



**Vishnu Institute of Pharmaceutical Education and Research
Narsapur, Medak District – 502 313, TS**

COURSE OUTCOMES FOR THE ACADEMIC YEAR 2023-24

B.PHARMACY I YEAR I SEMESTER

Course code	Subject name	CO statements
		Upon completion of the course, the student should be able to
111	HUMAN ANATOMY AND PHYSIOLOGY	Illustrate the Structural organization of body systems and use the anatomical terminology
		Identify the functional classification of joints and formations of bones and integumentary system
		Illustrate the Nerve impulse formation, transmission and release of neurotransmitter.
		Identify the functional coordination between the CNS & PNS
		Identify the disorders and approach for treatment of special senses.
		Identify the disorders and approach for treatment of Endocrine system and can suggest the non-pharmacological treatment.
112	PHARMACEUTICAL ANALYSIS	Apply different techniques of analysis and methods of expressing concentration in preparation and standardizations of Different compounds and explain source, types and minimization of errors.
		Classify and understand the theories of acid-base titrations along with an idea of non aqueous titrations with suitable examples.
		Describe concepts in precipitation titrations and complexometric titrations
		Perform gravimetric Analysis along with identification of impurities
		Comprehend concepts, principle ,types and applications of Redox Titrations
		Implement the Electro chemical method of analysis in Determination endpoints.
113	PHARMACEUTICS I	Describe historical background and development of pharmacy profession with special emphasis on prescriptions, dosage forms and Posology.
		Understand advantage and disadvantages of powders and liquid dosage forms along with pharmaceutical calculations..
		Identify stability problems and steps to overcome them along with an idea of monobasic liquids

		<p>. Define, Classify, Prepare formulations such as suspensions and emulsions.</p> <p>Define ,Classify ,Prepare and Evaluate suppositories and learn classification of Pharmaceutical Incompatibilities.</p> <p>Define, Classify and understand mechanisms and factors influencing dermal penetration of drugs and understand preparation and evaluation of semisolid dosage forms.</p>
114	PHARMACEUTICAL INORGANIC CHEMISTRY	<p>Determine the sources of impurities and principles involved in limit tests and to determine the impurities in inorganic drugs and pharmaceuticals.</p> <p>Apprehend theories of acids and bases, buffer capacity and buffer action, extra and intracellular electrolytes and dental products.</p> <p>Comprehend the ideal properties and mechanism of action of gastrointestinal agents.</p> <p>Define and classify gastrointestinal agents.</p> <p>Define, prepare following the principles and procedures involved in assay of expectorants, emetics, haematinics, astringent, poison and antidotes.</p> <p>Apprehend the definition, preparation, assay methods of radiopharmaceuticals.</p>
115	COMMUNICATION SKILLS	<p>Know the importance of communication, overcome barriers to communicate and perspectives in communication.</p> <p>Learn elements of communication and communication styles.</p> <p>Develop Listening skills required for communication</p> <p>Develop effective writing skills for good communication</p> <p>Develop skills to face interviews and deliver presentation of seminars.</p> <p>Improve soft skills and participation in group discussions without hesitation or fear.</p>
116	REMEDIAL BIOLOGY	<p>Understand the characteristics of living organisms, principles of classification, and morphological and anatomical features of flowering plants, including their various parts and functions.</p> <p>Explain the composition and functions of body fluids, mechanisms of circulation, digestion, absorption, respiration, and their regulatory processes in humans.</p> <p>Describe the excretory mechanisms, neural control, coordination systems, and the roles of the brain and spinal cord in humans.</p> <p>Understand the structure and functions of endocrine glands, hormonal regulation, and the processes of human reproduction.</p> <p>Analyze the role of minerals in plant nutrition, nitrogen metabolism, and the factors affecting photosynthesis and its processes.</p> <p>Illustrate the processes of plant respiration, growth, development, cell</p>

		structure, and division, along with the types and functions of plant tissues.
117	REMEDIAL MATHEMATICS	Learn in detail about matrices and components of matrices and determinants with emphasis on gauss elimination method Acquire knowledge on logarithms and functions along with their application in solving pharmaceutical problems Define and study limits and continuity of calculus Comprehend properties and derivatives in differentiation Understand integration with its formulae, rules and application. Perform differential equations and their applications in solving pharmacokinetic equations.
118	HUMAN ANATOMY AND PHYSIOLOGY LAB	Record body temperature by using sphygmomanometer. Interpret various organ system of human body with specimens and models. Study handling of simple and compound microscope. Identify axial and appendicular bones. Observe microscopically epithelial, connective, muscular and nervous tissue.
119	PHARMACEUTICAL ANALYSIS I –LAB	Prepare and standardize different compounds Classify titrimetric procedures by performing the assay along with percentage purity calculation Perform procedures of different methods of titrations Work on use of pH meter and conductivity meter Work on electro chemical method of analysis by calculation of potential and conductivity.
1110	PHARMACEUTICS I –LAB	Prepare Syrups and Elixirs Prepare Tinctures and solutions Prepare suspensions and emulsions Prepare powders and granules Prepare suppositories, semi-solids and gargles and mouthwashes.
1111	PHARMACEUTICAL INORGANIC CHEMISTRY LAB	Perform the limit test for chlorides, sulphates, lead, iron, heavy metals and arsenic Carry out identification tests for magnesium hydroxide, ferrous sulphate, sodium carbonate etc Perform swelling power of Bentonite.

