

# PROGRAM OUTCOMES

## B. PHARM

- 1. Pharmacy Knowledge:** Possess knowledge and comprehension of the core and basic knowledge associated with the profession of pharmacy, including biomedical sciences; pharmaceutical sciences; behavioral, social, and administrative pharmacy sciences; and manufacturing practices.
- 2. Planning Abilities:** Demonstrate effective planning abilities including time management, resource management, delegation skills and organizational skills. Develop and implement plans and organize work to meet deadlines.
- 3. Problem analysis:** Utilize the principles of scientific enquiry, thinking analytically, clearly and critically, while solving problems and making decisions during daily practice. Find, analyze, evaluate and apply information systematically and shall make defensible decisions.
- 4. Modern tool usage:** Learn, select, and apply appropriate methods and procedures, resources, and modern pharmacy-related computing tools with an understanding of the limitations.
- 5. Leadership skills:** Understand and consider the human reaction to change, motivation issues, leadership and team-building when planning changes required for fulfillment of practice, professional and societal responsibilities. Assume participatory roles as responsible citizens or leadership roles when appropriate to facilitate improvement in health and well-being.
- 6. Professional Identity:** Understand, analyze and communicate the value of their professional roles in society (e.g. health care professionals, promoters of health, educators, managers, employers, employees).
- 7. Pharmaceutical Ethics:** Honour personal values and apply ethical principles in professional and social contexts. Demonstrate behavior that recognizes cultural and personal variability in values, communication and lifestyles. Use ethical frameworks; apply ethical principles while making decisions and take responsibility for the outcomes associated with the decisions.
- 8. Communication:** Communicate effectively with the pharmacy community and with society at large, such as, being able to comprehend and write effective reports, make effective presentations and documentation, and give and receive clear instructions.
- 9. The Pharmacist and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety and legal issues and the consequent responsibilities relevant to the professional pharmacy practice.
- 10. Environment and sustainability:** Understand the impact of the professional pharmacy solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- 11. Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. Self-assess and use feedback effectively from others to identify learning needs and to satisfy these needs on an ongoing basis.

## **PROGRAMME SPECIFIC OUTCOMES ( B. PHARM.)**

1. To pursue excellence in pharmaceutical education.
2. To contribute significantly towards quality research in the field of pharmacy.
3. To make pharmaceutical education more relevant with contemporary needs in order to keep pace with the knowledge and information explosion.
4. To enhance students employability skills.
5. To develop a professionally competent, ethically sound and skilled pharmacist

## **PROGRAMME SPECIFIC OUTCOMES (M. PHARM.)**

**PSO1:** Apply skills to do specialized research in the core and applied areas of pharmaceutical sciences.

**PSO2:** Interpret data of pharmaceutical research in drug discovery as per the needs of pharmaceutical industries.

**PSO3:** Develop an ability to visualize and work on multidisciplinary tasks in the areas of pharmaceuticals and its allied field.

**PSO4:** Analyze, criticize, organize, improvise and manage documents, data and information related to pharmaceutical drug development process.

**PSO 5:** To create a talent pool by involving students in research projects and to make students undertake research projects under faculty guidance for publication and to foster ambitious desire among students to undertake higher studies and career growth.

**COURSE OUTCOMES ( B. PHARM ) 2019-20**

Sr. No	Program	Name of the course	Course outcome
1	First Year B. Pharm Sem-I	Human Anatomy and Physiology- I	<b>Upon completion of this course the student should be able to</b>
			1. Explain the gross morphology, structure and functions of various organs of the human body.
			2. Describe the various homeostatic mechanisms and their imbalances.
			3. Identify the various tissues and organs of different systems of human body.
			4. Perform the various experiments related to special senses and nervous system.
		5. Appreciate coordinated working pattern of different organs of each system	
		Pharmaceutical Analysis- I	1. Upon completion of the course student shall be able to understand the principles of volumetric and electrochemical analysis
			2. Carryout various volumetric and electrochemical titrations
			3. Develop analytical skills
		Pharmaceutics- I	The students should be able to-
			1. Know the history of pharmacy, development of pharmacy profession and industry in India.
			2. Describe alternative systems of medicines and various routes of administration.
			3. Understand concept of dosage forms.
			4 define various categories of additives with respect to particular dosage form with examples
		5. Define preformulation, describe various preformulation parameters.	
		Pharmaceutical Inorganic Chemistry	Upon completion of course student shall be able to
1. Know the sources of impurities			
2. Methods to determine the impurities in drugs and pharmaceuticals			
		3. Understand the medicinal and pharmaceutical importance of inorganic compounds	
Communication skills	1. Upon completion of the course the student shall be able to Understand the behavioral needs for a Pharmacist to function effectively in the areas of		

