

2.6.1

1. Programme outcomes (POs)



Dr. Vitthalrao Vikhe Patil
Foundation
Ahmednagar

DR. VITHALRAO VIKHE PATIL FOUNDATIONS
COLLEGE OF PHARMACY,
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Approved by AICTE, PCI, New Delhi & Recognized by UGC, New Delhi



Aim and objectives of program outcomes, program specific outcomes and graduate attributes for all programs offered by the institution are communicated to students and teachers through college website and other academic documents. The key components of these learning outcomes are also communicated to students and teachers at classrooms and student-teacher meet. Also statements of these outcomes are communicated while directing different academic and other co-curricular programs. Course objectives are discussed by each subject teacher during first lecture after commencement of every semester. The course objectives are reported in the syllabus copy of University which is available on university website.

Program Outcomes for Pharmacy Program:-

The following Program outcomes of the course should be achieved by acquiring an overall knowledge & complete understanding, earning essential skills and establishment of the right attitude.

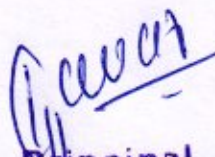
PO1. Professional skills and Pharmacy Knowledge

A graduate should be able to demonstrate different professional skills necessary for practice of a pharmacy programme by providing skills for synthesis and analysis of drugs from course of APIT, medicinal chemistry and pharmaceutical analysis. A graduate should be also able to formulate, store, dispense and manufacture the pharmaceutical products by adopting appropriate skills from course of pharmaceutics and industrial pharmacy. A graduate should elevate advanced knowledge and professional skills by participating in programmes of Savitribai Phule Pune University.

PO2. Ethics

A graduate will follow a code of ethics of Pharmacy Council of India with respect to community service. Also a graduate student is able to learn and apply the quality assurance principles in regulatory and ethical aspects from a course of Quality Assurance Technique.




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PO3. Community and Health care systems

A graduate should apply current knowledge of pharmacy and upgrade current information regarding awareness of healthcare issues along with problems related to hygiene among community by regular interaction to serve community better. A graduate should also maintain professional ethics in delivering liabilities with respect to community and healthcare services by participating in National Health Programmes.

PO4. Interpersonal and Communication Skills

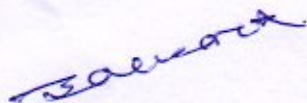
A graduate will adopt effective interpersonal written and verbal skills. Also able to effectively educate community, patients and Health Care Professionals. A graduate also do counselling and guide other members of the health care team and regulatory agencies. They will be able to exhibit update knowledge and aptitude regarding current technologies required for audio-visual presentation.

PO5. Research activity


A graduate is also actively involved in various research activities with important phases of drug synthesis, manufacturing of pharmaceuticals and formulation development.

PO6. Practice Based Learning

Establish self-assessment skills and made a commitment to the lifelong learning required and incorporate knowledge from scientific information to enhance the quality of pharmacy profession and other health care related services. Effectively utilize information, informatics and technology to optimize learning and patient care.



Academic Co-ordinator



Principal

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2. Programme specific outcomes (PSOs)



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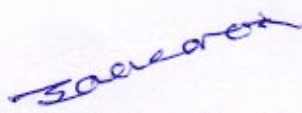
Program Specific Outcomes:-

PSO 1. Gain sufficient knowledge and scientific information regarding general basic principles of Human Anatomy and Physiology, Pharmaceutical analysis & Medicinal Chemistry, Pharmaceutics including Cosmeticology, Pharmacology, Pharmacognosy including herbal medicines, Quality assurance techniques, Drug Regulatory Affairs etc.

PSO 2. Introduce a particular Procedure to develop and characterize different pharmaceutical dosage forms. Also perform process validation for production of such pharmaceutical formulations.

PSO 3. Implement all laboratory procedures as per standard reported in official compendia and perform documentation in the field of Organic, Inorganic and medicinal chemistry. Also follow guidelines to apply and perform methods in subject of Biochemistry, Pharmacology and formulation development.

PSO 4. Recognize various applications of Pharmacy and Pharmaceutical Science in Drug discovery and development, formulation study, quality assurance and post marketing survey related to finished products.