		Perform neutralizing capacity of aluminium hydroxide gel
		Prepare boric acid, potash alum and ferrous sulphate
1112	COMMUNICATION SKILLS –LAB	Develop communicating with people by meeting people, asking questions and making friends and other modes of communicating people.
		Learn pronunciation of consonants, vowels and nouns
		Listening comprehension by direct and indirect speech.
		Develop effective writing skills and facing Interviews.
		Learn presentation skills and mailing skills
1113	REMEDIAL BIOLOGY –LAB	Handle simple and compound microscope.
		Perform section cutting, mounting, staining and permanent slide preparation
		Study of cell, root, leaf and modifications
		Study of frog by using computer models
		Determine blood group, blood pressure and tidal volume

I YEAR II SEMESTER

Course code	Subject name	CO statements
121	HUMAN ANATOMY AND PHYSIOLOGY II	Perform and analyze the hematological examination.
		Differentiate various CVS & heart disorders
		Analyze the GIT disorders based on the knowledge of anatomical & physiological of GIT.
		Conceptualize the anatomical aspects and mechanism of respiration
		Inter link the role of Urinary system with CVS in regulation and control of Blood Pressure.
		Conceptualize genetics to understand and illustrate the concepts of inheritance.
122	PHARMACEUTICAL ORGANIC CHEMISTRY I	Understand the fundamental concepts of organic chemistry, including classification, nomenclature, isomerism, electronic effects, and types of organic reactions, and their applications in analyzing the reactivity and stability of organic compounds.
		Analyze the preparation and reactions of alkanes, alkenes, alkynes, and conjugated dienes, including addition, elimination, and substitution mechanisms, and evaluate their structural and chemical properties.
		Explain the preparation, stereochemistry, and reactivity of alkyl halides, including SN1 and SN2 mechanisms, and their influencing factors.
		Understand the methods of preparation, properties, and reactions of alcohols, emphasizing key tests and transformations using reagents.
		Evaluate the preparation and reactivity of aldehydes and ketones, including condensation and reduction reactions, and analyze their identification through qualitative tests.
		Illustrate the preparation, properties, and reactivity of carboxylic acids, their derivatives, and aliphatic amines, emphasizing acidity, basicity, and qualitative identification methods.
		Understand the carbohydrate metabolism via various pathways and their significance and biological oxidation.
123	PHARMACEUTICAL BIOCHEMISTRY	Acquire knowledge on lipid metabolism
		. Acquire knowledge on amino acid metabolism
		Understand the structure and function of nucleic acids, transcription and translation process.
		Learn nucleic acid metabolism through biosynthesis and catabolism of nucleotides .
		Acquire knowledge on properties nomenclature, classification of enzymes along with enzyme kinetics, enzyme inhibitors regulation

		of enzyme.
124	PATHOPHYSIOLOGY	<p>Know and understand the basic principles of cell injury and adaption as well as the basic mechanism involved in the process of inflammation and repair.</p> <p>Analyse and describe the signs and symptoms, etiology, pathogenesis and complications of diseases/disorders related to Cardiovascular system, Respiratory system and Renal system.</p> <p>Understand and describe the signs and symptoms, etiology, pathogenesis and complications of hematological diseases. and diseases/disorders related to Endocrine system,</p> <p>Correlate the concepts of diseases/disorders related to Endocrine system and Nervous system</p> <p>Understand and describe the signs and symptoms, etiology, pathogenesis and complications of diseases related to liver, intestine, bones and joints.</p> <p>Outline and describe the signs and symptoms, etiology, pathogenesis and complications of diseases like infectious and sexually transmitted diseases.</p>
125	COMPUTER APPLICATIONS IN PHARMACY	<p>Apply concepts of Number system, Information systems and Software.</p> <p>Apply knowledge of programming languages, web servers and web products and databases in pharmacy.</p> <p>Apply knowledge of computers in drug designing and electronic prescribing.</p> <p>Apply knowledge of computers in discharge systems and diagnostic systems.</p> <p>Have an idea of Bioinformatics on databases and concepts of bioinformatics in Vaccine discovery.</p> <p>Know the importance of computers as part of data analysis n preclinical development.</p>
127	HUMAN ANATOMY AND PHYSIOLOGY II LAB	<p>Enumerate white and red blood cells.</p> <p>Determine Hemoglobin content, blood group, ESR, Bleeding and clotting time</p> <p>Record B.P by sphygmomanometer and basal mass index</p> <p>Aware of using family planning devices and pregnancy diagnose test</p> <p>Observe and identify permanent slides of vital organs and gonads.</p>
128	PHARMACEUTICAL ORGANIC CHEMISTRY I –LAB	<p>Synthesize Various Organic Compounds.</p> <p>Carry out systematic qualitative analysis of unknown organic compounds.</p> <p>Identify unknown compound using melting and boiling point</p>

