



VIVEKANAND EDUCATION SOCIETY'S COLLEGE OF PHARMACY

Hashu Advani Memorial Complex, Behind Collector Colony, Chembur (E), Mumbai – 400 074

Sindhi Linguistic Minority, Approved by AICTE, DTE, Pharmacy Council of India & Govt. of
Maharashtra, Affiliated to University of Mumbai

B. Pharm Programme is accredited by NBA, New Delhi from 2016-17 to 2021-22

2.6.1

**Teachers and students are aware of the
stated Programme and Course outcomes
of the Programme offered by the
institution**



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B PHARM CBCS SYLLABUS

VES COLLEGE OF PHARMACY

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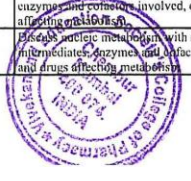
2.6.1 QIM

Teachers and students are aware of the stated Programme and course outcomes of the Programmes offered by the institution (15)

Describe Course Outcomes (COs) for all courses and mechanism of communication

B PHARM CBCS SYLLABUS COURSE OUTCOMES

	SUBJECT	Course Outcome	STATEMENTS	PO MAPPING
SEM I	General Chemistry	1	Draw and explain the structures of various molecules or ions based on the concept of ionic and covalent bonding	1,11
		2	Explain the Rate Law of a Chemical Reaction and Apply the knowledge of principles like Hammond's postulate, Reactivity and Selectivity Microscopic reversibility to predict the nature of reaction and product formation rate	1,11
		3	Differentiate the types of catalytic reactions and explain the role of catalyst	1,11
		4	Describe sclerosing agents and complexing agents. Classify Gastrointestinal Agents, Topical Agents, Saline Cathartics, Expectorants, Emetics, Antidotes and explain their mode of action.	1,11
		5	Classify electrolytes/ elements and elaborate their physiological role. Explain use of physiological ions in replacement therapy, acid-base balance and combination therapy.	1,3,11
		6	Explain the basic concepts of radiochemistry and biological effects of radiation; describe diagnostics and therapeutic uses of radiopharmaceuticals.	1,3,11
SEM I	Dispensing and Community Pharmacy	CO1	Define and identify various dosage forms	1
		CO2	Solve problems relating to pharmaceutical calculations	1,3,6,8
		CO3	Have knowledge of different prescription types.	1,3,6
		CO4	Identify and comprehend different steps involved in dispensing of formulations	1,2,3,7
		CO5	Understand principles involved in compounding of different dosage forms	1,2,3,6
		CO6	Identify physical and chemical incompatibilities among different active ingredients and formulations	1,3
		CO7	Understand the organization of community pharmacy, provide optimal patient care under the direct personal interaction/ counseling	1,2,3,4,6,7,8,9,10,11
SEM I	Anatomy, Physiology & Pathophysiology I	CO1	Outline and categorize the various body structural levels (cells, tissues, organs, and systems) and recall the structure, composition and functions of plasma membrane and methods of movement of substances across plasma membrane	1,3,6,8,9,10
		CO2	Explain anatomy, physiology of lymphatic system, recall & interpret the types of hypersensitivity reactions, and make use of the knowledge of the pathophysiology of AIDS and autoimmune diseases	1,3,6,8,9,10
		CO3	Tell the composition and functions of blood, explain the process of hemostasis and blood coagulation as well as recall & apply the knowledge of pathophysiology of common haematological disorders	1,3,6,8,9,10
		CO4	Comprehend the mechanisms of inflammation and repair.	1,3,6,8,9,10
		CO5	Recall the anatomy of skeletal, cardiac and smooth muscle, explain the transmission at the neuromuscular junction and energy metabolism in the muscle as well as the mechanism of skeletal muscle contraction and demonstrate various types of skeletal muscle contraction	1,3,6,8,9,10
SEM I	Biochemistry I	CO1	List and identify the commonly occurring carbohydrates, amino acids and fatty acids	1,6,7,8,9,10,11
		CO2	Describe higher order structures like oligo- and polysaccharides/peptides and membrane lipids	1,6,7,8,9,10,11
		CO3	Classify the different vitamins in terms of their aqueous solubility and the biochemical reactions/role they are involved in	1,6,7,8,9,10,11
		CO4	Define the laws of thermodynamics and explain the concepts of Gibbs free energy, favorable and unfavorable reactions and role of ATP and NADH as energy carriers	1,6,7,8,9,10,11
		CO5	Describe the process of digestion, absorption, storage and retrieval of different cellular nutrients	1,6,7,8,9,10,11
SEM I	Communication Skills and Ethics (NUES)	CO1	List and identify verbs and the passive voice	6,8
		CO2	Apply skills learnt to confidently stand in a group discussion	5,8
		CO3	Apply skills learnt to communicate effectively – technically/businesswise	4,5,8,9,11
		CO4	Appreciate and imbibe the importance of ethics, human values, honesty and integrity	5,6,7,8,9,11
SEM I	General Chemistry Lab	CO1	Analyze inorganic mixtures qualitatively by semi-micro method	1,11
		CO2	Identify different inorganic impurities in inorganic medicinal agents by performing Pharmacopoeial test.	1,11
		CO3	Prepare and purify inorganic pharmaceuticals	1,11
SEM I	Dispensing and Community Pharmacy Lab	CO1	Read prescriptions, identify commonly used Latin terms in Pharmacy practice	1,2,7
		CO2	Calculate the quantities of active ingredients and excipients required for compounding the required quantity of formulation (expansion and reduction of formula)	1,2,3,7
		CO3	Compound, label and dispense extemporaneous formulations	1,2,3,7
		CO4	Understand patient counseling and patient education methods	1,2,3,4,6,7,8,9,10,11
SEM I	Anatomy, Physiology & Pathophysiology Lab	CO1	Perform RBC count, WBC count, Differential Leukoocyte count, ESR, PCV, Bleeding time, clotting time and interpret the results and correlate with clinical conditions and record/measure blood pressure.	1,3,6,8,9
		CO2	Identify and locate the bones in human skeleton	1,3
		CO3	Identify and describe the various body tissues and organs based on the structure and organisation of cells.	1,3
		CO4	List the common diagnostic and biochemical tests performed in various clinical conditions and make use of it in diagnosis and prognosis of the diseases.	1,3,4,6,8,9
SEM II	Anatomy, Physiology & Pathophysiology - II	CO1	Explain the types of and mechanisms of cellular injuries and cellular adaptation.	1,3,6,8,9
		CO2	Compare and contrast between benign and malignant tumours. Classify malignant tumours and explain the etiology and pathogenesis of cancer	1,3,6,8,9
		CO3	Discuss the biological effects of radiations	1,3,6,8,9,10
		CO4	Explain the anatomy and physiology of the respiratory system, endocrine system, nervous system and the sensory organs	1,3,6,8,9
		CO5	Comprehend the aetiology, pathogenesis, signs, and symptoms of common diseases/disorders of respiratory system, endocrine system and nervous system	1,3,6,8,9
SEM II	Biochemistry - II	CO1	Discuss carbohydrate metabolism with respect to different pathways, structures of intermediates, enzymes and cofactors involved, energy requirements/yields, regulation and drugs affecting metabolism	1,3,6,7
		CO2	Discuss lipid metabolism with respect to different pathways, structures of intermediates, enzymes and cofactors involved, energy requirements/yields, regulation and drugs affecting metabolism	1,3,6,7
		CO3	Discuss protein metabolism with respect to different pathways, structures of intermediates, enzymes and cofactors involved, energy requirements/yields, regulation and drugs affecting metabolism	1,3,6,7



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SEM II	Pharmacognosy - I	CO1	Outline the Alternative and complementary systems of medicine, classify drugs of natural origin	1,3,6,7,9,10,11
		CO2	Describe Primary and secondary plant metabolites their biosynthesis, evaluation and therapeutic application	1,3,6,7,9,10,11
		CO3	Understand the morphological and Microscopic features of medicinal plants	1,3,6,7,9,10,11
		CO4	Elaborate commercial production, collection, preparation, storage and factors affecting cultivation of medicinal plants	1,3,6,7,9,10,11
		CO5	Describe chemistry, source, preparation, evaluation of carbohydrate containing crude drugs and their commercial utility as Pharmaceutical Aids and Medicines	1,3,6,7,9,10,11
SEM II	Hospital Pharmacy and Drug Store Management	CO1	Appreciate the difference in the functions, layout, legal requirements, organization, drug procurement, storage and dispensing of medicines in a retail versus hospital pharmacy setting.	1, 2, 3, 6, 8,
		CO2	Appreciate the importance of documentation in the functioning of a pharmacy	1, 2
		CO3	Understand the importance of a hospital level formulation and compounding of parenterals	1,2,3
		CO4	Understand the importance and functioning of the hospital sterile supply services department	1,2
		CO5	Appreciate the dangers/detection/reporting of fraudulent pharmacy practices	1,7, 8
		CO6	Appreciate the concept of Rational Drug Therapy	1,3
SEM II	Environmental Science	CO1	Describe the basics of Environmental sciences like need and purpose of study the subject, Ecology, food chain and ecological pyramids, sustainable development	1,3,4,10,11
		CO2	Outline, Environmental Legislation, role of different ministries and environment control boards	1,3,4,10,11
		CO3	Classify and compare different sources of energies	1,3,4,10,11
		CO4	Relate technology to control pollution and economic benefits thereof, infer, the concept of green building, carbon credit and disaster management Realize the environment related	1,3,4,10,11
SEM II	Pharmacognosy Lab - I	CO1	Carry out quantitative microscopy for leaf constants	1,3,6,7,9,10,11
		CO2	Determine different extractive and ash values as per pharmacopoeial requirements	1,3,6,7,9,10,11
		CO3	Identify diagnostic features of plants such as calcium-oxalate, starch and trichomes	1,3,6,7,9,10,11
		CO4	Differentiate between different plant parts based on morphological and microscopic evaluation	1,3,6,7,9,10,11
SEM II	Biochemistry Lab	CO1	Able to perform Qualitative analysis of various samples of carbohydrates and proteins	1,2,3,6,7,9
		CO2	Correlate theoretical concepts and conclude the results qualitatively based on confirmatory tests	1,2,3,6,7,9
		CO3	Able to perform quantitative analysis of various samples of carbohydrates, proteins, lipids and enzymes	1,2,3,6,7,9
		CO4	Correlate theoretical concepts and conclude the results of quantitative methods based on graphs and calculations	1,2,3,6,7,9
		CO5	Demonstrate oral and written communication and ability to plan experiment with proper time management.	1,6,8,9
SEM II	Computer Lab	CO1	Describe the components of a Computer	4
		CO2	Compare the different operating systems	4
		CO3	Record simple programs using BASIC and C programming languages	4
		CO4	Apply knowledge gained for use of computers in pharmacy	1, 4
SEM III	Organic Chemistry I	CO1	Assign IUPAC and stereochemical nomenclature of compounds containing multiple functional groups	1,8
		CO2	Predict aromatic character, resonance and tautomerism of compounds	1,3
		CO3	Explain the reactivity of compounds based on physicochemical properties	1,8
		CO4	Understand the factors affecting equilibria, rates and reaction mechanisms	1,11
		CO5	Explain the influence of structure on physicochemical properties and its application to various aspects of pharmaceuticals	1,3,8,11
SEM III	Physical Pharmacy I	CO1	Understand the various physical phenomena involved in designing of various formulations	1,4
		CO2	Determine various physical parameters of drugs and formulations	1,4
		CO3	Predict and anticipate in-process problems based on raw materials and manufacturing methods.	1,3
		CO4	Apply the knowledge of physical phenomena in selecting raw materials, including drug, inactive ingredients of appropriate quality leading to stable formulations.	1,3
SEM III	Anatomy, Physiology & Pathophysiology III	CO1	Explain the anatomy, and physiology of the reproductive system, cardiovascular system, urinary system and digestive system and know the concept, significance and application of ECG	1,3,6,8
		CO2	Comprehend the etiology, pathogenesis, signs and symptoms of common diseases of the reproductive system, cardiovascular system, urinary system and digestive system	1,3,6,8,9
		CO3	State the relevance of various body fluid compartments, electrolyte distribution and acid-base balance	1,3,6,8
SEM III	Pharmaceutical Analysis I	CO1	Explain the role of pharmaceutical analysis in the field of pharmacy and industry and delineate between qualitative- quantitative, manual, automatic and electrochemical	1,3,4,8,11
		CO2	Describe volumetric, gravimetric, electrochemical and solvent extraction methods of analysis.	1,3,4,8,11
		CO3	Solve numerical problems related to volumetric, gravimetric and solvent extraction methods of analysis and apply simple statistics to numerical data.	1,3
SEM III	Pharmaceutical Engineering	CO1	Understand mechanics of fluid, fluid flow, and its measurements	1,2,3,8
		CO2	Classify and describe pumps, heat measuring devices and conveyors	1,2,3,8
		CO3	Understand basic principles involved in unit operations such as crystallization, evaporation, distillation and refrigeration and will able to describe the equipment and accessories involved therein.	1,2,3,8,10
		CO4	Summarize construction material, discuss corrosion of equipment from pharmaceutical industry point	1,3,8,10
		CO5	Define and categorize the different industrial hazards	1,3,8,9,10
SEM III	Organic Chemistry Laboratory I	CO1	Practice and follow safety rules and precautionary measures in laboratory.	8,9
		CO2	Explain theoretical aspects of physical constant determination, detection of functional groups and Log P	2,3,8
		CO3	Characterize/ Identify/Spot monofunctional or bifunctional organic compounds by physical constant, elemental analysis and functional group analysis	1,2,3,8
SEM III		CO1	To understand the principles and methods for the determination of various physical parameters of drugs and formulations.	1,3,8
		CO2	To carry out various physical tests involved in characterization of drugs.	1,2,3,4,8