			pharmaceutical operation
			2. Communicate effectively (Verbal and Non Verbal)
			3. Effectively manage the team as a team player
			4. Develop interview skills
			5. Develop Leadership qualities and essentials
		Remedial Biology/ Remedial Mathematics	The students should be able to- 1. know the classification and salient features of five kingdoms of life
			2. Explain the basic components of anatomy & physiology of plant
			3. know the basic components of anatomy & physiology animal with special reference to human
2	<b>First Year B. Pharm. Sem-II</b>	Human Anatomy and Physiology- II	Upon completion of this course the student should be able to: 1. Explain the gross morphology, structure and functions of various organs of the human body.
			2. Describe the various homeostatic mechanisms and their imbalances.
			3. Identify the various tissues and organs of different systems of human body.
			4. 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.
			5. Appreciate coordinated working pattern of different organs of each system
			6. Appreciate the interlinked mechanisms in the maintenance of normal functioning (homeostasis) of human body
		Pharmaceutical Organic Chemistry-I	Upon completion of the course the student shall be able to 1. Write the structure, name the reaction and the type of isomerism of the organic compound.
			2. Know intermediates formed in reactions and important physical properties of organic compounds
			3. Write the reaction, name the reaction, mechanism and orientation of reactions.
			4. Prepare small organic compounds
			5. Account for reactivity/stability of compounds.
			6. Identify/confirm the identification of organic compounds.
		Biochemistry	Upon completion of course the students shall able to 1. Understand the catalytic role of enzymes and importance of enzyme in biochemical process.

			2. Understand the metabolism of nutrient molecules in physiological and pathological conditions.
			3. Understand the genetic organization of mammalian genome and functions of DNA in the synthesis of RNAs and proteins.
		Pathophysiology	Upon completion of the subject, student shall be able to 1. Describe the etiology and pathogenesis of the selected disease states; 2. Name the signs and symptoms of the diseases
		Computer Applications in Pharmacy	The students should be able to- 1. know the various types of application of computers in pharmacy 2. know the various types of databases 3. know the various applications of databases in pharmacy
		Environmental sciences	Upon completion of the course the student shall be able to 1. Create the awareness about environmental problems among learners 2. Impart basic knowledge about the environment and its allied problems 3. Develop an attitude of concern for the environment. 4. Motivate learner to participate in environment protection and environment improvement. 5. Acquire skills to help the concerned individuals in identifying and solving environmental problems. 6. Strive to attain harmony with Nature.
3	<b>Second Year B. Pharm Sem-III</b>	Pharmaceutical Organic Chemistry-II	On completion of the course, the student shall be able to 1. Understand various molecular representations and their interconversions. 2. Write the structure, name and the type of isomerism of the organic compound 3. Account for reactivity/stability of compounds 4. Write the reaction, name the reaction and orientation of reactions 5. Prepare small organic compounds.
		Physical Pharmaceutics -I	1. Investigate and apply various theories, laws and equations related to different states of matter 2. Distinguish the principles of complexation/ protein binding & to use them for calculations of drug release and stability constant. 3. Demonstrate use of physicochemical properties of drugs in the formulation development and evaluation of dosage forms.

	Pharmaceutical Microbiology	The students should be able to- 1. To learn basics, historical, recent advances of microbiology and applications in pharmacy.
		2. To know basic biology and characteristics of microbes' viz. Bacteria, Viruses yeast and moulds etc.
		3. To understand bacterial Isolation and counting methods, Concept, causes, sources, types of microbial contamination and limit tests.
		4. To study concept, need, types, mechanisms of Sterilization Sterility testing and effectiveness of various sterilization processes.
		5. To study concept, need, classification, mechanism of action and evaluation of disinfectants.
		6. To comprehend the basic aspects of Immunology, types of Immunity, Antigen Antibody reactions and their diagnostic use, types and preparation methods of vaccines.
	Pharmaceutical Microbiology [P]	The students should be able to- 1. To understand the principle, construction and working of various instruments used for microbiology practicals and to learn handling of microscope.
		2. To learn how to prepare and sterilize nutrient broth, nutrient agar, slants, stabs and plates and acquire the skills required for maintaining strictly aseptic condition && handling inoculating loop, its sterilization and inoculation procedure.
		3. To learn Isolation of bacteria by various techniques, observe motility and study morphology of bacteria by staining methods viz. simple staining, negative staining & gram staining etc.
		4. To carryout sterility testing of WFI, Antibiotic Assay and MIC.
	Pharmaceutical Engineering	The students should be able to- 1. Demonstrate understanding of molecular diffusion in gases and liquids.
		2. Define drying and explain the mechanism, theory & factors affecting it. Classify & compare various dryers with respect to their applications in pharmacy. Demonstrate understanding of heat transfer techniques including their mechanism and applications in pharmacy.
		3. Define crystallization and illustrate types of crystallizers.
		4. Explain evaporation and describe the types of