		<p>Prepare and confirm the identity of derivatives of unknown compounds by melting/boiling point</p> <p>Construct Molecular models.</p>
129	PHARMACEUTICAL BIOCHEMISTRY- LAB	<p>Carry out qualitative analysis of carbohydrates ,reducing sugars and abnormal constituents</p> <p>Study effect of temperature and substrate concentration on salivary amylase activity.</p> <p>Determine blood creatinine, blood sugar and serum total cholesterol.</p> <p>Identify proteins by using chemical tests</p> <p>Understand the effect of enzymatic hydrolysis of starch.</p>
1210	COMPUTER APPLICATIONS IN PHARMACY-LAB	<p>Retrieve information of a drug and its adverse effects using online tools</p> <p>Create a HTML web page and database in MS Access to store patient information.</p> <p>Generate and print report from patient database</p> <p>Design a questionnaire using a word processing package to gather information about a particular disease.</p> <p>Export tables, Queries, forms and reports to web pages and XML Pages.</p>

II YEAR I SEMESTER

Course code	Subject name	CO statements
211	PHARMACEUTICAL ORGANIC CHEMISTRY-II	<p>Understand the structure, resonance, and aromatic character of benzene, including its preparation, electrophilic substitution reactions, and the influence of substituents on reactivity and orientation.</p> <p>Explain the preparation, properties, and reactivity of phenols, aromatic amines, and aromatic acids, with emphasis on acidity, basicity, and the effect of substituents on these properties.</p> <p>Describe the preparation, classification, reactivity, and reduction of nitro compounds, along with their synthetic applications in organic reactions.</p> <p>Analyze the synthesis, properties, and reactions of ethers, both aliphatic and aromatic.</p> <p>Evaluate the synthesis, reactions, structures, and medicinal applications of polynuclear hydrocarbons such as naphthalene, phenanthrene, and anthracene, along with their derivatives.</p> <p>Understand the stability and reactivity of cycloalkanes, including theoretical concepts such as Baeyer's strain theory, Coulson and Moffitt's modification, and Sachse-Mohr's strain-free ring theory.</p>
212	PHYSICAL PHARMACEUTICS-I	<p>Explain various states of matter and their properties along with Physicochemical properties of drug molecules in the designing of the dosage form.</p> <p>To elaborate the principles of solubility by applying various laws of dissolution and drug release.</p> <p>To analyze the micromeritic properties of powders and their characteristics.</p> <p>To acquire knowledge on derived properties of powders</p> <p>To summarize the concepts of drug complexation and protein binding.</p> <p>To determine the pH of different solutions and buffers in pharmaceutical and biological systems .</p>
213	PHARMACEUTICAL MICROBIOLOGY	<p>Acquire knowledge on history, scope, and diversity of microorganisms. along with morphology, cultivation and preservation of various microorganisms.</p> <p>Identify the bacteria by using various staining techniques and biochemical tests and understand the importance of sterilization in pharmaceutical industry</p> <p>Describe the microbiology of fungi and virus.</p> <p>Outline disinfectants and their evaluation tests, sterility testing of different pharmaceutical substances.</p>

		<p>Apprehend the concepts of aseptic area, laminar air flow equipment, microbiological assays. standardization of antibiotics, vitamins ,amino acids and general aspects of environmental cleanliness</p> <p>Relate the microbial spoilage, antimicrobial agents and cell culture technology and their applications in pharmaceutical industries.</p>
214	PHARMACEUTICAL ENGINEERING	<p>Aware of size separation of different material to know about the Equipments used in size separation.</p> <p>Aware of mechanism of mixing & different type of mixers. Acquire knowledge on Crystallization techniques.</p> <p>Understand the basics of evaporation, Equipments of evaporation.</p> <p>Aware of the heat transfer mechanisms.</p> <p>Acquire knowledge on different types of dryers; EMC, FMC, DRC. Acquire knowledge on Distillation techniques.</p> <p>Aware of Filtration of different material to know about the Equipments used in Filtration & Centrifugation</p>
215	PHARMACEUTICAL ORGANIC CHEMISTRY-II LAB	<p>Perform laboratory techniques such as recrystallization and steam distillation.</p> <p>Determine acid value, saponification value and iodine value for oils.</p> <p>Preparation of Various organic compounds using Acylation, Halogenation, Nitration, Oxidation, Hydrolysis and Coupling Reactions</p> <p>Prepare Dibenzal acetone from Benzaldehyde by Claisen Schmidt reaction</p> <p>Prepare Cinnamic acid from benzaldehyde by perkin reaction.</p>
216	PHYSICAL PHARMACY-1 LAB	<p>Determine % composition of NaCl in a solution using phenol-water system by CST method.</p> <p>Determine solubility of drug at room temperature</p> <p>Analyse particle size, particle size distribution using sieving method and Microscopic method</p> <p>Calculate and compare bulk density, true density and porosity, angle of repose of various powders and granules.</p> <p>Determine pKa value by Half Neutralization/ Henderson Hassel Balch equation</p>
217	PHARMACEUTICAL MICROBIOLOGY LAB	<p>Carry out sterilization of glassware and culture media</p> <p>Determine motility of microorganism and bacteriological analysis of water</p> <p>Demonstrate and perform different staining methods of microorganisms.</p> <p>Incorporate and evaluate isolation of pure culture of microorganism.</p>