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		CO2	To carry out various physical tests involved in characterization of drugs.	1,2,3,4,8
		CO3	To demonstrate testing of various physical parameters involved in preformulation and formulation evaluation.	1,2,3,4,8
SEM III	Pharmaceutical Analysis Lab I	CO1	Employ practice of calibration and proper handling of volumetric apparatus, electronic analytical balance and safety measures in the laboratory.	1,2,4,11
		CO2	Demonstrate eye- hand coordination required for titrimetric analysis	1,2,4,11
		CO3	Perform and record, calculate and interpret data obtained for experiments related to volumetric, gravimetric and solvent extraction methods of analysis.	1,2,4,11
		CO4	Conduct and evaluate various tests mentioned in a pharmacopoeial monograph	1,2,4,11
SEM III	Organic Chemistry II	CO1	Outline few methods of preparation for various functional groups	1,11
		CO2	Understand how and why the C=O group reacts with nucleophiles (using molecular orbitals and curly arrows) to give varied products	1,3,11
		CO3	Predict the molecules that can be synthesized by reaction of C=C groups with electrophiles	1,3,8
		CO4	Understand reactivity of aromatic systems towards electrophiles and nucleophiles	1,3
SEM III	Physical Pharmacy II	CO1	Identify order of reactions, pathways of drug degradation and types of drug complexes	1,3
		CO2	Describe Fick's laws of diffusion, mechanism of drug dissolution and absorption	1,3
		CO3	Acquire understanding of drug complexes, protein binding and their applications	1,3
		CO4	Gain knowledge of the basic principles of coarse and colloidal dispersions	1,3
		CO5	Apply basic principles of drug characterization to biopharmaceutical aspects of drug delivery	1,3
SEM III	Pharmaceutics I	CO1	Describe the status of Pharma Industry in India and elaborate on the different official compendia, recall the various types of dosage forms, routes of administration and describe the alternate systems of medicine.	1,6,9
		CO2	Explain the concepts and need for GMP & QA and preformulation.	1,2,3,5,7,8,9
		CO3	Summarize the packaging of pharmaceuticals	1,6,8
		CO4	Explain the formulation considerations, unit operations, Q.A. aspects of monophasic systems, and powders	1,2,6,8
		CO5	Classify, describe the various biological products, viz. sutures & ligatures, blood products and plasma volume expanders.	1,2,6,8,10
SEM III	Pharmacology I	CO1	Define the scope, general principles and applications of Pharmacology. Comprehend pharmacokinetic and pharmacodynamic principles along with ability to compare and contrast various routes of administration with advantages and disadvantages. Understand the factors modifying drug action.	1,3,6,8
		CO2	Classify receptors and elucidate their role in drug/neurotransmitter/hormone action. Understand the mechanisms of drug action.	1,3,6,8
		CO3	Explain autonomic transmission and discuss the pharmacology of drugs acting on ANS and rationalize their therapeutic applications.	1,3,6,8
		CO4	Explain the pharmacology of drugs acting on cardiovascular system and as diuretics and discuss their use in associated diseases	1,3,6,8
SEM III	Microbiology	CO1	Describe the classification of microorganisms and list some of the common diseases caused by them	1,3,8,9,10
		CO2	Use different microscopic techniques, staining techniques, and differential media for the identification of some common disease causing microorganisms.	1,4,8
		CO3	Describe different methods for the control of growth of microorganisms and methods of preservation/sterilization of pharmaceutical products.	1,2,3,8
		CO4	Describe the importance of microbial testing and microbial limit tests for some pharmaceutical products	1,2,3,8
SEM III	Mathematics and Statistics	CO1	Know the theoretical concepts of topics and their application in Pharmacy	1
		CO2	Solve the different types of problems by applying theoretical concepts	1
		CO3	Appreciate the important application of mathematics and statistics in Pharmacy	1,4
		CO1	Determine reaction rate constant, order of reaction for different reactions	1,8



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SEM III	Physical Pharmacy Laboratory II	CO2	Predict shelf life by carrying out accelerated stability studies	1,2,3,8
		CO3	Calculate physical parameters such as stability constants, molecular weight, and critical micellar concentration	1,2,3,8
SEM III	Pharmaceutics Laboratory I	CO1	Prepare monophasic liquid systems and powder systems, justify the components and method of preparation	1,2,3,8
		CO2	Demonstrate the properties of the developed dosage forms and biological products, comment on the quality.	1,2,3,8
		CO3	Perform experiments as per GLP and record in the journals	1,2,3,8
SEM IV	Pharmacology Laboratory I	CO1	Perform in vitro experiment on cock ileum (tissue) to evaluate effect of drug (ACh) and its dose on response (contraction) to comprehend and infer drug effects on receptors and its outcomes	1,2,3,8
		CO2	State the principles behind plotting dose-response of drugs/agonist/antagonist and its applications. Define pA2 value and calculate pA2 value of antagonist	1,2,3,8
		CO3	Summarize the impact of drugs on eye and GI and discuss their potential therapeutic utility.	1,2,3,8
		CO4	Observe and explain the mechanisms of action of neurotransmitters, drugs and ions on isolated frog heart.	1,2,3,8
		CO5	Knowledge of animal handling techniques and understanding of ethical guidelines governing animal experimentation.	1,2,3,7,8
SEM V	Organic Chemistry III	CO1	Identify, nomenclature, and to employ fundamental heterocyclic organic reactions in the synthetic design of biologically active molecules containing heterocyclic nucleus	1,3
		CO2	Recognize the steroid molecules, synthetic methods, nature and their role in our body.	1,2
		CO3	Outline the synthesis, chemical reactions of steroids, conversion of cholesterol to progesterone, estrone and testosterone and elucidation of structure of cholesterol.	1,2,3
		CO4	State basic terminologies in polymers, different mechanisms involved in the polymer preparation, different polymerization techniques, details about the glass transition temperature and the factors affecting it and the types of polymers with some specific examples of each	1,3,4
SEM V	Pharmaceutics II	CO1	Understand the formulation of liquid biphasic, semisolid, suppository and aerosol dosage forms	1, 3
		CO2	Describe the evaluation of such dosage forms	1,3, 4,8
		CO3	Summarize the packaging of liquid biphasic, semisolid, suppository and aerosol dosage forms	1, 3,4,8
		CO4	Explain the basic concepts of cosmetic science	1, 3,4,8
SEM V	Pharmaceutical Biotechnology	CO1	To discuss the tools, techniques, ethics and environmental safety involved in gene cloning, and the applications of Recombinant DNA technology	1,7,9,10,11
		CO2	Discuss basics of immunology and explain the antigen-antibody interactions and defense mechanism and explain technique of monoclonal antibodies production for treating the human diseases	1,7,9,10
		CO3	Study fermentation technology and understanding the basic concepts for production of safer vaccines and antibiotics	1,7,9,10
		CO4	To study different techniques and applications of microbiological assay, enzyme immobilization and cell culture	1,4,10
SEM V	Pharmacology II	CO1	Discuss pharmacology of drugs used in chemotherapy and justify the need for rational use of antimicrobials.	1,3,6,7,8,9,11
		CO2	Explain pharmacology of drugs used as immunomodulators.	1,3,6,7,8,9,11
		CO3	Explain pharmacology of drugs used in endocrine disorders & haematological disorders.	1,3,6,7,8,9,11
SEM V	Organic Chemistry Lab II	CO1	To carry out the separation of simple compound mixtures.	1,2,3,5,6,11
		CO2	To identify organic compounds based on simple tests	1,6
		CO3	To recrystallize compounds use single solvent and binary solvent mixtures	1,6,11
SEM V	Pharmaceutics Lab II	CO1	Understand the formulation aspects of biphasic and semisolid dosage forms	1,3,8
		CO2	Explain calculations involved in formulations	1,2,3,4,8
		CO3	Describe the importance of quality evaluation of biphasics, semisolids, suppositories, aerosols	1,2,3,4,7,8
SEM V	Experimental Techniques in Microbiology and Biotechnology Lab	CO1	Characterization and identification of bacteria using various staining techniques (morphological study), colony characterization, serological and biochemical characteristics	1,2,4,8
		CO2	Analyze quality of raw material, food and water and assessment of extent of microbial contamination using counting technique and Evaluate sterility of products	1,2,4,7,8
		CO3	To impart the knowledge of bioassay of antibiotic and test antibiotic sensitivity of few antibiotics.	1,2,4,7,8
SEM V	Nutraceuticals and Dietary Supplements	CO1	Explain concept of nutraceuticals and dietary supplements, classify these based on chemical nature, health benefits and mechanism of action	1,9
		CO2	Discuss the chemistry of phytochemicals, their health benefits, pharmacokinetics, interactions with food and recommended doses along with the marketed preparations	1,9
		CO3	Explain the challenges in formulating nutraceuticals	1,3,4
		CO4	Understand the significance of safety and stability studies of nutraceuticals	1,7,10
		CO5	Describe the labeling and regulatory aspects for manufacture and sale of nutraceutical products.	1,7
SEM V	Microbial Genetics	CO1	Understand basic concepts of homologous recombination and genetic exchange among prokaryotes.	1,4,9
		CO2	Understand natural plasmids and transposons present in prokaryotes	1,4,9
		CO3	Give an account of prokaryotic gene structure and the mechanisms controlling gene expression	1,9
SEM V	Biochemistry III	CO1	Explain how DNA topology and chromatin structure affects the processes of DNA replication, repair, and transcription	1,9
		CO2	Compare and contrast the mechanisms of bacterial and eukaryotic DNA replication, transcription, and translation.	1,9
		CO3	Describe mechanisms by which DNA can be damaged, mutated and describe the molecular mechanisms by which protein complexes repair different forms of DNA damage	1
		CO4	Explain the molecular mechanisms behind different modes of gene regulation in bacteria	1