			evaporator with their mechanism, instrumentation and applications.
			5. Illustrate fundamentals and facts about flow of fluids. Describe different materials used in the pharmaceutical plant constructions.
			6. Describe types of distillation, their mechanisms with appropriate diagrams.
4	<b>Second Year B. Pharm Sem- IV</b>	Pharmaceutical Organic Chemistry-III	<p><b>On completion of the course, the student should be able to</b></p> <ol style="list-style-type: none"> <li>1. Know the structures with numbering of heterocyclic compounds, chemistry, methods of preparation and chemical reactions of five, six membered and fused heterocyclic rings.</li> <li>2. Understand the methods of preparation and properties of organic compounds.</li> <li>3. Explain the stereochemical aspects of organic compounds and stereo chemical reactions.</li> <li>4. Know the medicinal uses and other applications of organic compounds</li> </ol>
		Med. Chemistry -I	<p>Upon completion of the course the student shall be able to</p> <ol style="list-style-type: none"> <li>1. Understand the chemistry of drugs with respect to their pharmacological activity.</li> <li>2. Understand the drug metabolic pathways, adverse effect and therapeutic value of Drugs.</li> <li>3. Know the Structural Activity Relationship (SAR) of different class of drugs.</li> <li>4. Write the chemical synthesis of some drugs.</li> </ol>
		Physical Pharmaceutics II	<ol style="list-style-type: none"> <li>1. Relate various physicochemical properties of drug and excipient molecules in designing the dosage forms</li> <li>2. Distinguish the principles of chemical kinetics &amp; to use them for stability testing and determination of expiry date of formulations</li> <li>3. Demonstrate the behavior and mechanism of drugs and excipients in the formulation development and evaluation of dosage forms.</li> </ol>
		Pharmacology I	<p>Upon Completion of the Course Student Shall be Able to understand the,</p> <ol style="list-style-type: none"> <li>1. Scope, Nature and Sources of Drugs , roots drug administration with its advantages and disadvantages. Concern with Pharmacology.</li> <li>2. Understand the Mechanism of drug action and the basics of Pharmacokinetics and Pharmacodynamics.</li> <li>3. Understand the Principles of new drug development.</li> <li>4. Understand the definition pathophysiology</li> </ol>

			Complications , Diagnosis and The Drug Treatment for various diseases and disorders.
		Pharmacognosy and Phytochemistry- I	Upon completion of the course, the student shall be able 1. to know the techniques in the cultivation and production of crude drugs
			2. to know the crude drugs, their uses and chemical nature
			3. know the evaluation techniques for the herbal drugs
			4. to carry out the microscopic and morphological evaluation of crude drugs
<b>5</b>	<b>Third Year B. Pharm Sem-V</b>	Industrial Pharmacy-I	The students should be able to- 1. To comprehend the concept of dosage form design and formulation strategies.
			2. To learn Preformulation aspects of Tablets with special reference to selection of excipients.
			3. To understand formulation aspects of Tablets and evaluation thereof.
			4. To study manufacturing of Tablets, Tableting defects & remedies thereof.
			5. To learn the concept, need, types, techniques & equipments used in tablet coating.
			6. To know capsules types, additives, size selection, manufacturing, evaluation, equipments and defects.
		Pharmaceutical Analysis-III	<b>On completion of the course, the student should be able to</b> 1. Explain the different types of instrumental analytical techniques available for quality control of APIs & formulations
			2. Explain principles of UV-VIS, Flourimetry, Atomic absorption, atomic emission, Spectroscopies, Flame photometry, Phosphorimetry and Nepheloturbidimetry.
			3. Elaborate instrumentation of UV-VIS, Flourimetry, Atomic absorption, atomic emission, Spectroscopies, Flame photometry, Phosphorimetry and Nepheloturbidimetry.
			4. Describe applications of UV-VIS, Flourimetry, Atomic absorption, atomic emission, Spectroscopies, Flame photometry, Phosphorimetry and Nepheloturbidimetry.
		Medicinal	On completion of the course students should