		Evaluation of microbiological assay of different antibiotics.
218	PHARMACEUTICAL ENGINEERING LAB	<p>Determine the radiation constant of brass, iron, unpainted glass, various techniques of distillation and To gain knowledge about overall heat transfer mechanism.</p> <p>Determine the rate of drying, moisture content on rate of drying, humidity(relative humidity & absolute humidity)</p> <p>Know about principles, working of various dryers and mixers. To calculate uniformity index by using double cone blender.</p> <p>Discuss about factors influencing rate of filtration & evaporation. To study the effect of time on rate of crystallization.</p> <p>Gain the knowledge on the various equipment which is used in the pharmaceutical industry.</p>

II YEAR II SEMESTER

Course code	Subject name	CO statements
221	PHARMACEUTICAL ORGANIC CHEMISTRY- III	Demonstrate the stereo chemical aspects of organic compounds and stereo chemical reactions.
		Understand and explain geometric isomerism and stereo isomerism in biphenyl compounds (Atropisomerism) and conditions for optical activity.
		Classify heterocyclic compounds with nomenclature.
		Synthesize and recall the medicinal uses of some heterocyclic compounds.
		Recall properties of organic compounds and prepare heterocyclic compounds
		Write the reaction mechanisms of some named reactions.
223	PHYSICAL PHARMACEUTICS-II	Apply the principles of chemical kinetics in assigning expiry date for Formulation
		Demonstrate the rheological properties of drug molecules.
		Demonstrate use of physicochemical properties in evaluation of dosage forms.
		Explain physical stability of emulsions and their preservation
		Apply physicochemical properties of drug molecules in formulation research and Development.
		Recall Classification of dispersed systems & their general characteristics.
224	PHARMACOLOGY-I	Define concepts of general pharmacology and their importance
		Apply the concepts of signal transduction in drug discovery & development; and to analyze and report adverse drug reactions and drug interactions
		Apply mechanism of drug action and its relevance in the treatment of different ANS diseases.
		Identify drug of choice in management of Myasthenia gravis and Glaucoma.
		List out various neurotransmitters and their role in CNS Disorders
		Apply basic pharmacological knowledge in the prevention and treatment of various CNS diseases with emphasis on drug addiction and drug abuse.
225	PHARMACOGNOSY	Describe basic concepts of pharmacognosy with emphasis on sources of drugs, their classification and quality control tests

	AND PHYTOCHEMISTRY- I	Apprehend Cultivation, Collection, Processing and storage of drugs of natural origin Comprehend biological source, chemical nature and uses of drugs of natural origin with emphasis on Plant Products like Primary metabolites like Proteins and Enzymes . Comprehend biological source, chemical nature and uses of drugs of natural origin with emphasis on Plant Products like Primary metabolites like Lipids and marine drugs. Discuss the role of Pharmacognosy and secondary metabolites in allopathy and traditional systems of medicine. Elaborate historical development of plant tissue culture, types of cultures with emphasis on nutritional requirements, growth and applications of plant tissue culture in pharmacognosy.
227	PHYSICAL PHARMACEUTICS-II LAB	Determine Surface tension. Determine of HLB number of a surfactant by saponification method & know the acid base values Determine viscosity of liquid using Ostwald's viscometer & know the viscosity of various liquids . Determine viscosity of semisolids by using Brookfield viscometer & know the viscosity of various liquids. Design Accelerated stability studies
228	PHARMACOLOGY-I LAB	Measure the effect of drug on Ciliary motility of frog oesophagus Observe the effects of drugs on locomotor activity using actophotometer Expertise in common laboratory techniques such as blood withdrawal, serum separation and anesthesia used for animal studies Expertise different routes of drug administration in rats and mice Perform anxiolytic activity of drugs using rats and mice
229	PHARMACOGNOSY AND PHYTOCHEMISTRY- I LAB	Demonstrate the ability to analyze and identify crude drugs and natural products using standard chemical tests Perform microscopic techniques to determine stomatal number, stomatal index, vein islet number, vein termination number, and palisade ratio in plant samples. Utilize micrometry methods to measure the size of starch grains, calcium oxalate crystals, and phloem fibers, as well as quantify starch grains using the Lycopodium spore method. Evaluate the physicochemical properties of crude drugs, including ash values, extractive values, moisture content, swelling index, and foaming index, for quality assessment. Analyze fixed oils by determining their acid value, ester value, saponification value, and iodine value to assess their purity and