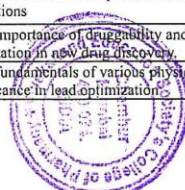
SEM V	Synthon Approach	CO1	Learner will also gain confidence for drawing the schematic retrosynthetic pathway from the course	1,3
		CO2	Learner will be able to analyze the retrosynthetic scheme synthesis planning and route analysis for any given target molecule.	1,3,8
SEM V	Cosmeticology	CO1	Discuss the various raw materials for cosmetics	1,3
		CO2	Understand the toxicological aspects and toxicity testing for cosmetics	1,3,7,8
		CO3	Discuss the various cosmetics products w.r.t. raw materials, large scale manufacturing and functional and physicochemical evaluation	1,2,3,4,7,8,10,11
		CO4	Know the regulatory guidelines and sensorial assessment for cosmetics	1,2,3,4,7,8,9,
SEM V	Packaging of Pharmaceuticals	CO1	Classify Packaging materials and explain the functions and design aspects	1,3,4
		CO2	Discuss the different primary and ancillary packaging materials, their functions and evaluation	1,3,4,7,8
		CO3	Elaborate on labelling aspects of pharmaceuticals	1,3,4,7,8
		CO4	Discuss sterilization and stability of packaging materials.	1,3,4,7,8
SEM VI	Pharmaceutical Chemistry I	CO1	Identify and study the suitable drug targets for treatment of disorders	1,6
		CO2	Identify the relationship between the physicochemical properties of the chemical entity and biological response	1,3,6
		CO3	Draw a schematic metabolic pathway for any given drug	1,3,6
		CO4	Identify the SAR of all the classes of antimalarial, antitubercular, anti-infective, antibiotic, antiparasitic disorders	1,3,6
SEM VI	Pharmaceutics III	CO1	Know the various solid oral dosage forms and their manufacturing techniques	1,2,4, 8
		CO2	Know various considerations in development of pharmaceutical dosage forms including stability	1,2,3,4,8
		CO3	Formulate solid dosage forms and evaluate them for their quality	1,2,3,4,7,8
		CO4	Understand the responsibilities of quality assurance & quality control departments	1,2,3,4,7,8
		CO5	Appreciate the importance of documentation	1,2,4,8
SEM VI	Pharmaceutical Analysis II	CO1	Comprehend underlying principle, instrumentation, application and limitations in instrumental techniques involving molecular as well as atomic absorption and emission techniques such as UV-Visible, Fluorescence, Infra-Red, Raman, Atomic absorption spectroscopy and Atomic emission spectroscopy	1,3,4,8,11
		CO2	Explain fundamentals, working principle and applications of X-ray diffraction technique, potentiometric titrations and thermal methods of analysis like TG, DSC and DTA.	1,3,4,8,11
		CO3	Generalize the concepts and quality control aspects related to radiopharmaceuticals.	1,3,4,8,11
		CO4	Calculate and interpret the results for spectral analysis and statistical data analysis.	1,3
SEM VI	Pharmacognosy II	CO1	Explain the concept of adulteration and substitution in crude drugs, extraction process for phyto-constituents using different methods and principles.	1,3,6,7,9,10,11
		CO2	Write the source, composition, general methods of extraction, evaluation, chemical tests, therapeutic uses of crude drugs containing volatile oils, resins and tannins	1,3,6,7,9,10,11
		CO3	Write the biosynthesis of monoterpenoids and phenylpropanoid constituents of volatiles	1,3,6,7,9,10,11
		CO4	Understand the chemistry of phytoconstituents belonging to the classes of terpenoids, sulfur containing constituents and quinones and write source composition and structures of phytoconstituents of crude drugs belonging to these classes	1,3,6,7,9,10,11
		CO5	Write the significance of excipients of natural origin, used in pharmaceutical formulations and describe various classes of excipients like binders, colours, sweeteners and flavorants along with the examples of their utility	1,3,6,7,9,10,11
		CO6	Describe the applications of plant tissue culture techniques with respect to production of secondary metabolites and edible vaccines	1,3,6,7,9,10,11
SEM VI	Pharmaceutical Chemistry Lab I	CO1	Design and perform various unit operations of organic synthetic reaction	1,2,4,5,6
		CO2	Know the theoretical concepts behind organic synthesis.	1,6
		CO3	Understand the concept and techniques of waste management	1,2,3,8, 9,10
SEM VI	Pharmaceutics Lab III	CO1	Formulate solid dosage forms like tablets and capsules and evaluate them for their quality.	1,2,3,4,5,7,8, 10,11
		CO2	Understand the tablet coating process.	1,2,3,4,5, 7,8,10,11
		CO3	Learn the concepts of accelerated stability testing and shelf life calculations	1,2,3,4,5,7,8, 10,11
SEM VI	Pharmaceutical Analysis Lab II	CO1	Record the absorbance and calculate concentration of analyte in formulation or as an API by use of A(1%, 1cm), single point and double point standardisation by UV spectrophotometer	1,2,3,4,8
		CO2	Relate and construct linear regression analysis data for colorimetric assays and operate a colorimeter instrument.	1,2,3,4,8
		CO3	Record and calculate the concentration of an analyte by measure of fluorescence of an analyte in absence and presence of quenching agent.	1,2,3,4,8
		CO4	Operate a pH meter, measure equivalence point by potentiometric titration, calculate pKa and normality for a given acid or mixture of acids.	1,2,3,4,8
		CO5	Understand the sample preparation technique for FTIR spectroscopy, interpret the IR spectra to identify the functional groups of an analyte, and understand the working of a flame photometer	1,2,3,4,8
SEM VI	Pharmaceutical Management	CO1	Study and interpret companies' financial statements & its components.	1,3
		CO2	. State the importance of marketing in the pharma industry	1, 5,6,8
		CO3	Outline the basic principles of management	1, 5,6,8
		CO4	Discuss the importance of management in quality control & government regulation.	1, 5,6,8
SEM VI	Biopharmaceutics and Pharmacokinetics	CO1	Explain the basic terms used in Biopharmaceutics and Pharmacokinetics	1,3,4,8
		CO2	Understand the concept of pharmacokinetics models and significance of various pharmacokinetic parameters	1,2,3,4,7,8
		CO3	Understand BCS Classification, theories of Dissolution and methods of dissolution testing	1,2,3,4,7,8
		CO4	Explain the concepts of Bioavailability and Bioequivalence and IVIVC	1,2,3,4,6,7,8
		CO5	Solve problems based on principles of Pharmacokinetics	1,2,3,4,8
Basic Principles of Toxicology		CO1	Define toxicological terms mentioned in the course.	1,6
		CO2	Discuss mechanism of toxicity, factors influencing toxicity and management of poisoning	1,3,6,7
		CO3	Explain metal poisoning and basic principles with suitable example of drug induced toxicity	1,3,6,7,11



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SEM VI	Toxicology	CO4	Discuss in brief about different types of toxicity test	1,3,6,7,11
		CO5	Demonstrate the knowledge of regulatory toxicology and able to apply this knowledge for design of nonclinical toxicology and clinical development of drugs.	1,3,6,7,11
SEM VI	Cell and Tissue Culture	CO1	Understand the basic requirements of cell and tissue culture	1,4,10
		CO2	Plan experiments using cultured cells	1,2,4,8
		CO3	Carry out cell culture, and associated laboratory techniques	1,2,4,8
		CO4	Explore the concepts of cell and tissue culture in production of pharmaceutical products.	1,2,4,9,10
SEM VI	Pharmaceutical Process Chemistry and Technology	CO1	Describe the basic concepts of process chemistry and process development	1,2,3
		CO2	Describe chemical process, reaction systems and equipment used in API manufacturing	1,2,3,4,6
		CO3	Outline the regulatory guidelines related to API manufacturing	1,7
		CO4	Appreciate the importance of safety in pharmaceutical industry	1,9,10
SEM VI	Pharmaceutical Excipients	CO1	Define, classify and elaborate on regulatory aspects of Pharmaceutical excipients	1,6,8,9
		CO2	Understand the characterization and interactions of excipients with APIs and packaging materials	1,3,4,8,9,10
		CO3	Elaborate on common and novel excipients in Pharmaceuticals	1,3,4,7,8,
		CO4	Explain the role of polymers as excipients	1,3,8
SEM VII	Pharmaceutical Chemistry II	CO1	Students will gain knowledge in the thrust areas chemotherapy for cancer, antiviral diseases, cardiovascular drugs like antianginal agents, antiarrhythmic agents, diuretics, drug affecting the RAS pathway, vasodilators, antihyperlipidemic agents. They will be apply this knowledge in research areas.	1,6,8,9
SEM VII	Pharmacognosy III	CO1	Write the source, composition, general methods of extraction, evaluation, chemical tests, therapeutic uses of crude drugs containing phytoconstituents like steroidal, triterpenoidal, anthraquinone, flavonoidal glycosides, alkaloids glycoproteins	1,3,6,7,9,10,11
		CO2	Write the biosynthesis of biosynthesis of alkaloids obtained from different amino acids	1,3,6,7,9,10,11
		CO3	Understand regulatory requirements for manufacture and sale of Ayurvedic, Siddha and Unani (ASU) Medicines and Phytopharmaceuticals, monographs of herbal drugs	1,3,6,7,9,10,11
		CO4	Apply the knowledge of excipients from natural origin and pharmaceutical technology to herbal formulation and understand the challenges in herbal formulation	1,3,6,7,9,10,11
		CO5	Understand the concept of herbal drug standardization and its application to herbal formulation	1,3,6,7,9,10,11
		CO6	Apply the knowledge of pharmacology to understand pharmacodynamic and pharmacokinetic interactions of herbal drugs with food	1,3,6,7,9,10,11
		CO7	Apply spectroscopic techniques to characterize small molecules both from the categories of aromatic and aliphatic nature	1,3,6,7,9,10,11
SEM VII	Pharmaceutical Analysis III	CO1	Explain various methods used for multicomponent analysis of drugs by UV spectroscopy	1,3
		CO2	Summarize chromatographic and hyphenated techniques used for the separation, identification and quantification of analytes.	1,3,8
		CO3	Describe the working of proton 1H NMR spectroscopy and mass spectrometry.	1,3,4
		CO4	Interpret spectral data to predict structure of a given compound.	1,3,4,8,11
		CO5	Summarize the parameters of ICH guidelines for analytical method validation.	1,11
SEM VII	Pharmacology III	CO1	Explain pharmacology of drugs acting on central nervous system and associated diseases	1,3,6,7,11
		CO2	Classify and explain pharmacology of anti-inflammatory drugs, make use of knowledge of these drugs to justify their use in asthma and gout.	1,3,6,7,11
		CO3	Discuss the pharmacology of drugs used in gastrointestinal disorders.	1,3,6,7,11
		CO4	Know the toxic effects of heavy metals, drugs and environmental toxicants.	1,3,6,7,8,10
SEM VII	Pharmaceutical Jurisprudence	CO1	Interpret Pharmaceutical Legislation	1,2,6,7,8,9,
		CO2	Understand pricing of drugs & pharmaceuticals	1,3,6,7,8,9
		CO3	Summarize offences & penalties concerned with laws for drugs and pharmaceuticals	1,3,6,7,8,9,11
		CO4	Gain an insight into Drug Regulatory Affairs	1,2,3,5,6,7,8,9,11
SEM VII	Pharmacognosy Lab II	CO1	Identify crude drugs based on morphological characters, microscopic characters and give biological source with the chemical constituents and therapeutic uses	1,3,6,7,9,10,11
		CO2	Apply the knowledge of microscopic characters in ascertaining the genuinely of powdered formulations.	1,3,6,7,9,10,11
		CO3	Extract and perform qualitative chemical tests on the crude drugs containing Anthraquinone Glycosides, Cardiac Glycosides, Flavonoids, Cyanogenetic Glycosides, Alkaloids, Triterpenoid and Steroidal Glycosides, Saponins, Tannins	1,3,6,7,9,10,11
		CO4	Apply analytical procedures and principles for quantitative determination of total Aldehyde content / Phenol content / total alkaloids from crude drugs	1,3,6,7,9,10,11
		CO5	Understand principles involved apply these for carrying out extraction of active constituents	1,3,6,7,9,10,11
		CO6	Identify crude drugs based on the morphological characters and quote some formulations available in market with their therapeutic utility	1,3,6,7,9,10,11
SEM VII	Pharmaceutical Analysis Lab III	CO1	Record, calculate and interpret data obtained by UV spectrophotometric analysis for pKa determination and concentration determination by multicomponent analysis techniques	1,3,4
		CO2	Apply ICH guidelines to validate an analytical method by UV spectroscopy and interpret results obtained.	1,11
		CO3	Develop and optimize mobile phase composition for qualitative analysis by TLC and interpret qualitative analysis data by TLC and paper chromatography.	1,3,4,11
		CO4	Outline working and application of column chromatography, HPLC and GC.	1,11
SEM VII	Pharmacology Lab II	CO1	Define Bioassay, list the types, methods and applications of bioassay and perform in vitro bioassay using cock ileum and record, calculate and interpret unknown concentration of agonist/antagonist/drug.	1,2,3,6
		CO2	Observe preclinical models which provide evidences on drug/lead pharmacological activity	1,2,3,6,7,8,9
		CO3	Relate to and apply the ethical, regulatory and toxicity guidelines/rules (ICH, OECD, CPCSEA, Schedule Y) in drug/lead testing using preclinical animals	1,2,3,6,7,8,9
SEM VII	Intellectual Property Rights	CO1	Correlate the knowledge of IPR with respect to pharmaceutical products	1,2,3,4,7,8,11

