniques	To know about: <ul style="list-style-type: none"> <li>• Chemicals and Excipients</li> <li>• The analysis of various drugs in single and combination dosage forms.</li> <li>• Theoretical and practical skills of the instruments.</li> </ul>
Quality Management System	<ul style="list-style-type: none"> <li>• The importance of quality.</li> <li>• ISO management systems.</li> <li>• Tools for quality improvement.</li> <li>• Analysis of issues in quality.</li> <li>• Quality evaluation of pharmaceuticals.</li> <li>• Stability testing of drug and drug substances.</li> <li>• Statistical approaches for quality.</li> </ul>
Quality Control and Quality Assurance	<ul style="list-style-type: none"> <li>• Understand the cGMP aspects in a pharmaceutical industry.</li> <li>• To appreciate the importance of documentation.</li> <li>• To understand the scope of quality certifications applicable to pharmaceutical industries.</li> <li>• To understand the responsibilities of QA &amp; QC departments.</li> </ul>
Product Development and Technology Transfer	<ul style="list-style-type: none"> <li>• To understand the new product development process.</li> <li>• To understand the necessary information to transfer technology from R&amp;D to actual manufacturing by sorting out various information obtained during R&amp;D.</li> <li>• To elucidate necessary information to transfer technology of existing products between various manufacturing places.</li> </ul>
<b>Second Semester</b>	
Hazards and Safety Management	<ul style="list-style-type: none"> <li>• Understand about environmental problems among learners.</li> <li>• Impart basic knowledge about the environment and its allied problems.</li> <li>• Develop an attitude of concern for the industry environment.</li> <li>• Ensure safety standards in pharmaceutical industry.</li> <li>• Provide comprehensive knowledge on the safety management.</li> </ul>



	<ul style="list-style-type: none"> <li>• Empower an ideas to clear mechanism and management in different kinds of hazard management system.</li> <li>• Teach the method of Hazard assessment, procedure, methodology for provide safe industrial atmosphere.</li> </ul>
Pharmaceutical Validation	<ul style="list-style-type: none"> <li>• The concepts of calibration, qualification and validation.</li> <li>• The qualification of various equipments and instruments.</li> <li>• Process validation of different dosage forms.</li> <li>• Validation of analytical method for estimation of drugs.</li> <li>• Cleaning validation of equipments employed in the manufacture of pharmaceuticals.</li> </ul>
Audits and Regulatory Compliance	<ul style="list-style-type: none"> <li>• To understand the importance of auditing.</li> <li>• To understand the methodology of auditing.</li> <li>• To carry out the audit process.</li> <li>• To prepare the auditing report.</li> <li>• To prepare the check list for auditing</li> </ul>
Pharmaceutical Manufacturing Technology	<ul style="list-style-type: none"> <li>• The common practice in the pharmaceutical industry developments, plant layout and production planning.</li> <li>• Will be familiar with the principles and practices of aseptic process technology, non sterile manufacturing technology and packaging technology.</li> <li>• Have a better understanding of principles and implementation of Quality by design (QbD) and process analytical technology (PAT) in pharmaceutical manufacturing.</li> </ul>
<b>Third and Fourth Semester</b>	
Research Methodology and Biostatistics	<ul style="list-style-type: none"> <li>• To have knowledge on various kinds of research questions and research designs.</li> <li>• To have basic knowledge on qualitative, quantitative and mixed methods research, as well as relevant ethical and philosophical considerations.</li> <li>• Able to formulate research questions and develop a sufficiently coherent research design.</li> <li>• Able to assess the appropriateness of different kinds of research designs and methodology, for instance in terms of their appropriateness, transparency and quality.</li> <li>• To develop independent thinking for critically analyzing research reports.</li> </ul>
Journal club	<ul style="list-style-type: none"> <li>• To critically appraise the literature.</li> <li>• To develop an approach to the analysis of the various types of articles.</li> <li>• To understand the basis of hypothesis testing.</li> <li>• To understand how results of study can be used in pharmaceutical research.</li> </ul>
Research Work	<ul style="list-style-type: none"> <li>• Describe the fundamental concepts in pharmaceutical sciences and apply their basic science knowledge to pharmaceutical science applications.</li> <li>• Design, implement, and perform independent and original research in an area of pharmaceutical sciences.</li> </ul>

	<ul style="list-style-type: none"> <li>Analyze and present experimental results of research in pharmaceutical sciences.</li> <li>Identify problems in their research, provide strategy to analyze the problems, and solve the problems.</li> <li>Evaluate relevant literature to identify new approaches in research.</li> <li>Create new knowledge from the existing knowledge in pharmaceutical sciences.</li> <li>Develop effective written communication and oral presentation skills to defend the findings to the pharmaceutical science community.</li> <li>Learn a research topic independently using the scientific literature with the science knowledge they obtained and the skills they developed in the program.</li> </ul>
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### **M. Pharmacy (Pharmacology)**