		suitability for medicinal use.
2210	GENDER SENSITIZATION LAB	<p>Understand gender equality and also learn about the new laws that provide protection and relief to women.</p> <p>Acquire knowledge on socialization of women and men and also about the gender discrimination works in our society.</p> <p>Develop the importance of women's invisible work and understand the relationship of gendered division of labour to society politics and economics.</p> <p>Reflect critically on gender violence and basic dimensions of the biological, sociological, psychological and legal aspects of gender.</p> <p>Develop a sense of gender development issue and gender sensitive language.</p>
2211	Pharmaceutical Jurisprudence	<p>Explain the objectives, definitions, and legal provisions of the Drugs and Cosmetics Act, 1940 and its rules, including the schedules, prohibited drugs, and regulations for drug import and manufacture.</p> <p>Analyze the conditions for wholesale, retail, and restricted sale of drugs, along with labeling, packing requirements, and the role of regulatory authorities under the Drugs and Cosmetics Act.</p> <p>Describe the objectives, structure, and functions of the Pharmacy Act, 1948, Medicinal and Toilet Preparations Act, 1955, and Narcotic Drugs and Psychotropic Substances Act, 1985, with an emphasis on licensing, penalties, and regulations</p> <p>Summarize the provisions of the Drugs and Magic Remedies Act, 1954 and the Prevention of Cruelty to Animals Act, 1960, including the ethical considerations in animal experimentation and the role of institutional committees.</p> <p>Examine the National Pharmaceutical Pricing Authority (NPPA), including the Drug Price Control Order (DPCO), and understand the significance of the National List of Essential Medicines (NLEM) in regulating drug prices.</p> <p>Review key pharmaceutical legislations and ethical frameworks, including the Code of Pharmaceutical Ethics, Medical Termination of Pregnancy Act, Right to Information Act, and an introduction to Intellectual Property Rights (IPR).</p>

III YEAR I SEMESTER

Course code	Subject name	CO statements
311	MEDICINAL CHEMISTRY II	Analyze the chemistry of Anti histaminic and Anti neoplastic drugs with respect to their biological activity.
		Work on the concepts of SAR of Anti-anginal, Diuretics and Anti-hypertensive Agents
		Answer the Chemistry, Metabolism and SAR of Anti-arrhythmic and Anti-hyper lipidemic agents
		Answer the Chemistry, Metabolism and Uses of Coagulant, Anticoagulants and Drugs used in Congestive Heart Failure.
		Answer the Nomenclature, Stereochemistry, Degradation, Adverse effects and therapeutic value of Drugs acting on Endocrine system
		Gain knowledge on Classification, Mechanism of action, uses and synthesis of Anti diabetic and Local Anesthetic agents.
312	INDUSTRIAL PHARMACY – I	Analyze the preformulation characteristics of drug substance in formulation & development of various dosage forms.
		Acquire knowledge on manufacturing considerations in development of tablets and liquid orals
		Gain knowledge on formulation requirements and in process quality control tests for capsules and pellets with emphasis on special techniques.
		Design a layout on parenterals and ophthalmic product with emphasis on evaluation studies.
		Learn the fundamentals of cosmetics and learn about various skin and hair care products
		List out the types of Parenteral Products, Formulation of injections, Containers and closures, Ophthalmic Preparations
313	PHARMACOLOGY II	Recall and explain pharmacology of drugs acting on cardiovascular System.
		Enlist the drugs acting on haematopoietic system and able to explain pharmacology of drugs acting on urinary system.
		Analyze the pharmacological action of autacoids and related drugs.
		Apply the concepts of inflammatory mediators and their role in the management of inflammation.
		Identify endocrine glands & treatment strategies in the management of endocrine imbalances.
		Define the clinical significance of hormonal analogues and antagonists enumerate the types and application of bioassay.
319	ENVIRONMENTAL SCIENCES	Create awareness about natural resources available with an emphasis on the role of individual in conservation of energy.
		Impart basic knowledge about the ecosystem and concepts of