		CO2	Apply knowledge of IPR in designing strategy for pharmaceutical product development	1,2,3,4,6,7,8,11
		CO1	Know the terms involved in green chemistry.	1,3
SEM VII	Green Chemistry and Catalysis	CO2	Understand the concept and techniques of waste management	1,2,3,8,9,10
		CO3	Know various guidelines of environmental management system.	1,7,10
		CO4	Outline type of catalysis and their uses	1,4
		CO5	Learn greener process designing	1,2,3,8,10,11
		CO1	Explain physicochemical principles relevant to pharmaceutical dosage forms	1,3,4,6
SEM VII	Preformulation Studies	CO2	Comprehend the importance of solubility, stability and compatibility of drug substances with different excipients	1,3,4,6
		CO3	Understand the role of preformulation studies in drug discovery, drug and product development	1,3,4,6,8
		CO1	Students will gain knowledge in the thrust areas of CNS, ANS active drugs, analgesic agents and male female hormones. They will be apply this knowledge in research areas.	1,6,8,9
SEM VIII	Pharmaceutical Chemistry III	CO1	Apply the knowledge of sterile technology in designing safe and effective injectables and ophthalmic products	1,2,3,4,6,7,8
SEM VIII	Pharmaceutics IV	CO2	Study the rationale for oral SR/CR products, principles of design, development and evaluation of SR formulations	1,2,3,4,6,7,8
		CO3	Understand the concepts of validation and pilot plant scale up for large scale manufacturing operations	1,2,3,4,5,6,7,8
		CO4	Understand the concept of biopharmaceutics and significance of various pharmacokinetic parameters	1,2,3,4,6,8
		CO1	Design and perform various unit operations of organic synthetic reactions	1,2,4,5,6
SEM VIII	Pharmaceutical Chemistry Lab II	CO2	Characterize reaction intermediates and final products.	1,4,6
		CO3	Know the theoretical concepts behind organic synthesis.	1,6
		CO4	Understand the concept and techniques of waste management	1,2,3,8,9,10
		CO1	Demonstrate the intricacies of formulation and development of parenterals and ophthalmic products.	1,2,3,4,6,7,8,11
SEM VIII	Pharmaceutics Lab IV	CO2	Understand and know about quality control and documentation of a manufacturing process.	1,2,3,4,6,7,8,9,11
		CO3	Know about the pharmacopoeial tests for these products and their packaging materials.	1,2,3,4,6,7,8,9,11
		CO4	Explain the concept of dissolution testing as an important quality control tool and relate to its importance from regulatory point of view	1,2,3,4,6,7,8,9,11
		CO5	Apply pharmacokinetic principles of oral routes of administration	
		CO6	Demonstrate oral and written communication skills and ability to plan the experimentation with proper time management	1,2,3,4,6,7,8,
		CO1	Understand terms related to phytopharmaceuticals and standardization of Natural Products	1,2,6
SEM VIII	Project	CO2	Explain industrial preparation of standardized extracts, isolation of phytoconstituents and their applications.	1,2,3,5,6,9,10,11
		CO3	Discuss the challenges faced in formulation of conventional and NDDS of herbal medicines.	1,2,5,6,9
		CO4	Explain the applications of QC and QA of Phytopharmaceuticals.	1,2,6,5,6,9,10
		CO5	To suggest the use of herbs as nutraceuticals in common disorders and cosmeceuticals.	1,2,5,6,8,9,11
		CO6	Describe the regulatory requirements for phytopharmaceuticals.	1,2,5,6,8,9,11
		CO1	Understand terms related to phytopharmaceuticals and standardization of Natural Products	1,2,6
SEM VIII	Phytopharmaceutical Technology	CO2	Explain industrial preparation of standardized extracts, isolation of phytoconstituents and their applications.	1,2,3,5,6,9,10,11
		CO3	Discuss the challenges faced in formulation of conventional and NDDS of herbal medicines.	1,2,5,6,9
		CO4	Explain the applications of QC and QA of Phytopharmaceuticals.	1,2,6,5,6,9,10
		CO5	To suggest the use of herbs as nutraceuticals in common disorders and cosmeceuticals.	1,2,5,6,8,9,11
		CO6	Describe the regulatory requirements for phytopharmaceuticals.	1,2,5,6,8,9,11
		CO1	Relate to the role of pharmacist in different setups like clinics, pharmacies and in the community and appraise the crucial role of pharmacists in patient counselling and eventually in drug adherence and compliance to therapy.	1,3,4,6,7,8,11
SEM VIII	Clinical Pharmacy	CO2	Discuss the types, risk factors, classification, methods of detection, monitoring and reporting of ADRs, drug interactions, pharmacovigilance and TDM in normal as well as special populations.	1,3,4,6,7,8,11
		CO3	Outline the process of drug discovery and development, Ethical Guidelines/Schedules, Role of Ethics Committee, essential documents in clinical trials/research, BA-BE studies and, apply and appreciate the role of GCP in conduct of clinical research.	1,3,4,6,7,8,11
		CO4	Identify and analyze the trends in drug use to optimize health outcomes	1,3,4,6,7,8,11
		CO1	Relate to the role of pharmacovigilance and its prevalence in different setups	1,3,4,6,7,8,11
SEM VIII	Pharmacovigilance	CO2	Discuss the different facets of ADRs in normal as well as special populations with their relation to pharmacovigilance methods	1,3,4,6,7,8,11
		CO3	Integrate knowledge of resources of drug information, safety data and drug utilization	1,3,4,6,7,8,11
		CO4	Outline the regulatory processes in pharmacovigilance.	1,3,4,6,7,8,11
		CO1	Understand the basics of new drug and generic product development	1,3,4,6,7,8,11
SEM VIII	Pharmaceutical Regulatory Affairs	CO2	Apply knowledge of regulatory requirements for preparing the documents for registration	1,3,4,6,7,8,11
		CO3	Understand various harmonized practices and integrate the knowledge required for various certifications	1,3,4,6,7,8,10,11
		CO1	Understand the importance of drugability and physicochemical/ADME/Toxicity property optimization in new drug discovery.	1,3,6,9
SEM VIII	Lead Optimization – Strategies and	CO2	Understand the fundamentals of various physicochemical and pharmacokinetic properties and their significance in lead optimization.	1,3,6,9



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SEM VIII	Strategies and Methods	CO3	Know various strategies for structure modification for optimizing druggability of lead molecules	1,3,6,9
		CO4	Describe different methods of determination of various physicochemical and pharmacokinetic properties of lead compounds	1,3,6,8,9
SEM VIII	Novel Drug Delivery Systems	CO1	Understand the basic concept of NDDS	1,2,3,4
		CO2	Discuss the different NDDS for different routes-oral, transdermal, ocular, transmucosal and implantable	1,2,3,4
		CO3	Explain the need and concepts of targeting and active & passive targeting	1,2,3,4
		CO4	Elaborate on principles and targeting systems for brain, colon, lymphatics and tumors	1,2,3,4
		CO5	Discuss the various multiparticulate systems for targeting	1,2,3,4

B PHARM R 2019 SYLLABUS

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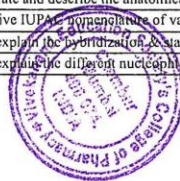
2.6.1 QIM

Teachers and students are aware of the stated Programme and course outcomes of the Programmes offered by the institution (15)