<b>Course Title</b>	<b>Course Outcome</b>
<b>First Semester</b>	
Modern Pharmaceutical Analytical Techniques	To know about: <ul style="list-style-type: none"> <li>Chemicals and Excipients.</li> <li>The analysis of various drugs in single and combination dosage forms.</li> <li>Theoretical and practical skills of the instruments.</li> </ul>
Advanced Pharmacology - I	<ul style="list-style-type: none"> <li>Discuss the pathophysiology and pharmacotherapy of certain diseases.</li> <li>Explain the mechanism of drug actions at cellular and molecular level.</li> <li>Understand the adverse effects, contraindications and clinical uses of drugs used in treatment of diseases.</li> </ul>
Pharmacological and Toxicological Screening Methods-I	<ul style="list-style-type: none"> <li>Appraise the regulations and ethical requirement for the usage of experimental animals.</li> <li>Describe the various animals used in the drug discovery process and good laboratory practices in maintenance and handling of experimental animals.</li> <li>Describe the various newer screening methods involved in the drug discovery process.</li> <li>Appreciate and correlate the preclinical data to humans.</li> </ul>
Cellular and Molecular Pharmacology	<ul style="list-style-type: none"> <li>Explain the receptor signal transduction processes.</li> <li>Explain the molecular pathways affected by drugs.</li> <li>Appreciate the applicability of molecular pharmacology and biomarkers in drug discovery process.</li> <li>Demonstrate molecular biology techniques as applicable for pharmacology.</li> </ul>
<b>Second Semester</b>	
Advanced Pharmacology - II	<ul style="list-style-type: none"> <li>Explain the mechanism of drug actions at cellular and molecular level.</li> <li>Discuss the Pathophysiology and pharmacotherapy of certain diseases.</li> </ul>

	<ul style="list-style-type: none"> <li>• Understand the adverse effects, contraindications and clinical uses of drugs used in treatment of diseases.</li> </ul>
Pharmacological and Toxicological Screening Methods-II	<ul style="list-style-type: none"> <li>• Explain the various types of toxicity studies.</li> <li>• Appreciate the importance of ethical and regulatory requirements for toxicity studies.</li> <li>• Demonstrate the practical skills required to conduct the preclinical toxicity studies.</li> </ul>
Principles of Drug Discovery	<ul style="list-style-type: none"> <li>• Explain the various stages of drug discovery.</li> <li>• Appreciate the importance of the role of genomics, proteomics and bioinformatics in drug discovery.</li> <li>• Explain various targets for drug discovery.</li> <li>• Explain various lead seeking method and lead optimization.</li> <li>• Appreciate the importance of the role of computer aided drug design in drug discovery.</li> </ul>
Experimental Pharmacology practical-II	<ul style="list-style-type: none"> <li>• Explain the regulatory requirements for conducting clinical trial.</li> <li>• Demonstrate the types of clinical trial designs.</li> <li>• Explain the responsibilities of key players involved in clinical trials.</li> <li>• Execute safety monitoring, reporting and close-out activities.</li> <li>• Explain the principles of pharmacovigilance.</li> <li>• Detect new adverse drug reactions and their assessment.</li> <li>• Perform the adverse drug reaction reporting systems and communication in pharmacovigilance.</li> </ul>
<b>Third and Fourth Semester</b>	
Research Methodology and Biostatistics	<ul style="list-style-type: none"> <li>• To have knowledge on various kinds of research questions and research designs</li> <li>• To have basic knowledge on qualitative, quantitative and mixed methods research, as well as relevant ethical and philosophical considerations</li> <li>• Able to formulate research questions and develop a sufficiently coherent research design</li> <li>• Able to assess the appropriateness of different kinds of research designs and methodology, for instance in terms of their appropriateness, transparency and quality.</li> <li>• To develop independent thinking for critically analyzing research reports.</li> </ul>
Journal club	<ul style="list-style-type: none"> <li>• To critically appraise the literature.</li> <li>• To develop an approach to the analysis of the various types of articles.</li> <li>• To understand the basis of hypothesis testing.</li> <li>• To understand how results of study can be used in pharmaceutical research</li> </ul>
Research Work	<ul style="list-style-type: none"> <li>• Describe the fundamental concepts in pharmaceutical sciences and apply their basic science knowledge to pharmaceutical science applications.</li> <li>• Design, implement, and perform independent and original</li> </ul>