		ecosystem
		Acquire knowledge on biodiversity ,concepts of biodiversity along with laws for the protection of biodiversity.
		Self Motivate to participate in environmental protection against different types of pollution
		Aware of all the rules and regulations and the punishments laid on violation of laws pertaining to environmental protection
		Strive to attain harmony with nature
314	PHARMACOGNOSY AND PHYTOCHEMISTRY – II	Inculcate the knowledge on biogenesis of secondary metabolites in the plant and utilization of radioactive isotopes in the investigation of Biogenetic studies
		Comprehend different extraction methods at laboratory with emphasis on chemical nature of few crude drugs
		Understand and explain different crude drugs under the category of tannins and Resins
		Understand and explain different crude drugs under the category of glycosides and terpenoids
		Isolate, Identify and analyze Phyto-constituents belonging to Alkaloids, Glycosides, Terpenoids and Resins
		Obtain awareness on industrial production of phytoconstituents.
315	CELL AND MOLECULAR BIOLOGY	Summarize cell biology, history, cellular functioning, composition and describe the chemical foundations of cell biology
		Outline the genetic properties of cell biology
		Define protein structures and regularities in protein pathways
		Analyze cellular process in protein synthesis
		Comprehend cell signals,receptors of cell signals and their pathways.
		Correlate the concepts of basic molecular genetics mechanisms and cell cycle check points.
316	INDUSTRIAL PHARMACY LAB	Understand to Perform the preformulation parameters of drug substance
		Formulate and evaluate tablets
		Develop skills on filling and evaluation of capsules
		Formulate and evaluate Parenterals
		Evaluate materials used for packaging such as glass, plastic, rubber closures etc
317	PHARMACOLOGY - II LAB	Measure the effect of drug on isolated frog heart
		Observe the diuretic activity of drugs using rats and mice
		Conduct DRC using frog rectus abdominus muscle by acetylcholine
		Perform bioassay of different drugs on rats by matching method, interpolation method and four point methods
		Perform anti-inflammatory and analgesic activities on rats

318	PHARMACOGNOSY AND PHYTOCHEMISTRY - II LAB	Determine morphology , histology , extraction and detection of different powder crude drugs of Alkaloids
		Extract and isolate caffeine from tea
		Carry out isolation of herbal extraction by using TLC method
		Carry out Extraction and Detection of various volatile oils by TLC.
		Perform Quality control tests of crude drugs.
		Determine morphology , histology , extraction and detection of different powder crude drugs of Glycosides.

III YEAR II SEMESTER

Course code	Subject name	CO statements
321	MEDICINAL CHEMISTRY – III	Answer the Nomenclature, Stereochemistry, Degradation, Adverse effects and therapeutic value of Beta Lactam antibiotics, Aminoglycosides and Tetracyclines.
		Work on the concepts of SAR of Macrolide, Quinoline and Biguanide antibiotics.
		Analyze the chemistry of drugs with respect to their biological activity.
		Determine Chemistry, Metabolism and SAR of Anti tubercular, Anti viral, Quinilones and urinary tract antinfective agents.
		Classify and understand Mechanism of action, uses and synthesis of Anti fungal, Antiprotozal, Antihelminthics and sulfonamides.
		Apply different techniques on drug design .
322	PHARMACOLOGY III	Enlist the different drugs used to treat various Respiratory and GIT disorders.
		Analyze the general principles of chemotherapy and list the clinical uses, side effects of different antibiotics.
		Enumerate the different therapeutic agents used to manage various diseases like tuberculosis, leprosy, malaria, etc.
		Identify the drug of choice in the management of different viral and fungal infections.
		Apply the chemotherapeutic approaches for the management of various infectious diseases.

		Define the principles of toxicology and can list out the treatment options for various poisoning conditions.
323	HERBAL DRUG TECHNOLOGY	Apply the fundamentals of herbal raw materials in biodynamic farming techniques.
		Correlate the insights of Nutraceuticals and herbal food interactions.
		Improve knowledge of herbal formulation preparation and evaluation.
		Explain the role of cosmetic excipients and building blocks in cosmetic formulation.
		Demonstrate the regulations that applies to protection of traditional knowledge against infringement.
		Describe the herbal drug industry's present and future prospects, as well as the components of Good Manufacturing Practice (GMP) for Indian medical systems.
324	BIOPHARMACEUTICS AND PHARMACOKINETICS	Explain the concepts of biopharmaceutics and pharmacokinetics ,factors affecting drug absorption, distribution and Clinical significance of protein binding.
		Acquire knowledge on basic metabolic pathways ,renal excretion and protocols for bioequivalence studies.
		Outline the dosage regimens of the drugs using pharmacokinetic and biopharmaceutic parameters
		Compute various pharmacokinetic parameters from plasma and urinary excretion data by applying compartment and non compartment modeling.
		Familiarize with two compartment open model and IV bolus Kinetics of multiple dosing and their significance.
		Detect the causes of nonlinearity and compute Km and Vmax by Michaelis menton equation using graphical methods.
325	PHARMACEUTICAL QUALITY ASSURANCE	Define the concepts of quality control and quality assurance and implement the pharmacy guidelines in pharmaceutical industry
		Work at the different areas of maintenance ,purchase, stores of raw materials and designs of the pharmaceutical premises
		Describe QC tests for containers,closures and secondary packageing materials.
		Work on testing and controlling areas,testing facilities on clinical laboratory studies according to GLP.
		Document various records in pharmaceutical industries.
		Calibrate and validate various analytical instruments like UV.
326	MEDICINAL CHEMISTRY - III LAB	Prepare Drugs and important intermediates.
		Analyze the purity of drugs
		Synthesize medicinally important compounds and intermediates by using Microwave irradiation technique