Describe Course Outcomes (COs) for all courses and mechanism of communication

B PHARM R 2019 SYLLABUS COURSE OUTCOMES

SEM	SUBJECT	Course Outcome	STATEMENTS	PO MAPPING
SEM I	Human Anatomy and Physiology I	CO1	Outline and categorize the various body structural levels (cells, tissues, organs, and systems) and recall the structure, composition and functions of plasma membrane and methods of movement of substances across plasma membrane	1, 3, 6, 8, 9
		CO2	Recall the anatomy of skeletal, cardiac and smooth muscle, explain the transmission at the neuromuscular junction and energy metabolism in the muscle as well as the mechanism of	1, 3, 6, 8, 9, 10
		CO3	Explain the anatomy and physiology of the Cardiovascular system, Lymphatic system, Peripheral Nervous system and sensory organs and appreciate coordinated working pattern of	1, 3, 6, 8, 9, 10
	Pharmaceutical Analysis I	CO1	Explain the role of pharmaceutical analysis in the field of pharmacy and industry and delineate	1,3,4,8,11
		CO2	Describe volumetric, gravimetric, electrochemical methods of analysis.	1,3,4,8,11
		CO3	Solve numerical problems related to volumetric, gravimetric methods of analysis and apply	1,3
	Pharmaceutics- I	CO1	Have knowledge of different Pharmacopecias, various monophasic and biphasic, liquid and	1,6,7,8,9,11
		CO2	Explain evaluation of solutions, suspensions, and emulsions, semisolid dosage forms	1,2,3,4,6,7,8,9,10,11
		CO3	Perform related calculations and prepare liquid and semisolid dosage forms.	1,3,4,6,7,8,9,10,11
		CO4	Analyze the errors in the prescription and identify physical and chemical incompatibilities	1,3,6,7,8,9,11
		CO5	Devise the composition of monophasic and biphasic dosage forms, considering the	1,2,3,4,5,6,7,8,9,10,11
	Pharmaceutical Inorganic Chemistry	CO1	Describe the principles and methods of limit tests to control common impurities	1,2,3,4,6
		CO2	Explain different pharmaceutical buffers, their preparations, uses in pharmaceutical system,	1,2,3,4,6,8
		CO3	Explain the medicinal importance of pharmaceutical inorganic compounds.	1,2,3,4,6,8
	Communication Skills	CO1	Understand the behavioral needs for a pharmacist to function effectively in the areas of	1, 6, 8
		CO2	Effectively develop presentation skills with confidence to crack interviews	6,7,11
		CO3	Effectively manage the team as a team player. Apply skills learnt to confidently stand in a group	5,8
		CO4	Apply skills learnt to communicate effectively technically/businesswise	4,5,8,9,11
	Remedial Biology	CO1	Understand the cell biology (Basic Nature of Plant cell and Animal cell) and Classification	1,6,8,9,10,11
		CO2	Learn and comprehend various tissue system and organ system in plant and animals	1,6,8,9,10,11
		CO3	Understand and explain anatomy and Physiology of plants and animals.	1,6,8,9,10,11
	Remedial Mathematics	CO1	Know the theoretical concepts of various topics and their application in Pharmacy	1,3
		CO2	Solve the different types of pharmaceutical problems by applying theoretical concepts	1,3,4
		CO3	Appreciate the important application of mathematics and statistics in Pharmacy	1,3,4,7
	Human Anatomy and Physiology I LAB	CO1	Explain the parts of microscope, apply this knowledge to study histology of different tissues and	1,4,6,7,8,9,10,11
		CO2	Explain the components of the skeletal system and identify and describe each part in detail	1,4,6,7,8,9,10,11
		CO3	Perform the methods used in diagnosis of diseases using hematological tests like bleeding time,	1,4,6,7,8,9,10,11
		CO4	Explain the basic principles of cardiovascular system and able to assess heart rate, pulse rate and	1,4,6,7,8,9,10,11
		CO5	Plan, execute and conclude the experiment using various methodologies	1,3,4,6,7,8,9,10,11
	Pharmaceutical Analysis Lab	CO1	Employ practice of calibration and proper handling of volumetric apparatus, electronic analytical balance and safety measures in the laboratory	1,2,4,11
		CO2	Demonstrate eye- hand coordination required for titrimetric analysis	1,2,4,11
		CO3	Perform and record, calculate and interpret data obtained for experiments related to limit tests,	1,2,4,11
		CO4	Conduct and evaluate various tests mentioned in a pharmacopoeial monograph	1,2,4,11
	Pharmaceutics I Lab	CO1	Prepare monophasic, biphasic, powders and semi solid systems, justify the components and	1,2,3,5,6,7,10,11
		CO2	Perform experiments as per GLP and record in the journals	1,2,3,5,6,7,10,11
		CO3	Plan, execute and conclude the experiment using various methodologies (defined protocol or	1,2,3,5,6,7,10,11
	Pharmaceutical Inorganic Chemistry Lab	CO1	Perform qualitative analysis of given inorganic mixtures.	1,2,4,6,8
		CO2	Carry out identification test of given inorganic compounds	1,2,3
		CO3	Perform limit test for chlorides, sulphates etc.	1,2,4,6,8
		CO4	Prepare inorganic compounds	1,2,4,6,8
	Communication Skills Lab	CO1	Practice the Basic Communication attributes required during meeting people, making friends, asking questions using Wordsworth® English language lab software	4,6,8,11
		CO2	Learn the Advanced techniques involved in effective communication, writing skills, interview handling skills, presentation skills, E-mail writing using Wordsworth® English language lab	1,4,6,7,8,11
		CO3	Plan, execute and conclude the tasks using various methodologies (defined protocol or	1,2,3,4,6,8,9,11
	Remedial Biology lab	CO1	Demonstrate Handling of microscope independently & able to demonstrate understanding of section cutting techniques, mounting and staining, permanent slide preparation. Able to apply	1,2,3,4,6,7,8,9,10,11
		CO2	Understand and explain morphology of plant with respect to stem, root, leaf and its modification	1,6,8,10,11
CO3		Identify the bones and understand and explain about determination of blood group, blood pressure, tidal volume which basal characteristics are commonly assessed during physical	1,2,3,4,6,7,8,9,10,11	
CO4		Explain about study of frog by using computerized simulated software.	1,3,4,6,7,8,9,10,11	
CO5		Plan, execute and conclude the experiment using various methodologies	1,2,3,4,6,7,8,9,10,11	
Anatomy and Physiology II	CO1	Explain the anatomy and physiology of Nervous System and Endocrine system and their role in	1, 3, 6, 8, 9, 10	
	CO2	Describe and illustrate the anatomical features of the Respiratory system, Digestive system and	1, 3, 6, 8, 9, 10	
	CO3	Identify, illustrate and describe the anatomical and physiological features of Reproductive	1, 3, 6, 8, 9, 10	
Organic Chemistry	CO1	Classify and give IUPAC nomenclature of various organic compounds along with the type of	1,8	
	CO2	Describe and explain the hybridization & stability in alkanes, alkenes & conjugated dienes along	1,3,8	
	CO3	Describe and explain the different nucleophilic substitution & addition reactions in Alkyl Halides	1,3,8	



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Pharmaceutical Organic Chemistry I	CO4	Describe and explain the method of preparation, reactions, chemical properties, uses, structures & the qualitative identification tests for compounds of different functional groups like alcohols,	1,3,8,11
	CO1	Understand classification, structure, functions, digestion and metabolism of basic biomolecules	1
Biochemistry	CO2	Learn thermodynamic and bioenergetic aspects of biochemical reactions	1
	CO3	Reproduce names, structures, products and enzymes involved in all metabolic processes	1, 11
	CO4	Understand the catalytic role of enzymes, importance of enzyme inhibitors in design of new	1, 11
	CO5	Explain three cornered central paradigms of biochemistry i.e. replication, transcription and	1,11
	CO1	Explain of Principles related to cell injury, adaptation, repair, growth, inflammation and	1,6,7,8,9,11
Pathophysiology	CO2	Describe the etiology and pathophysiology of diseases related to cardiovascular, Skeletal,	1, 6,7,8,9,11
	CO3	Describe the etiology and pathophysiology of diseases related to infectious diseases.	1, 6,7,8,9,11
	CO4	Apply the knowledge of related to diseases and symptoms to identify the disease.	1, 6,7,8,9,11
	CO1	Understand the basics of computers	3,4,10
Environmental Science	CO2	Differentiate among different web technologies and databased	1,4,7,10
	CO3	Delate various application of computers in Pharmacy	1,4,6,10
	CO1	Describe the basics of Environmental sciences like need and purpose of study the subject,	1,3,4,10,11
	CO2	Classify and compare different sources of energies	1,3,4,10,11
	CO3	, Relate technology to control pollution and economic benefits thereof, infer, the concept of green building, carbon credit and disaster management Realize the environment related moral	1,3,4,10,11
Human Anatomy and Physiology II Lab	CO1	Determine body temperature, Basal mass index , vital capacity and tidal volume and explain how total blood count is determined using cell counter and which basal characteristics are commonly	1,2,3,4,7,9,10,11
	CO2	Understand and explain the anatomy and physiology of the different systems in the body and	1,2,4,6,7, 8,9,10,11
	CO3	Identify and explain the histology, structure of different organs and tissues in the human body	1,6,7,9,10,11
	CO4	Explain the response of the human body to difference reflexes, visual acuity, different types of	1,2,4,6,7,8,9,10,11
	CO5	Plan, execute and conclude the experiment using various methodologies	1,3,4,6,7,8,9,10,11
Pharmaceutical Organic Chemistry - I Lab	CO1	Practice and follow safety rules & precautionary measures in a laboratory.	8,9
	CO2	Explain theoretical aspects of physical constant determination, detection of functional groups.	1,2,3,8
	CO3	Characterize/ Identify monofunctional or bifunctional organic compounds by physical constant,	1,2,3,8
	CO4	Prepare solid derivatives from organic compounds & molecular model construction of basic	1,2,3,8
	CO5	Plan, execute and conclude the experiment using various methodologies (defined protocol or	2
Biochemistry Lab	CO1	Able to perform Qualitative and quantitative analysis of various samples of carbohydrate,	1,2
	CO2	Estimate enzyme activity with respect to various factors Temp, substrate concentration and	1,2
	CO3	understand clinical applications of biochemical methods through experiments	1
	CO4	Correlate findings with theoretical concepts and conclude the results based on confirmatory tests	1,3
	CO5	Demonstrate oral and written communication and ability to plan experiment with proper time	2,3,8
Computer Applications in Pharmacy Lab	CO1	Designing and creating, questioners, HTML forms and MS access databases	2,4,5,11
	CO2	Apply learning to the problems of pharmaceutical origin	1,2,3,4,5,11
Pharmaceutical Organic Chemistry II	CO1	Explain different reactions of benzene and predict aromatic character, resonance, orientation, effect of substituents in benzene and its derivatives	1,3,8
	CO2	Describe and explain the method of preparation, reactions, chemical properties, uses, structures & the qualitative identification tests for compounds of different functional groups like phenols, aromatic amines, aromatic acids and hydrocarbons.	1,3,8,11
	CO3	Explain reactions shown by fats & oils along with determining their analytical constants like Acid value, Saponification value, RM value.	1,3,8
	CO4	Describe different conformational stabilities of cycloalkanes & reactions of cyclopropane & cyclobutane.	1,3,8
Physical Pharmaceutics I	CO1	Understand various physicochemical properties of drug molecules in the designing the dosage forms	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11
	CO2	Know the principles of chemical kinetics & to use them for stability testing and determination of expiry date of formulations	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11
	CO3	Demonstrate use of physicochemical properties in the formulation development and evaluation of dosage forms.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11
Pharmaceutical Microbiology	CO1	Understand classification and methods of identification, isolation, cultivation and preservation of various classes of microorganisms	1,6,8,10,11
	CO2	Understand the use of various microscopic techniques, staining techniques and biochemical tests for identification of microorganisms	1,4,6,8,10,11
	CO3	Describe various methods for control of microorganisms, their evaluation and factors affecting their efficiency	1,3,6,8,9,10,11
	CO4	Demonstrate various methods used for sterilization of pharmaceutical products and evaluation of efficiency of methods of sterilization	1,3,4,6,8,9,10,11
	CO5	Describe the cell culture technology and its application in pharmaceutical industry and research	1,4,6,8,9,10,11
Pharmaceutical Engineering	CO1	Understand mechanics of fluid, fluid flow, and its measurements	1,2,3,8
	CO2	Classify and describe new measuring devices, mixers and dryers with respect to their applications in pharmacy	1,2,3,8
	CO3	distillation, size reduction, filtration, centrifugation and refrigeration and will able to describe the equipment and accessories involved therein.	1,2,3,8,10
	CO4	Summarize construction material, discuss corrosion of equipment from pharmaceutical industry point	1,3,8,10
Pharmaceutical Organic Chemistry - II Lab	CO1	Perform experiments involving laboratory techniques like recrystallization, distillation.	1,2,4
	CO2	Determine analytical constants like Acid value, Iodine value in Fats & Oils.	1,2,3,8
	CO3	Describe the theoretical aspects of organic synthesis & perform various unit operations of organic synthetic reactions.	1,2,4,5,6
	CO4	Plan, execute and conclude the experiment using various methodologies (defined protocol or qualitative or quantitative techniques).	2
CO1	Understand the principles and methods for the determination of various physical parameters of drugs and formulations.	1,2,3,4,5,6,8,10,11	