	Chemistry-I	1. Understand the chemistry of drugs with respect to their pharmacological activity
		2. To know the structure activity relationship of different class of drugs.
		3. Gain Knowledge about the mechanism pathways of different class of medicinal compounds.
		4. Get Well acquainted with the synthesis of some important class of drugs.
		5. Understand the drug metabolic pathways, adverse effect and therapeutic value of drugs
		6. Understand recent developments in categories such as adrenergic & cholinergic agents and drugs affecting cardiovascular system.
	Pharmacology-II	Upon completion of this course the student should be able to
		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
		3. Demonstrate the various receptor actions using isolated tissue preparation
		4. Appreciate correlation of pharmacology with related medical sciences
	Analytical Pharmacognosy & Extraction Technology	1. Comprehend & explain underlying principle of mass transfer process in extraction, effect of various factors, specific care in herbal material, & various approaches in extraction processes with their theoretical consideration, methodological steps, & applications.
		2. Understand & explain principle & applications of chromatographic & nonchromatographic separation methods.
		3. Explain source material & extraction methods of phytochemicals specified; draw schematic representation of such processes;
		4. Explain need of analysis of natural products & explain their significance; Understand & explain various parameters with their principles, significance & applications.
	Pharmaceutical Business Management & Disaster Management	Upon completion of the course the student shall be able to
		1. Learn the Pharmaceutical business and management strategy.

			2. Gain knowledge of marketing research, product management.
			3. Learn about human resource and development needs.
			4. Learn about the disaster management and preparedness, mitigation
		Active Pharmaceutical Ingredients Technology (APIT)	On completion of course, the students should be able to 1. Explain basics chemical process kinetics with respect to various classes of reactions.
			2. Understand chemical process, reaction system, equipment used in API manufacturing and layout design.
			3. Explain design of synthetic routes, optimization of reactions, raw material and reagents selection; scale up techniques, quality control aspects, Material Safety Data Sheet (MSDS), environmental aspects, green chemistry approaches, health hazards of chemical handling and manufacturing process flow charts of some important APIs.
			4. Explain manufacturing techniques of some chiral APIs and polymorphism in APIs.
			5. Practice Quality Assurance (QA), Quality Control (QC) and follow GMP in API manufacturing including ICH Q7, Q7A and Q11 while working in API industry.
6	<b>Third Year B. Pharm Sem-VI</b>	Industrial Pharmacy-II	The students should be able to 1. To comprehend the concept of disperse systems, classification, theories and stability considerations.
			2. To learn suspensions, types, formulation development, manufacturing, excipients used and evaluation.
			3. To learn emulsions, types, theory, formulation development, excipients used, evaluation and stability.
			4. To study semi-solids, selection of bases used, formulation development, & evaluation.
			5. To understand anatomy & physiology of skin, Percutaneous absorption and flux measurement and to study penetration enhancers.
			6. Describe layout for manufacturing of suspensions, emulsions & semi-solids as per schedule M.
		Pharmaceutical Analysis-IV	On completion of course, the students should be able to 1. Explain principles of chromatographic, thermal, X ray Diffraction and Radio chemical techniques.
			2. Elaborate instrumentation of chromatographic,

	thermal, X ray Diffraction and Radio chemical techniques.
	3. Describe applications of chromatographic, thermal, X ray Diffraction and Radio chemical techniques.
	4. Explain to validate various analytical instruments & methods as per ICH/USP guidelines.
Medicinal Chemistry-II	On successful completion of the course a learner should be able to
	1. Know general aspects of drug metabolism, the drug design aspects on the basis of drug metabolism and metabolism of therapeutically important drugs.
	2. Know the general aspects of design of the drugs acting on CNS.
	3. Understand the history, classification, nomenclature, structure activity relationship (SAR)
	4. Understand mechanism of action, therapeutic uses, adverse effects
	5. Understand recent developments in the CNS active drugs and drugs acting on blood.
Pharmacology-III	1. Upon completion of course student students shall know classification, mechanism of action, pharmacological actions, pharmacokinetics', therapeutic uses, adverse effects, drug interactions, contraindications, dosages of Psychopharmacological drugs, General Anesthesia, Alcohols and alcoholism, Antiepileptic Drugs, Opioid Analgesics and antagonist, NSAID Rheumatoid Arthritis, Osteoarthritis and Gout
	2. Know about Gastrointestinal tract disorders: Respiratory tract disorders: Pharmacotherapy of Parkinson's disease and Alzheimer's disease
	3. Know various bioassay methods, Eddy's hot plate analgesiometer, actophotometer, Rotarod.
Natural Product Chemistry	1. Understand & explain various physical, chemical, spectroscopic means & methods used in structural elucidation of natural products. He/she should be able to interpret data generated from above techniques.
	2. Understand & explain tools & techniques used in study of biosynthetic pathways in plants.
	3. Explain source, chemistry & applications of drugs from marine origin. He/she should be able to compare & contrast marine & terrestrial sources of medicinal materials.
	4. Explain difficulties in elucidation of biosynthetic