		<p>Draw structures and reactions using chem draw software</p> <p>Determine physicochemical properties such as logP, clogP, MR, Molecular weight, Hydrogen bond donors and acceptors for class of drugs.</p>
327	PHARMACOLOGY – III LAB	<p>Calculate the dose for different pharmacological experiments.</p> <p>Evaluate the various novel compounds for their anti-ulcer activity.</p> <p>Apply the concepts of pharmacological screening methods for determining the therapeutic effect of different drugs.</p> <p>Estimate the serum biochemical parameters by using semi-auto-analyser.</p> <p>Apply several bio-statistic methods in experimental pharmacology.</p>
328	HERBAL DRUG TECHNOLOGY LAB	<p>Carry out phytochemical screening for crude drugs</p> <p>Determine aldehyde, phenolic and alkaloid content in crude drugs</p> <p>Evaluate different excipients of natural origin</p> <p>Incorporate and evaluate natural extract in shampoos and creams</p> <p>Incorporate and evaluate natural extract in syrups, tablets and mixtures</p>
329	HUMAN VALUES AND PROFESSIONAL ETHICS	<p>Recall the importance of Values and Ethics in their personal life and professional life</p> <p>Imbibe the students about the personal ethics by few Moral contents and to implement in their lives</p> <p>Analyze the role of Pharmacy in relation to other professions</p> <p>Aware of their rights and responsibilities in work place and how to implement professional ethics</p> <p>Know their rights and responsibilities as an employee, team member and a global citizen</p> <p>List the current scenarios like world summits, issues and globalization</p>

IV YEAR I SEMESTER

Course code	Subject name	CO statements
411	INSTRUMENTAL METHODS OF ANALYSIS	Describe concepts of UV & Visible Spectrophotometry and Fluorimetry.
		Describe the principle ,instrumentation and applications of IR and Atomic absorption spectra.
		Explain the Principles, Instrumentation and Applications of TLC and paper chromatography.
		Explain the principles, instrumentation and applications of electrophoresis
		Write the Principles, Instrumentation and Applications of HPLC and GC
		Describe the principles, instrumentation and applications of Ion exchange and Gel Chromatographic Techniques and Affinity chromatography..
412	INDUSTRIAL PHARMACY-II	Discuss the pilot plant and scale-up processes for pharmaceutical dosage forms, as well as the SUPAC guidelines.
		Categorize the different aspects of technology transfer involved from research and development to manufacture.
		Comprehend and implement different responsibilities and regulatory requirements for drug approval
		Communicate different laws and acts that regulate pharmaceutical industry in India and US
		Explore the functions and responsibilities of regulatory agencies in drug approval.
		Describe the structure and functions of the national and state licensing authorities.
413	PHARMACY PRACTICE	Organize the hospital according to the primary, secondary and Tertiary Hospitals and their functioning.
		Educate and implement various drug distribution methods used in the hospital.
		Understand and to be able to do patient counseling in community pharmacy
		Apply Clinical review, Medication history management and pharmaceutical care in health care sector.
		Organize the pharmacy stores, Drug information centre and importance of management
		Carry out inventory control of pharmacy according to the needs of the hospital .
414	NDDS	Describe various approaches for the development of controlled drug delivery systems and application of polymers.
		Summarize the concepts and formulation considerations of