sem III	Physical Pharmaceutics – I Lab	CO2	Carry out various physical tests involved in the characterization of drugs.	1,2,3,4,5,6,8,10,11
		CO3	Demonstrate testing of various physical parameters involved in pre-formulation and formulation evaluation.	1,2,3,4,5,6,8,10,11
		CO4	Plan, execute the experiment using various methodologies (defined protocol or qualitative or quantitative techniques) and summarize the findings in systematic way verbally and	1,2,3,4,5,6,8,10,11
			in written communication.	
	Pharmaceutical Microbiology Lab	CO1	Demonstrate methods of subculturing, characterization and identification of bacteria using various techniques (morphological, serological and biochemical)	1,2,3,5,6,7,8,10,11
		CO2	Practice methods of sterilization for various products, perform test for sterility on pharmaceuticals and bioassay of antibiotics	1,2,3,5,6,7,8,9,10,11
		CO3	Demonstrate the use of different equipments used in experimental microbiology	1,2,3,4,5,6,7,8,10,11
		CO4	Plan, execute and conclude the experiment using various methodologies	1,2,3,4,5,6,7,8,10,11
	Pharmaceutical Engineering Lab	CO1	Impart knowledge of different unit operations	1,2,3,4,11
		CO2	Understand process controls with respect to unit operations that are employed in the pharmaceutical industry	1,2,3,4,8
		CO3	Perform experiments as per GLP and record in the journals	1,2,3,8
	Pharmaceutical Organic Chemistry –III	CO1	Understand basic concepts and various terminologies involved in stereochemistry.	1,11
		CO2	Understand the methods of preparation and properties of heterocyclic organic compounds.	1,11
		CO3	Predict and explain the reaction products considering the mechanisms and their stereochemical aspects.	1,3,11
	Medicinal Chemistry I	CO1	Identify and study the suitable drug targets for treatment of disorders	1,3
		CO2	Identify the relationship between the physicochemical properties of the chemical entity and biological response	1,3,6
		CO3	Draw a schematic metabolic pathway for any given drug	1,3,6
		CO4	Identify the SAR of all the classes of Drugs acting on Autonomic Nervous System, Cholinergic neurotransmitters, Drugs acting on Central Nervous System.	1,3,6
	Physical Pharmaceutics II	CO1	Understand the concept of coarse and colloidal dispersions, rheology, powder technology and drug stability	1,6,9,10,11
		CO2	Identify the different types of dispersion, rheological properties of the different dosage form	1,6,9,10,11
		CO3	Identify different order of reactions and pathways of drug degradation	1,6,9,10,11
		CO4	Apply basic principles of drug characterization to achieve stable and reproducible drug delivery	1,4,6,9,10,11
	Pharmacology I	CO1	Understand and explain the basic pharmacological principles related to drugs like concepts of	1, 6, 8, 9,10,11
		CO2	Understand and explain the basic principles of Pharmacokinetics, Pharmacodynamics and adverse reaction of drugs	1,6, 8, 9,10,11
CO3		Understand and explain the pharmacology and drugs used for peripheral nervous system	1,6, 8, 9,10,11	
CO4		Understand and explain the Pharmacology and drugs used for central nervous system	1,6, 8, 9,10,11	
CO5		Analyze and apply the knowledge of basic principles of pharmacology in predicting adverse drug reactions, drug interactions and drug development process	1,2,3,5,6,7,8,9,10,11	
Pharmacognosy and Phytochemistry I	CO1	Outline the Alternative and complementary systems of medicine, classify drugs of natural origin	1,3,6,7,9,10,11	
	CO2	Describe primary and secondary plant metabolites their biosynthesis, evaluation and therapeutic application	1,3,6,7,9,10,11	
	CO3	Describe the applications of plant tissue culture techniques with respect to production of secondary metabolites and edible vaccines	1,3,6,7,9,10,11	
	CO4	Elaborate commercial production, collection, preparation, storage and factors affecting cultivation of medicinal plants and its conservation	1,3,6,7,9,10,11	
	CO5	Evaluate and analyse crude drugs by morphological and microscopic and other evaluation techniques of Drugs of Natural Origin	1,3,6,7,9,10,11	
	CO6	Describe the source, composition, preparation and applications of crude drugs containing carbohydrates, lipids, fibers, important protein and enzymes of natural origin and marine drugs	1,3,6,7,9,10,11	
Medicinal Chemistry I Lab	CO1	Demonstrate skills of handling synthetic procedures and quantitative evaluation techniques.	1,11	
	CO2	Understand and apply various isolation techniques, purification techniques in synthetic chemistry and different types of assay methods for quantitative evaluation.	1,3,11	
	CO3	Design or predict experimental requirements for determining partition coefficient of organic molecule and interpret results obtained.	1,3,11	
	CO4	Recognize the reaction from experimental conditions, deduce the mechanism and transform one functional group to other.	1,3,11	
	CO5	Perform experiments as per GLP and record in the journals	1,8	
Physical Pharmaceutics- II Lab	CO1	Demonstrate the properties of the powder and liquid dosage forms and comment on the quality.	1,2,3,4,5,6,8,10,11	
	CO2	Determine reaction rate constant, order of a reaction for different reactions	1,2,3,4,5,6,8,10,11	
	CO3	Predict shelf life by carrying out accelerated stability studies	1,2,3,4,5,6,8,10,11	
	CO4	Demonstrate testing of various physical parameters involved in pre-formulation and formulation evaluation.	1,2,3,4,5,6,8,10,11	
	CO5	Plan, execute the experiment using various methodologies (defined protocol or qualitative or quantitative techniques) and summarize the findings in systematic way verbally and	1,2,3,4,5,6,8,10,11	
		in written communication.		
		CO1	Understand, explain, evaluate and apply basic techniques related to the instruments and animal handling for experimental purpose including routes of the administration.	1,2,3,4,6,7,9,10,11
		CO2	Explain the guidelines recommended for ethical handling of animals and perform the animal experiments in ethical manner	1,2,3,4,6,7,9,10,11
		CO3	Learn, analyze and perform common laboratory techniques and observe the effect of hepatic microsomal enzymes on drug induced sleeping time in mice	1,2,3,4,6,7,9,10,11
		CO4	Perform, explain and apply the principle for experiments that study the effect of drugs acting on the central nervous system.	1,2,3,4,6,7,9,10,11



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iv	Pharmacology I Lab	CO5	Plan, execute and conclude the experiment using various methodologies	1,3,4,6,7,8,9,10,11
	Pharmacognosy and Phytochemistry I Lab	CO1	Carry out quantitative microscopy for leaf constants	1,3,6,7,9,10,11
		CO2	Determine different extractive values, ash values, moisture content, swelling index and foaming index as per Official Compendia	1,3,6,7,9,10,11
		CO3	Determine the histological features of plants of diagnostic significance such as calcium oxalate	1,3,6,7,9,10,11
		CO4	Demonstrate oral and written communication skills and ability to plan the experimentation with proper time management	1,3,7,8
CO5		Identify crude drugs containing carbohydrates, lipids and protein by chemical tests	1,3,6,7,9,10,11	
sem v	Medicinal Chemistry II	CO1	1. Understand the chemistry of drugs with respect to their pharmacological activity	1,6
		CO2	2. Explain the drug metabolic pathways, adverse effect and therapeutic value of drugs	1,2,6
		CO3	3. Distinguish Structural Activity Relationship of different class of drugs	1,6
		CO4	4. Illustrate the chemical synthesis of selected drugs	1,6
	Industrial Pharmacy I	CO1	To understand dosage forms and their manufacturing techniques	1,3,4,6,7,11
		CO2	To understand all the related and practical aspect of solid, liquid and semisolid dosage form development and evaluation	1,2,3,4,7,8,10,11
		CO3	To correlate the theoretical knowledge with professional and practical need of pharmaceutical industry.	1,2,3,4,5,6,7,8,9,10,11
	Pharmacology II	CO1	Classify the drugs used for cardiovascular system, urinary system and endocrine system and explain their Pharmacology.	1,8,9,10,11
		CO2	Classify and explain antacids and related drugs and their role in inflammatory disorders like rheumatic and gout.	1,8,9,10,11
		CO3	Explain the concept of bioassay, their types, methods and application with different examples of drugs.	1,8,9,10,11
	Pharmacognosy and Phytochemistry II	CO1	Describe the modern extraction process by using different methods and principles, in the isolation, purification, identification and analysis of various phyto-constituents	1,3,6,7,9,10,11
		CO2	To develop the skills of general methods of extraction, evaluation, chemical tests of crude drugs containing various secondary metabolites.	1,3,6,7,9,10,11
		CO3	Describe basic metabolic pathways and biosynthesis of various secondary metabolites through these pathways	1,3,6,7,9,10,11
		CO4	To understand utilization of radioactive isotopes in the investigation of biogenetic studies.	1,3,6,7,9,10,11
		CO5	To understand the industrial production, estimation and utilization of different classes of phytoconstituents	1,3,6,7,9,10,11
Pharmaceutical Jurisprudence	CO1	The Pharmaceutical legislations and their implications in the development and marketing of		
	CO2	Various Indian pharmaceutical Acts and Laws.		
	CO3	The regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals.		
	CO4	The code of ethics during the pharmaceutical practice	1,2,5,6,7,8,9,10,11	
Industrial Pharmacy I Lab	CO1	To understand all the theoretical and practical aspect of dosage form development.	1,3,4,6,7,11	
	CO2	To formulate and evaluate solid, liquid and semisolid dosage forms.	1,2,3,4,7,8,10,11	
	CO3	To correlate the theoretical knowledge with professional and practical need of pharmaceutical industry.	1,2,3,4,5,6,7,8,9,10,11	
	CO4	Plan, execute the experiment using various methodologies (written protocol or quantitative or qualitative techniques) and summarize the findings in systematic way verbally and in written communication.	2,3,4,5,6,8,11	
Pharmacology II Lab	CO1	Demonstrate the understanding of guidelines for animal experimentations, various routes of drug administration, and methods for blood collection from experimental animals.	1,3,4,6,7,9,10,11	
	CO2	Describe the composition of physiological salt solutions and basic instruments used in experimental pharmacology.	1,3,4,6,7,9,10,11	
	CO3	Perform experiments using various isolated preparation and describe the effect of different drugs on the concentration response curves, interpret the action of various drugs using preclinical models/computer simulations.	1,3,4,6,7,9,10,11	
	CO4	Plan, execute and conclude the experiment using various methodologies.	1,3,4,6,7,8,9,10,11	
Pharmacognosy and Phytochemistry II Lab	CO1	Identify crude drugs based on morphological characters, microscopic characters and give biological source with the chemical constituents and therapeutic uses	1,3,6,7,9,10,11	
	CO2	Apply the knowledge of microscopic characters in ascertaining the genuineness of powdered formulations.	1,3,6,7,9,10,11	
	CO3	Understand the principle involved for carrying out extraction, isolation and detection of active constituents by chromatography	1,3,6,7,9,10,11	
	CO4	Demonstrate oral and written communication skills and ability to plan the experimentation with proper time management	1,3,7,8	
	CO5	Identify unorganized drugs by qualitative chemical tests	1,3,6,7,9,10,11	
	CO6	Understand principle involved in distillation of volatile oils and detection of phytoconstituents by	1,3,6,7,9,10,11	
Pharmacology III	Medicinal Chemistry III	CO1	Understand structure, chemistry, therapeutic value, mechanism, and adverse reactions of medicinally important drugs.	1,11
		CO2	Understand the importance of drug design and different modern techniques of drug design.	1,3,4,11
		CO3	Express Development for particular class of the drug and interpret effect of substitution on	1,3,8,11
	Pharmacology III	CO1	Classify the drugs acting on respiratory and gastrointestinal system into correct therapeutic categories; correlate the pathophysiology of few common disorders of respiratory and gastrointestinal system to their pharmacotherapy; explain the principal pharmacological actions, including the mode of action, side effects and uses of related drugs.	1,3,6,8,9,10
		CO2	Classify chemotherapeutic agents; explain the principal pharmacological actions, including the mode of action, side effects and uses of related drugs; and justify the need for rational use of antimicrobials.	1,3,6,8,9,10
		CO3	Explain the principles of immunology and chronopharmacology and discuss their pharmacotherapeutic applications.	1,3,6,8,9,10
		CO4	Comprehend the principles of toxicology and treatment of various poisonings.	1,3,6,8,9,10
		CO1	To understand herbs as raw materials and its processing to produce herbal drug product.	1,3,6,7,9,10,11
		CO2	Outline the fundamental principles involved in different traditional systems of medicine including ayurveda and standardization of various ayurvedic formulations	1,3,6,7,9,10,11
		CO3	Understand and apply the significance of excipients of natural origin, used in pharmaceutical formulations and describe various classes of excipients.	1,3,6,7,9,10,11
CO4	Apply the knowledge of pharmacology to understand pharmacodynamic and pharmacokinetic herb-drug and herb-food interactions	1,3,6,7,9,10,11		