			pathways in plant & explain approaches used with their merits & demerits.
			5. Understand & explain underlying reasons as why natural products are appropriate material in discovering new drugs & also explain their contribution in modern drug discovery.
			6. Explain source, extraction, processing, chemistry & applications of natural products used in pharmaceutical & allied industry such as coloring & sweetening agents.
	==	Bioorganic Chemistry & Drug Design	On successful completion of following theory topics, a learner should be able to : 1. Explain the significance of Bioorganic Chemistry and establish its relevance in drug design and discovery 2. Describe various approaches in rational drug design 3. Explain various drug targets and their biochemical features, physiological & pathophysiological roles and their significance in drug design. 4. Explain pro-drug concept in drug design.
		Pharmaceutical Biotechnology	The students should be able to- 1. Define Biotechnology & its state its scope in pharmacy 2. Know the basics of biotechnology techniques and the various systems used. 3. Know the method of genetic engineering for production of rDNA products including monoclonal antibodies. 4. Know the information about the application of genetic engineering in animals 5. Have a knowhow of enzymes and their uses by immobilization. 6. Illustrate use of Fermenter for production of fermentation products and information about their purification by downstream process.
7	<b>Final Year B. Pharm Sem-VII</b>	Sterile Products	On completion of following theory topics & laboratory experiments, learner should be able to: 1. Describe the General requirements, routes of administration, significance of tonicity adjustment and sterility and Pre-formulation of sterile products 2. Describe various packaging materials used, types, choice of containers, official quality control tests and methods of evaluation. 3. Describe the GMP and design and layout of Parenteral Production Facility, environmental control

	zones, heating ventilation air conditioning (HVAC), HEPA filter and laminar area flow systems
	4. Explain Classification and formulation of SVP, types and selection of vehicles and added substance, processing, manufacturing and Quality control of SVPs along with Special types of SVPs and Pilot plant scale up.
	5. Explain Large Volume Parenterals (LVPs),Types, concept of formulation, influence of physiological factors, processing, manufacturing and Quality control of LVPs, along with Parenteral Nutrition, intravenous admixture and Peritoneal dialysis fluid and Pilot plant scale up.
	6. Explain General requirements, formulation, types and evaluation of ophthalmic products.
	7. Describe Blood Products and Surgical Dressings
Pharmaceutical Analysis-V	On completion of course, the students should be able to 1. Explain the different types of instrumental analytical techniques available for quality control of APIs & formulations.
	2. Explain principles of Infra red (FTIR, NIR) Raman, Gas Chromatography, HPLC, UPLC, Scanning & Electron microscopy.
	3. Elaborate instrumentation of Infra red (FTIR, NIR) Raman, Gas Chromatography, HPLC and Scanning & Electron microscopy.
	4. Describe applications of Infra red (FTIR, NIR) Raman, Gas Chromatography, HPLC, UPLC, Scanning & Electron microscopy.
Medicinal Chemistry-III	The students should be able to- 1. General aspects of drug design and history of drug development.
	2. Understand the classification, nomenclature, and chemistry of anti-infective agents and antineoplastic agents.
	3 Understand the Structure activity relationship (SAR), mechanism of action, therapeutic uses, adverse effects of anti-infective agents and antineoplastic agents.
	4. Know the recent developments and synthetic routes of anti-infective agents and antineoplastic agents.
Pharmacology-IV	1. Upon completion of the course student shall be able to understand Classification, mechanism of action, antibacterial spectrum, resistance, therapeutic uses,

	adverse effects and contraindications of various antibiotics.
	2. Student also known about Various endocrine hormones, its types, receptors involved and mechanisms involved, Biosynthesis, Mechanism of action, Pharmacology and regulation of Thyroid, antithyroid drugs and Parathyroid hormones.
	3. Know Biosynthesis, Secretion, Mechanism of action, Pharmacology of insulin and glucagon and Pharmacotherapy of Diabetes Mellitus, Pharmacology of Androgens, Estrogens, Progestin and oral contraceptives.
	4. Know about Use of isolated tissue preparations for bioassay methods, Basic aspects to carryout Critical appraisal of marketed fixed dose combinations (FDC), and Understanding Prescription auditing and standard treatment protocols.
Natural Drug Technology (T)	The students should be able to- 1. Understand & explain various difficulties in standardization of herbal material, new approaches evolved, and steps in development of plant monograph.
	2. Understand & explain need & significance of plant material authentication, new approaches used with their merits & demerits.
	3. Comprehend & explain various factors affect on level of secondary metabolites, how these can be minimized to ensure quality in raw material, effect of post harvesting manipulations, and changes during storage etc& methods to control these modification. Explain various guidelines issued by WHO in relation with cultivation, collection, storage etc. pharmaceutical & allied industry such as bioavailability & skin permeation agents; wound healing agents, biofuels.
	4. Understand & explain concept of health & pathogenesis, philosophical basis, diagnosis & treatment aspects of Ayurveda, Unani, Siddha & Homoeopathic system of medicine; Understand & explain method of preparation of Ayurvedic dosage forms; significance of novel drug delivery of natural products; herbs used in cosmetic preparation & methods of their formulations.
	5. Compare & contrast nutraceuticals & functional