		<p>Microencapsulation, Mucoadhesive and Implantable drug delivery system.</p> <p>Design and evaluate the Transdermal and Gastro Retentive Drug Delivery systems.</p> <p>Explain the concepts of Nasopulmonary drug delivery systems.</p> <p>Acquire the concepts, approaches and applications of Targeted Drug Delivery Systems.</p> <p>Outline the concepts and applications of Ocular and IntraUterine Drug Delivery Systems.</p>
415	PHARMACOVIGILANCE	<p>Explain the Importance of safety monitoring of Medicine & able to Detect and report adverse drug reactions.</p> <p>Recall the Drug dictionaries and coding in pharmacovigilance.</p> <p>Explain various Pharmacovigilance methods.</p> <p>Evaluate statistical methods for medication safety during new drug development process.</p> <p>Explain the significance of altered Pharmacogenomics of adverse drug reactions.</p> <p>Analyze and assess the drug safety evaluation in special population</p>
416	INSTRUMENTAL METHODS OF ANALYSIS LAB	<p>Perform the analysis of compounds by colorimetry, UV and Flourimetry.</p> <p>Determine absorption maxima of organic compounds</p> <p>Estimate compounds by Flame photometry and nephlo turbidimetry</p> <p>Carry out the separation of compounds by paper, column and Thin layer chromatography</p> <p>Analyze the compounds by HPLC & GC</p>
417	PRACTICE SCHOOL	<p>Interact with executives to facilitate the process of learning by observations and discussions duly aided by checklist.</p> <p>Visit the hospitals and work on some case studies like cardiovascular, diabetes and chronic diseases.</p> <p>Collect the data from different pharmacy shops related to the most prescribed medicines in that area, prescription patterns, medical audit.</p> <p>Submit the detailed report, to the concerned organization after successful completion of 150 hours in the hospital.</p> <p>Collect and analyze the regulatory affairs of some important cases filed by drug control officers to be analyzed and reported.</p>
418	INDUSTRIAL TRAINING	<p>Visit Industries and get exposed to various equipments used for formulations/Preparations in industries.</p> <p>Get exposure to basic facilities required for an industry.</p>

	Understand GMP/GLP of Industries by practically observing them in industry.
	Learn applications of theory which they have studied in their subject theoretically.
	Develop presentation skills of what they have learnt.

IV YEAR II SEMESTER

Course code	Subject name	CO statements
421	BIOSTATISTICS AND RESEARCH METHODOLOGY	Define biostatistics ,Statistics, measures of central tendency, measures of dispersion with emphasis on Karl pearson coefficient of correlation.
		Perform parametric tests along with acquiring knowledge on the concepts of Regression
		Carry out non parametric tests using specific tests like Wilcoxin Rank some test,Mann whitney test and friedman test
		Design methodology of clinical trials using cohurt studies,observational studies,experimental studies with special focus on phases of clinical trials.
		Operate MS EXCEL,SPSS,Rand MINITAB and Design of experiments.
		Apply statistical techniques to design and carry out analysis of experiments like optimization software .
422	SOCIAL AND PREVENTIVE PHARMACY	Discuss the concepts of Health, Prevention & control of diseases, food in relation to nutrition, poverty, personal hygiene and health.
		Analyze the preventive & control measures for Communicable & Non Communicable Diseases.
		Acquire knowledge on National Health Programs and its objectives.
		Summarize the functioning and outcomes of National Health Programs.
		Explain the concepts of various National health intervention program and Role of WHO in Indian National Program.
		Extend the community services in rural, urban and school health like rural sanitation and health education programs.
423	PHARMACEUTICAL JURISPRUDENCE	Define the standards of schedules to the act and rules of D& C Act, Conditions for grant of license and conditions of license for

		<p>manufacture of drugs,</p> <p>List out important schedules administrative agencies of D& C Act</p> <p>Acquire knowledge on Pharmacy Act – 1948, Medicinal and Toilet Preparation Act -1955,</p> <p>Acquire knowledge on Narcotic Drugs and Psychotropic substances Act-1985 and Rules</p> <p>Restate Salient Features of Drugs and magic remedies Act and its rules, Prevention of Cruelty to animals Act-1960, National Pharmaceutical Pricing Authority</p> <p>Acquire knowledge on Pharmaceutical Legislations, Code of Pharmaceutical ethics, Medical Termination of pregnancy act, Right to information Act and Intellectual Property Rights (IPR)</p>
424	ADVANCED INSTRUMENTATION TECHNIQUES	<p>Explain details of principle, theories, instrumentation, and applications of NMR and Mass spectrometry.</p> <p>Analyze concepts involved in thermal methods of analysis and X ray Diffraction and crystallography techniques with its applications.</p> <p>Calibrate and validate Laboratory requirements as per ICH and USFDA guidelines such as Analytical balance</p> <p>Calibrate and validate Analytical instruments as per ICH and USFDA guidelines such as UV, Flame photometer, fluorimeter, HPLC & GC.</p> <p>Comprehend concepts on Radio immune assay and extraction techniques with its applications.</p> <p>Adopt the usage of Hyphenated techniques such as LC-MS/MS,GC-MS/MS and HPTLC-MS</p>
425	PROJECT WORK	<p>Learn basic level of research like literature collection, literature review by visiting online journals and reading offline journals and books.</p> <p>Learn to select an area of research for their project work keeping in view of their subject of interest.</p> <p>Get exposure to Experimental works beyond regular laboratory studies in curriculum along with operation of equipments.</p> <p>Acquire knowledge on basics of all subjects in a nut shell and new techniques in various departments of Pharmacy.</p> <p>Learn techniques involved in documentation of results obtained, interpretation of results and thesis writing.</p> <p>Learn presentation skills with emphasis on ppt preparation and communication skills.</p>