Herbal Drug Technology	CO5	Attain the knowledge of health benefits of nutraceuticals, herbal cosmetics, conventional and novel herbal formulations.	1,3,6,7,9,10,11
	CO6	To understand and demonstrate patenting, regulatory requirements and evaluation of natural products.	1,3,6,7,9,10,11
Biopharmaceutics and Pharmacokinetics	CO1	Understand the basic concepts in biopharmaceutics and pharmacokinetics and their significance.	1,2,3,4,5,6,7,8,9,10
	CO2	Use of plasma drug concentration-time data to calculate the pharmacokinetic parameters to describe the kinetics of drug absorption, distribution, metabolism, excretion, elimination.	11
	CO3	To understand the concepts of bioavailability and bioequivalence of drug products and their	1,2,3,4,5,6,7,8,9,10
	CO4	Understand various pharmacokinetic parameters, their significance & applications	1,2,3,4,5,6,7,8,9,10
Pharmaceutical Biotechnology	CO1	Understand the tools, techniques, ethics and environmental safety involved in gene cloning, and	1,4,7,9,10,11
	CO2	Discuss basics of immunology and explain the antigen-antibody interactions and defense mechanism and explain technique of monoclonal antibodies production for treating the human diseases	1,4,7,10,11
	CO3	Study fermentation technology and understanding the basic concepts for production of safer vaccines and antibiotics	1,9,10,11
	CO4	Demonstrate different techniques and applications of enzyme immobilization and cell culture	1,4,9,10,11
Pharmaceutical Quality Assurance	CO1	Understand the concepts of quality assurance, total quality management, ICH guidelines and quality by design	1,2,3,4,9
	CO2	Understand the organization, planning of premises and resources for pharmaceutical industry.	2,3,5,6,9,10
	CO3	Apply the principles of quality control and good laboratory practices during practical training.	2,3,4,11
	CO4	Evaluate and apply document maintenance and complaint handling to practical situations.	1,3,5,7,8
	CO5	Evaluate and support the calibration and validation principles as applicable to academic laboratories.	1,2,3,4,11
Medicinal chemistry III Lab	CO1	Perform Synthesis of Some drugs and intermediates	1,2,3,5,11
	CO2	Perform Assay of drugs	1,2,3,5,11
	CO3	Apply principles of Green Chemistry to synthesis	1,2,3,5,10
	CO4	Experimenting on computers for studies in pharmaceutical chemistry	1,2,3,5,11
Pharmacology III Lab	CO1	Solve the problems based on dose calculation in pharmacological experiments, calculation of pharmacokinetic parameters, student's t test, ANOVA test, Chi square test, Wilcoxon Signed Rank test.	1,2,3,5,6,8,9
	CO2	Explain the principle and methodology of some in vivo and in vitro tests and discuss the analysis of the same.	1,2,3,5,6,7,8,9
	CO3	Explain the principle and methodology of acute oral toxicity, skin irritation and eye irritation	1,2,3,6,7,8,9
	CO4	Apply the principle and methodology of acute oral toxicity, skin irritation and eye irritation using various methodologies (qualitative or quantitative techniques).	1,3,4,6,7,8,9,10,11
Herbal Drug Technology Lab	CO1	Extract and perform qualitative chemical tests on the crude drugs containing various phytoconstituents.	1,3,6,7,9,10,11
	CO2	Apply analytical procedures and principles for quantitative determination of total aldehyde content, phenol content and total alkaloids from crude drugs	1,3,6,7,9,10,11
	CO3	Carry out evaluation of ayurvedic dosage form, herbal drugs, herbal formulations, herbal	1,3,6,7,9,10,11
	CO4	Demonstrate oral and written communication skills and ability to plan the experimentation with proper time management	1,3,7,8
Instrumental Methods of Analysis	CO1	Recall with examples the terminologies associated with spectroscopy and chromatography	1,2,3,8,11
	CO2	Explain and illustrate the theory and applications of UV visible spectroscopy, fluorimetry, IR spectroscopy, HPLC, GC, paper chromatography, TLC, ion chromatography, gel chromatography and affinity chromatography	1,2,3,4,6,8,11
	CO3	Apply the knowledge gained and perform mathematical calculations to obtain quantitative results from UV spectroscopy and chromatographic parameters	2,3,4,8,11
	CO4	Predict the spectroscopic behavior of molecules	2,3,4,8,11
Industrial Pharmacy II	CO1	Know the process of pilot plant and scale up of pharmaceutical dosage forms	1,2,3,4,6,7,10,11
	CO2	Understand the process of technology transfer from lab scale to commercial batch	1,2,3,4,6,7,10,11
	CO3	Know different Laws and Acts that regulate pharmaceutical industry	1,2,3,4,5,6,7,8,9,10,11
	CO4	Understand the approval process and regulatory requirements for drug products	1,2,3,4,6,5,7,8,9,10,11
Pharmacy Practice	CO1	Understand the management of hospital pharmacy, community pharmacy, clinical pharmacy and the functions of pharmacy and therapeutics committee.	1,2,5,6,9,10
	CO2	Comprehend adverse drug reaction classification, therapeutic drug monitoring, drug store management and inventory control.	1,3,5,7,9
	CO3	Summarize the over the counter medications, investigational use of drugs, and interpretation of clinical laboratory tests.	1,2,4,11
	CO4	Apply drug distribution systems, prescribed medication order and communication skills during practical situations.	2,3,4,5,8
	CO5	Evaluate medication adherence, patient counselling and education programs in hospitals.	2,3,5,7,8,11
Novel Drug Delivery Systems	CO1	To understand various approaches for development of novel drug delivery systems.	1,2,3,4,5,6,7,8,9,10,11
	CO2	To understand the criteria for selection of drugs and polymers for the development of Novel drug delivery systems, their formulation and evaluation	1,2,3,4,5,6,7,8,9,10,11
Instrumental Methods of Analysis Lab	CO1	Apply the principles of uv-vis spectroscopy, fluorescence spectroscopy, flame photometry, colorimetry and turbidimetry to perform, analyze, determine and report the content of drugs in formulation/sample solution	2,3,4,6,8,10
	CO2	Relate the principles of separation with chromatographic techniques to identify and separate two components in a mixture	2,3,4,6,8,10
	CO3	Recall the working principle, instrumentation and pharmaceutical applications of HPLC, GC and HPTLC	1,2,3,4,10,11
	CO4	Plan, execute and conclude the experiment using qualitative or quantitative techniques	1,2,3,4
	CO1	Apply theoretical knowledge learned in classroom in practical setting	11



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SEM VII	Practice School	CO2	Understanding the importance and applications of various subjects and their correlation with practice of Pharmacy	1,4,11
		CO3	Development of skills in the handling of modern tools	1,4,11
		CO4	Acquire skills of documentation and record keeping	1,4,11
		CO5	Plan academic, career and personal interests via research experience	1,4,11
SEM VII	Research Methodology and Biostatistics	CO1	Understand descriptive statistics, Graphics, Correlation, Regression, logistic regression Probability theory, Sampling technique, Parametric tests, Non-Parametric tests, ANOVA, Introduction to Design of Experiments, Phases of Clinical trials and Observational and Experimental studies,	1,7,3,9,10,11
		CO2	Perform analysis using SPSS, R and MINITAB statistical software's, analysing the statistical data using Excel.	1,2,3,4,7,9,10,11
		CO3	Explain the basics of biostatistics and its role in Pharmacy	1,5,7,8,9,10,11
		CO4	Evaluate and apply the principles of biostatistics during conduct of basic research	1,2,3,4,5,6,7,8,9,10,11
	Social and Preventive Pharmacy	CO1	Explain the basic concepts related to health, diseases and health education and apply the knowledge for promoting health and hygiene at the social level.	1,3,6,7,8,9,10,11
		CO2	Explain the various measures to control and prevent spread of diseases and apply these principles to avoid spread of the disease	1,4,5,6,7,8,9,10,11
		CO3	Understand the different types of national health programs and their objectives and apply this knowledge to create awareness among those socially connected with the learner.	1,3,4,5,6,7,8,9,10,11
		CO4	Understand the importance of community services and render them for societal benefit through analysis of social health problems and contribute to public health objectives	1,3,4,5,6,7,8,9,10,11
	Pharmaceutical Marketing Management	CO1	State the importance of marketing in the pharma industry. Develop an understanding of Indian pricing strategy.	1, 6, 8, 7
		CO2	Formulate marketing strategies with respect to Pharmaceutical products. Able to formulate a advertising strategies for Pharmaceutical products.	1, 6, 8, 7
		CO3	Take crucial product related decisions in the business world and create promotion and advertising strategies for Pharmaceutical products.	1, 6, 8, 7, 9
		CO4	Gain a deeper understanding about pharmaceutical supply chain and logistics through different channels. Understand the role and responsibilities of Medical Representatives and Product Management team.	1, 6, 8, 7, 9
	Pharmaceutical Regulatory Science	CO1	Know about the process of drug discovery and development	1,6,7,10
		CO2	Know the important regulatory concepts, documentation requirements, regulatory registration procedures, regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals globally.	1,4,6,7,9,11
		CO3	Describe the clinical trials requirements for approvals for conducting clinical trials and discuss the role of pharmacovigilance and the process of monitoring in clinical trials.	1,2,3,4,5,6,7,8,9,10,11
		CO4	To correlate the theoretical knowledge with professional and practical need of pharmaceutical industry.	1,2,3,4,5,6,7,8,10,11
	Pharmacovigilance - Elective	CO1	Remember the history and development of pharmacovigilance and discuss the importance of drug safety monitoring.	1,3,4,6,7,8,11
		CO2	Discuss the various facets of ADRs in normal as well as special populations with their relation to pharmacovigilance methods.	1,3,4,6,7,8,11
		CO3	Integrate knowledge of drug-disease classification, coding and information resources and outline the pharmacovigilance process.	1,3,4,6,7,8,11
		CO4	Outline the regulatory processes in pharmacovigilance and summarize the components of pharmacovigilance program.	1,3,4,6,7,8,11
	Quality Control and Standardization of Herbsals – Elective	CO1	Describe WHO guidelines for quality control of herbal drugs.	1,3,6,7,9,10,11
		CO2	Understand the significance of Quality Assurance in herbal drug industry by implementing cGMP, GAP, GMP and GLP	1,3,6,7,9,10,11
		CO3	Describe EU and ICH guidelines for quality control of herbal drugs.	1,3,6,7,9,10,11
		CO4	Understand the stability testing of herbal medicines and application of different chromatographic	1,3,6,7,9,10,11
		CO5	Understand regulatory requirements for herbal medicines.	1,3,6,7,9,10,11
	Computer Aided Drug Design	CO1	Recognize various stages and approaches of drug discovery and development	1,2,3,4,9,11
		CO2	Interpret the QSAR equation and 3D contour plots	1,3,4,9,10,11
		CO3	Experimenting with facts learned, for designing new molecules using molecular docking, de novo drug design, pharmacophore, virtual screening techniques	1,3,4,9,11
		CO4	Debate on use of informatics and databases in drug design	1,2,3,4,10,11
		CO5	Explain Molecular and Quantum Mechanics methods in drug design	1,3,4,11
	Cell and Molecular Biology- Elective	CO1	Understand the basic mechanisms related to cell function, composition and molecular biology	1,9,10,11
		CO2	Learn and comprehend the basics of molecular genetics, structure and function of nucleic acids and protein synthesis	1,9,10,11
		CO3	Understand about cell cycle and cell signaling pathways	1,9,10,11
		CO4	Develop the ability to apply and analyze the knowledge of cell and molecular biology in identifying molecular targets for drugs	1,3,5,7,8,10,11
	Cosmetic Science- Elective	CO1	Discuss the various raw materials for cosmetics and structure and function of human skin	1,3,8,11
		CO2	Understand the toxicological aspects and toxicity testing for cosmetics and cosmeceuticals	1,3,4, 7,8,11
		CO3	Discuss the various cosmetics products w.r.t. raw materials, large scale manufacturing and functional and physicochemical evaluation including Herbal cosmetics.	1,2,3,8,11
		CO4	Know the regulatory guidelines and sensorial assessment for cosmetics	1,3,4,5,7,8,9,10,
		CO1	Understand the regulations and ethical requirement for the usage of experimental animals, the maintenance of laboratory animals as per the guidelines, basic knowledge of various in-vitro and in-vivo preclinical evaluation processes.	1,6,7,9,10,11
		CO2	Explain the knowledge gained on preclinical evaluation of drugs and recent experimental techniques in the drug discovery and development.	1,6,7,10,11
CO3		Learn about the various screening methods involved in the drug discovery process.	1,6,7,10,11	