		foods & understand & explain their significance. Explain & classify natural products used as dietary supplements. Understand & explain significance of natural pesticides & explain source, chemistry & applications.
		6. Explain source, extraction, processing, chemistry & applications of natural products used in pharmaceutical & allied industry such as bioavailability & skin permeation agents; wound healing agents, biofuels.
	Bio-pharmaceutics & Pharmacokinetics	The students should be able to-1.Understand the concept of biopharmaceutics and its applications in formulation development.
		2. Study pharmacokinetic processes and their relevance in efficacy of dosage form.
		3. Learn the every aspect of bioavailability and bioequivalence studies along with its regulatory relevance with specific reference to biowaivers.
		4. Grasp the concept and mechanisms of dissolution, in vitro methods to perform dissolution studies and model dependant and independent approach to analyze dissolution data.
		5. Be knowledgeable to establish in vitro in vivo correlation based on BCS and acceptable to regulatory authorities.
		6. Comprehend non linear kinetics and compartmental models and non compartmental analysis methods to assess pharmacokinetic parameters for drugs following linear kinetics.
	Pharmaceutical Jurisprudence	The students should be able -
		1. To understand the significance and relevance of purpose, principles, dimensions, rules and regulations and procedures made to execute the laws in India.
		2. To study the constitution, purpose, responsibilities and inspection procedures of the Board.
		3. To learn the various laws governing the manufacturing, sale, research and usage of drugs.
		4. To comprehend legal issue of potential fraud and abuse related to narcotic and psychotropic substance.
		5. To learn about quality and pricing of essential

			medicine.
			6. To know about IPR and patents, procedure for filing patent and patent application.
8	<b>Final Year B. Pharm Sem-VIII</b>	Advanced Drug Delivery System	The students should be able to- 1. Explain significance of quality in Pharmaceutical manufacturing, Role of Regulatory agencies in deciding Quality Standards, significance of validation in quality assurance
			2. Follow cGMP, GLP and GDP while working in Pharmaceutical industry
			3. Explain the concept of QbD
		Cosmetic science	1. Understand the concepts of cosmetics; anatomy of skin v/s hair, general excipients used in cosmetics.
			2. Explain formulation of cosmetics for skin, manufacturing, equipments & evaluation of creams like cold cream, vanishing cream etc. & powder cosmetics.
			3. Explain formulation of cosmetics for hair, manufacturing & evaluation of hair shampoos, tonics etc.
			4. Describe formulation of cosmetics for eyes, manufacturing & evaluation of eye mascara, shadow etc.
			5. Understand formulation of manicure products like nail lacquer, remover etc.
			6. Learn formulation, manufacture & evaluation of baby cosmetics like baby oils, powders etc.
		Pharmaceutical Analysis-VI	On completion of course, the students should be able to 1. Explain the different types of instrumental analytical techniques available for quality control of APIs & formulations.
			2. Explain principles of NMR spectroscopy, ESR spectroscopy, Ion Exchange Chromatography, Super critical Fluid Chromatography and Mass Spectrometry.
			3. Elaborate instrumentation of NMR spectroscopy, ESR spectroscopy, Ion Exchange Chromatography, Super critical Fluid Chromatography and Mass Spectrometry.
			4. Describe applications of NMR spectroscopy, ESR spectroscopy, Ion Exchange Chromatography, Super critical Fluid Chromatography and Mass Spectrometry.
		Medicinal	The students should be able to-