	<p>research in an area of pharmaceutical sciences.</p> <ul style="list-style-type: none"> <li>Analyze and present experimental results of research in pharmaceutical sciences.</li> <li>Identify problems in their research, provide strategy to analyze the problems, and solve the problems.</li> <li>Evaluate relevant literature to identify new approaches in research.</li> <li>Create new knowledge from the existing knowledge in pharmaceutical sciences.</li> <li>Develop effective written communication and oral presentation skills to defend the findings to the pharmaceutical science community.</li> <li>Learn a research topic independently using the scientific literature with the science knowledge they obtained and the skills they developed in the program.</li> </ul>
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### M. Pharmacy (Pharmacognosy)

Course Title	Course Outcome
<b>First Semester</b>	
Modern Pharmaceutical Analytical Techniques	<p>To know about:</p> <ul style="list-style-type: none"> <li>Chemicals and Excipients</li> <li>The analysis of various drugs in single and combination dosage forms.</li> <li>Theoretical and practical skills of the instruments.</li> </ul>
Advanced Pharmacognosy -I	<ul style="list-style-type: none"> <li>Advances in the cultivation and production of drugs</li> <li>Various phyto-pharmaceuticals and their source, its utilization and medicinal value.</li> <li>Various nutraceuticals/herbs and their health benefits</li> <li>Drugs of marine origin</li> <li>Pharmacovigilance of drugs of natural origin</li> </ul>
Phytochemistry	<ul style="list-style-type: none"> <li>Different classes of phytoconstituents, their biosynthetic pathways, their properties, extraction and general process of natural product drug discovery.</li> <li>Phytochemical fingerprinting and structure elucidation of phytoconstituents.</li> </ul>
Industrial Pharmacognostical Technology	<ul style="list-style-type: none"> <li>The requirements for setting up the herbal/natural drug industry.</li> <li>The guidelines for quality of herbal/natural medicines and regulatory issues.</li> <li>The patenting/IPR of herbals/natural drugs and trade of raw and finished materials.</li> </ul>
<b>Second Semester</b>	
Medicinal Plant biotechnology	<ul style="list-style-type: none"> <li>Know the process like genetic engineering in medicinal plants for higher yield of Phytopharmaceuticals.</li> <li>Use the biotechnological techniques for obtaining and</li> </ul>

	improving the quality of natural products/medicinal plants
Advanced Pharmacognosy-II	<ul style="list-style-type: none"> <li>• Validation of herbal remedies</li> <li>• Methods of detection of adulteration and evaluation techniques for the herbal drugs</li> <li>• Methods of screening of herbals for various biological properties</li> </ul>
Indian system of medicine	<ul style="list-style-type: none"> <li>• To understand the basic principles of various Indian systems of medicine</li> <li>• To know the clinical research of traditional medicines, Current Good Manufacturing Practice of Indian systems of medicine and their formulations.</li> </ul>
Herbal cosmetics	<ul style="list-style-type: none"> <li>• Understand the basic principles of various herbal/natural cosmetic preparations.</li> <li>• Current Good Manufacturing Practices of herbal/natural cosmetics as per the regulatory authorities.</li> </ul>
<b>Third and Fourth Semester</b>	
Research Methodology and Biostatistics	<ul style="list-style-type: none"> <li>• To have knowledge on various kinds of research questions and research designs</li> <li>• To have basic knowledge on qualitative, quantitative and mixed methods research, as well as relevant ethical and philosophical considerations</li> <li>• Able to formulate research questions and develop a sufficiently coherent research design</li> <li>• Able to assess the appropriateness of different kinds of research designs and methodology, for instance in terms of their appropriateness, transparency and quality.</li> <li>• To develop independent thinking for critically analyzing research reports.</li> </ul>
Journal club	<ul style="list-style-type: none"> <li>• To critically appraise the literature.</li> <li>• To develop an approach to the analysis of the various types of articles.</li> <li>• To understand the basis of hypothesis testing</li> <li>• To understand how results of study can be used in pharmaceutical research</li> </ul>
Research Work	<ul style="list-style-type: none"> <li>• Describe the fundamental concepts in pharmaceutical sciences and apply their basic science knowledge to pharmaceutical science applications.</li> <li>• Design, implement, and perform independent and original research in an area of pharmaceutical sciences.</li> <li>• Analyze and present experimental results of research in pharmaceutical sciences.</li> <li>• Identify problems in their research, provide strategy to analyze the problems, and solve the problems.</li> <li>• Evaluate relevant literature to identify new approaches in research.</li> <li>• Create new knowledge from the existing knowledge in pharmaceutical sciences.</li> </ul>

	<ul style="list-style-type: none"><li>• Develop effective written communication and oral presentation skills to defend the findings to the pharmaceutical science community.</li><li>• Learn a research topic independently using the scientific literature with the science knowledge they obtained and the skills they developed in the program.</li></ul>
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