Experimental Pharmacology- Elective	CO4	Understand and explain the rationale used for selection of sex, gender, number, group of various animals used in the drug discovery process and good laboratory practices in maintenance and handling of experimental animals.	1,6,7,9,10,11
	CO5	They would appreciate to correlate the preclinical data to humans.	1,4,6,7,9,11
Advanced Instrumentation Techniques	CO1	Recall with examples the terminologies associated with spectroscopy, X-ray diffraction, extraction, immunoassays, calibration and validation	1, 2, 3, 8, 11
	CO2	Explain and illustrate the theory, instrumentation and applications of Nuclear Magnetic Resonance spectroscopy, mass spectrometry, thermal methods of analysis, X ray diffraction methods, radioimmunoassay, extraction and hyphenated techniques and the methodology of calibration and validation of analytical instruments	1, 2, 3, 4, 6, 8, 11
	CO3	Apply the knowledge gained and perform mathematical calculations to obtain: chemical shift values and relative intensities of peaks in ¹ H NMR; mass to charge ratio of fragments in MS	2, 3, 4, 8, 11
	CO4	Predict the spectroscopic behavior of molecules	2, 3, 4, 8, 11
Dietary Supplements and Nutraceuticals - Elective	CO1	Explain concept of nutraceuticals, dietary supplements, functional foods, classify these based on chemical nature, health benefits and mechanism of action	1,3,7,9,10
	CO2	Acquire the knowledge of chemistry of phytochemicals as nutraceuticals, their health benefits, recommended doses along with the marketed formulations	1,3,7,9,10
	CO3	To understand the effect of processing, storage and interactions of different environmental factors on the potential of nutraceuticals.	1,3,7,9,10
	CO4	To understand the role of antioxidants as nutraceuticals for prevention of various chronic diseases	1,3,7,9,10
	CO5	Describe the regulatory aspects for manufacture and sale of nutraceutical products and dietary supplements	1,3,7,9,10
Pharmaceutical Product Development- Elective	CO1	Understand the process product development, with respect to preformulation, formulation development and manufacturing aspects and stability studies.	1,2,3,4,6,7,10,11
	CO2	Understand the about Pharmaceutical excipients with respect to product development.	1,2,3,4,6,7,10,11
	CO3	Understand the concepts of Optimization and QbD and its application to pharmaceutical product development.	1,2,3,4,5,6,7,8,9,10,11
	CO4	Understand the regulatory requirements and quality control testing of different types of dosage	1,2,3,4,6,5,7,8,9,10,
Project Work	CO1	Apply theoretical knowledge learned in classroom to a solve research problem	1, 3, 11
	CO2	Understanding the importance and applications of various subjects and their correlation in hypothesizing and solving research problem	1, 11
	CO3	Development of critical thinking, and analytical skills through hands-on learning	1, 3, 11
	CO4	Acquire various skills like Problem solving, data handling, presentation, documentation etc.	1, 2, 3, 8, 11
	CO5	Plan academic, career and personal interests via research experience	1, 2, 9
	CO6	Work collaboratively with other researchers/ fellow colleagues.	4,5,6

SEM VIII

Project Work



MS
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SEM VII	Practice School	CO2	Understanding the importance and applications of various subjects and their correlation with practice of Pharmacy	1,4,11
		CO3	Development of skills in the handling of modern tools	1,4,11
		CO4	Acquire skills of documentation and record keeping	1,4,11
		CO5	Plan academic, career and personal interests via research experience	1,4,11
SEM VII	Research Methodology and Biostatistics	CO1	Understand descriptive statistics, Graphics, Correlation, Regression, logistic regression Probability theory, Sampling technique, Parametric tests, Non-Parametric tests, ANOVA, Introduction to Design of Experiments, Phases of Clinical trials and Observational and Experimental studies,	1,7,3,9,10,11
		CO2	Perform analysis using SPSS, R and MINITAB statistical software's, analysing the statistical data using Excel.	1,2,3,4,7,9,10,11
		CO3	Explain the basics of biostatistics and its role in Pharmacy	1,5,7,8,9,10,11
		CO4	Evaluate and apply the principles of biostatistics during conduct of basic research	1,2,3,4,5,6,7,8,9,10,11
	Social and Preventive Pharmacy	CO1	Explain the basic concepts related to health, diseases and health education and apply the knowledge for promoting health and hygiene at the social level.	1,3,6,7,8,9,10,11
		CO2	Explain the various measures to control and prevent spread of diseases and apply these principles to avoid spread of the disease	1,4,5,6,7,8,9,10,11
		CO3	Understand the different types of national health programs and their objectives and apply this knowledge to create awareness among those socially connected with the learner.	1,3,4,5,6,7,8,9,10,11
		CO4	Understand the importance of community services and render them for societal benefit through analysis of social health problems and contribute to public health objectives	1,3,4,5,6,7,8,9,10,11
	Pharmaceutical Marketing Management	CO1	State the importance of marketing in the pharma industry. Develop an understanding of Indian	1, 6, 8, 7
		CO2	Formulate marketing strategies with respect to Pharmaceutical products. Able to formulate a pricing strategy.	1, 6, 8, 7
		CO3	Take crucial product related decisions in the business world and create promotion and advertising strategies for Pharmaceutical products.	1, 6, 8, 7, 9
		CO4	Gain a deeper understanding about pharmaceutical supply chain and logistics through different channels. Understand the role and responsibilities of Medical Representatives and Product Management team.	1, 6, 8, 7, 9
	Pharmaceutical Regulatory Science	CO1	Know about the process of drug discovery and development	1,6,7,10
		CO2	Know the important regulatory concepts, documentation requirements, regulatory registration procedures, regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals globally.	1,4,6,7,9,11
		CO3	Describe the clinical trials requirements for approvals for conducting clinical trials and discuss the role of pharmacovigilance and the process of monitoring in clinical trials.	1,2,3,4,5,6,7,8,9,10,11
		CO4	To correlate the theoretical knowledge with professional and practical need of pharmaceutical industry.	1,2,3,4,5,6,7,8,10,11
	Pharmacovigilance - Elective	CO1	Remember the history and development of pharmacovigilance and discuss the importance of drug safety monitoring.	1,3,4,6,7,8,11
		CO2	Discuss the various facets of ADRs in normal as well as special populations with their relation to pharmacovigilance methods.	1,3,4,6,7,8,11
		CO3	Integrate knowledge of drug-disease classification, coding and information resources and outline the pharmacovigilance process.	1,3,4,6,7,8,11
		CO4	Outline the regulatory processes in pharmacovigilance and summarize the components of pharmacovigilance program.	1,3,4,6,7,8,11
	Quality Control and Standardization of Herbsals – Elective	CO1	Describe WHO guidelines for quality control of herbal drugs.	1,3,6,7,9,10,11
		CO2	Understand the significance of Quality Assurance in herbal drug industry by implementing cGMP, GAP, GMP and GLP	1,3,6,7,9,10,11
		CO3	Describe EU and ICH guidelines for quality control of herbal drugs.	1,3,6,7,9,10,11
		CO4	Understand the stability testing of herbal medicines and application of different chromatographic	1,3,6,7,9,10,11
		CO5	Understand regulatory requirements for herbal medicines.	1,3,6,7,9,10,11
	Computer Aided Drug Design	CO1	Recognize various stages and approaches of drug discovery and development	1,2,3,4,9,11
		CO2	Interpret the QSAR equation and 3D contour plots	1,3,4,9,10,11
		CO3	Experimenting with facts learned, for designing new molecules using molecular docking, de novo drug design, pharmacophore, virtual screening techniques	1,3,4,9,11
		CO4	Debate on use of informatics and databases in drug design	1,2,3,4,10,11
		CO5	Explain Molecular and Quantum Mechanics methods in drug design	1,3,4,11
	Cell and Molecular Biology- Elective	CO1	Understand the basic mechanisms related to cell function, composition and molecular biology	1,9,10,11
		CO2	Learn and comprehend the basics of molecular genetics, structure and function of nucleic acids and protein synthesis	1,9,10,11
		CO3	Understand about cell cycle and cell signaling pathways	1,9,10,11
		CO4	Develop the ability to apply and analyze the knowledge of cell and molecular biology in identifying molecular targets for drugs	1,3,5,7,8,10,11
	Cosmetic Science- Elective	CO1	Discuss the various raw materials for cosmetics and structure and function of human skin	1,3,8,11
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		CO1	Understand the regulations and ethical requirement for the usage of experimental animals, the maintenance of laboratory animals as per the guidelines, basic knowledge of various in-vitro and in-vivo preclinical evaluation processes.	1,6,7,9,10,11
		CO2	Explain the knowledge gained on preclinical evaluation of drugs and recent experimental techniques in the drug discovery and development.	1,6,7,10,11
CO3		Learn about the various screening methods involved in the drug discovery process.	1,6,7,10,11	