	Chemistry-IV	1. General aspects of drug design and history of drug development of antihistaminics, proton pump inhibitors, Serotonergic agents, Autacoids, NSAIDs, analgesics & antipyretics, Narcotic agents, Steroidal Drugs, Hormones, Insulin & Oral Anti-hyperglycemic drugs and Diagnostic agents.
		2. Understand the classification, nomenclature, and chemistry of above agents.
		3 Understand the Structure activity relationship (SAR), mechanism of antihistaminics, proton pump inhibitors, Serotonergic agents, Autacoids, NSAIDs, analgesics & antipyretics, Narcotic agents, Steroidal Drugs, Hormones, Insulin & Oral Anti-hyperglycemic drugs and Diagnostic agents.
		4. Know the recent developments and synthetic routes of antihistaminics, proton pump inhibitors, Serotonergic agents, Autacoids, NSAIDs, analgesics & antipyretics, Narcotic agents, Steroidal Drugs, Hormones, Insulin & Oral Anti-hyperglycemic drugs and Diagnostic agents.
	Pharmacology-V (Including Biostatistics)	1. Know Important aspect, classification, mechanism of drug-drug interaction and ADRs. Basic aspects of drug safety and Pharmacovigilance in relation to monitoring and reporting of ADRs
		2. Functioning and role of hospital pharmacy and practice of rational drug therapy and methods of assessment of patient compliance and non-compliance. Clinical trials, ethics and practice of Good Clinical Practice involved in clinical trials. Process, working and personnel involved in clinical data management and their roles.
		3. Know Use of isolated tissue preparations for antagonistic bioassay methods, Basic aspects to carryout neurobehavioral characterization and Understanding various parametric and non-parametric tests used in biostatistics.
	Natural Products: Commerce, Industry & Regulations	1. Understand & realize the significance of natural products in daily life. He/she should be able to classify different segments in market, demand & supply position; export & import potential; position of Indian herbal drug industry in global contest; government organizations & policies for promotion; their regulation

		in India & other countries, various regulatory guidelines, ethical issues etc.
		2. Realize the market potential of natural products & explore entrepreneurship skills to grab these opportunities.
		3. Understand & explain safe use of natural products, possible toxicities & interaction, toxicities in most venerable group (elderly patients), need & significance of pharmacovigilance systems; WHO guidelines in this regard.
	Quality Assurance Tech.	The students should be able to-
		1. Understand the significance of quality in pharmaceutical manufacturing.
		2. Know current Good Manufacturing Practices
		3. Acquaint with various aspects of documentation, SOPs and relevant records.
		4. Understand role of validation in assurance of quality in pharmaceutical industry
		5. Learn quality by design approach.
		6. Comprehend ICH guidelines in stability testing and QMS.

### **Course outcome (M. Pharm) 2019-20**

Sr. No	Programm	Name of the course	Course outcome
1	M. Pharm. Sem-I (Pharmaceutics)	Modern Pharmaceutical Analytical Techniques	1 Analytical techniques for identification, characterization and quantification of drugs
			.2 Theoretical and practical skills of instrument handling and use.
			3 Structural Elucidation of organic compounds using spectroscopic tools
		Drug Delivery System	1 The various approaches for development of novel drug delivery systems.
			2 The criteria for selection of drugs and polymers for the development of delivering system
			3 The formulation and evaluation of Novel drug delivery systems

		Modern Pharmaceutics	1 The elements of preformulation studies.
			.2 The Active Pharmaceutical Ingredients and Generic drug Product development
			3 Industrial Management and GMP Considerations.
			4 Optimization Techniques & Pilot Plant Scale Up Techniques
		Regulatory Affair	1 To know the chemistry, manufacturing controls and their regulatory importance
			2 To learn the documentation requirements
			3 To learn the importance
	M. Pharm. Sem-II (Pharmaceutics)	Molecular Pharmaceutics (Nano Tech and Targeted DDS)	1 The various approaches for development of novel drug delivery systems.
			2 The criteria for selection of drugs and polymers for the development of NTDS.
			3 The formulation and evaluation of novel drug delivery systems.
		Advanced Biopharmaceutics & Pharmacokinetics	1. The basic concepts in biopharmaceutics and pharmacokinetics.
			2 The critical evaluation of biopharmaceutic studies involving drug product equivalency
			3 The design and evaluation of dosage regimens of the drugs using pharmacokinetic and biopharmaceutic parameters.
		Computer Aided Drug Development	1 History of Computers in Pharmaceutical Research and Development
			2 Computational Modeling of Drug Disposition
			3 Computers in Preclinical Development
			4 Optimization Techniques in Pharmaceutical Formulation
		Cosmetic & Cosmeceuticals	1 Key ingredients used in cosmetics and cosmeceuticals.
			2 Key building blocks for various formulations.
			3 Current technologies in the market
2.	M.Pharm. Sem-I (Pharmaceutical Chemistry)	Advanced Organic Chemistry – I	Upon completion of course, the student shall be able to understand 1. The principles and applications of reterosynthesis 2. The mechanism & applications of various named

			<p>reactions</p> <p>3. The concept of disconnection to develop synthetic routes for small target molecule.</p> <p>4. The various catalysts used in organic reactions</p> <p>5. The chemistry of heterocyclic compounds</p>
		Advanced Medicinal Chemistry	<p>Upon completion of this course, the students shall be able to understand</p> <p>1. Different stages of drug discovery.</p> <p>2. Role of medicinal chemistry in drug research</p> <p>3. Different techniques for drug discovery</p> <p>4. Various strategies to design and develop new drug like molecules for biological targets Peptidomimetics.</p>
		Chemistry of Natural Products	<p>The students should be able to-</p> <p>1. Know different types of natural compounds and their chemistry and medicinal importance</p>
			<p>2. Realize the importance of natural compounds as lead molecules for new drug discovery</p>
			<p>3. Understand the concept of rDNA technology tool for new drug discovery</p>
			<p>4. Know various methods of structural elucidation of compounds of natural origin.</p>
			<p>5. Understand process of Isolation, Purification and characterization of simple chemical constituents from natural source</p>
	M. Pharm. Sem-II (Pharmaceutical Chemistry)	Advanced Spectral Analysis	<p>The students should be able to-</p> <p>1. Interpret of the NMR, Mass and IR spectra of various organic compounds</p>
			<p>2. Understand theoretical and practical skills of the hyphenated instruments</p>
			<p>3. Understand the process of identification of organic compounds</p>
		Advanced Organic Chemistry –II	<p>Upon completion of course, the student shall be able to understand</p> <p>1: The principles and applications of Green chemistry</p> <p>2. The concept of peptide chemistry.</p>
			<p>3: The various catalysts used in organic reactions</p>

			4: The concept of stereochemistry and asymmetric synthesis
		Computer Aided Drug Design	Upon completion of this course, , the student shall be able to understand 1: Role of CADD in drug discovery
			2. Different CADD techniques and their applications
			3: Various strategies to design and develop new drug like molecules.
			4: Working with molecular modeling software's to design new drug molecules
			5: The in silico virtual screening protocols
		Pharmaceutical Process Chemistry	1. To develop synthetic routes that is safe, cost-effective, environmentally friendly, and efficient.
			2. To impart knowledge on the development and optimization of a synthetic route/s.
			3. The pilot plant procedure for the manufacture of Active Pharmaceutical Ingredients and new chemical entities for the drug development phase.
			4. To create and carry out work up and separation procedure.
			5. To predict the outcome of organic reactions using a basic understanding of the general reactivity of functional groups and mechanism.
3.	M. Pharm. Sem-I (Pharmacology)	Advanced Pharmacology - I	1 Discuss the Pathophysiology and pharmacotherapy of certain diseases
			2. Explain the mechanism of drug actions at cellular and molecular level
			3. Understand the adverse effects, contraindications and clinical uses of drugs used in treatment of diseases
		Pharmacological and Toxicological Screening Methods-I	1 Explain the various types of toxicity studies.
			2 Appreciate the importance of ethical and regulatory requirements for toxicity studies.
			3 Demonstrate the practical skills require conducting the preclinical toxicity studies.
		Cellular and Molecular Pharmacology	1 Explain the receptor signal transduction processes.
			2 Explain the molecular pathways affected by drugs.
			3 Appreciate the applicability of molecular pharmacology and biomarkers in drug discovery process.
			4 Demonstrate molecular biology techniques as

			applicable for pharmacology.
M. Pharm. Sem-II (Pharmacology)	Advanced Pharmacology II		1 Explain the mechanism of drug actions at cellular and molecular level
			2. Discuss the Pathophysiology and pharmacotherapy of certain diseases.
			3. Understand the adverse effects, contraindications and clinical uses of drugs used in the treatment of diseases.
		Pharmacological and Toxicological Screening Methods-II	1 Explain the various types of toxicity studies.
			2 Appreciate the importance of ethical and regulatory requirements for toxicity studies.
			3 Demonstrate the practical skills require conducting the preclinical toxicity studies.
		Principles of Drug Discovery	1 Explain the various stages of drug discovery.
			2 Appreciate the importance of the role of genomics, proteomics and bioinformatics in drug discovery.
			3 Explain various targets, biomarkers and <i>in vitro</i> screening techniques for drug discovery.
			4 Explain various lead seeking method and lead optimization.
			5 Appreciate the importance of the role of computer aided drug design in drug discovery.
		Clinical Research and Pharmacovigilance	1 Explain the regulatory requirements for conducting clinical trial.
			2 Demonstrate the types of clinical trial designs.
			3 Explain the responsibilities of key players involved in clinical trials.
			4 Execute safety monitoring, reporting and close-out activities.
			5 Explain the principles of Pharmacovigilance.
			6 Detect new adverse drug reaction and their assessment.
			7 Perform the adverse drug reaction reporting systems and communication in Pharmacovigilance.