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3. Course outcomes (COs)



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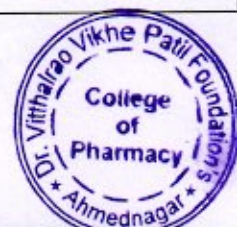


Course Outcomes

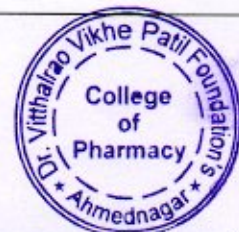
Course name (F.Y.B.Pharm)	Course outcomes
Pharmaceutics- I	Student should know about:
	1. History and Development of pharmacy profession as a career and Introduction to different Pharmacopoeias
	2. Alternative systems of medicine
	3. Different types of dosage forms and Excipients used in pharmaceuticals, classification and definitions
	4. Pharmaceutical calculations and Posology
	5. Pharmaceutical incompatibilities
	6. Different Liquid and Semisolid dosage forms, Preparation and Evaluation
	7. Monophasic and Biphasic liquids and powders
	8. Describe the different mechanisms of mixing and equipments for mixing
	9. Clarify importance of Particle size analysis and size separation in pharmacy and explain methods for size reduction of solids
Modern Dispensing Practices	10. Packaging technology, Identify factors related to enhanced filtration, Pharmaceutical plant layout designing
	1. Fundamental operations in compounding and dispensing of pharmaceutical products.
	2. Study information regarding Purchase records, Stock records
	3. Role of pharmacists in community healthcare and education
	4. Calculation of doses for infants and children
	5. Patient counseling for prescription drugs
	6. Provide consultation to patients and other health care professionals regarding various diseases
	7. Types, parts of prescription and analyze the prescription
	8. Compound and dispense medication according to prescription.
	9. Proper labeling of dispensed medicines
Pharmaceutical Inorganic Chemistry	10. Study of various types of incompatibilities
	1. Introduction and significance of Inorganic chemistry to various parts of pharmaceutical sciences
	2. Different Pharmacopoeia and contents of individual monographs in pharmacopoeias
	3. Official methods of control like limit tests for pharmaceutical preparation
	4. Different official waters and official control tests for water and Important inorganic gases used in Pharmacy
	5. Miscellaneous agents with inorganic pharmaceuticals like Expectorants, Antidotes, Antidepressant and Cytotoxic agents
	6. To analyze acid and basic radicals, Essential and trace elements
	7. Various types of Gastrointestinal agents and Topical agents
	8. Sources of contamination in pharmaceuticals and methods to control by using limit tests
	9. Other qualitative tests such as swelling power, adsorption property etc.
10. Preparation of different inorganic compounds and its identification tests as per I. P.	



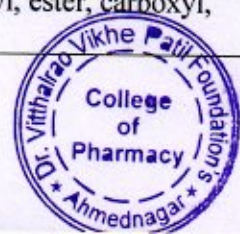
Pharmaceutical Organic Chemistry-	1. Basic principles and concepts of organic chemistry related to hybridization, types of bonds and e-displacement effects
	2. Classification of organic compounds on basis of functional group, IUPAC nomenclature of different organic compounds
	3. Isomerism and Principles of stereochemistry along with assigning configurations
	4. Various types of reaction intermediates in organic reactions along with classes of reactions
	5. Methods of preparation, Addition & Elimination Reactions of alkenes and alkynes
	6. Different electrophilic substitution reaction of aromatic compounds along with orientatation and reactivity
	7. Practicals related to information of understanding safety measures in laboratory and Different laboratory techniques
	8. Method of preparation and reactions of organic compounds like phenols, sulphonic acid, alcohols and ethers, amines, Alkyl halides
	9. Systematic Qualitative analysis of organic compounds and preparation of their derivatives
	10. Synthesis of different organic compounds of various types of functional groups along with reaction & mechanism.
Human Anatomy & Physiology	Student should understand
	1. Anatomy and physiology of each organ of Human body along with Basic terminologies used in anatomy and physiology
	2. To study various systems of human body in co-ordination with organs.
	3. Significance of Human Anatomy and Physiology with correlation to Pharmaceutical Sciences.
	4. basic information about cells and tissues of human body and Health Education
	5. Study the role of Respiratory system, Endocrine system, Nervous system and muscular system involve in regulation of overall activity of human body.
	6. The construction, working, care and handling of various materials, instruments, glasswares.
	7. Practical like complete blood count, heart rate, B.P., Pulse rate, body temperature etc. which helpful in diagnosis of disease.
	8. To study structural and microscopical aspects of various organs of human system.
	9. To study related various parameters are use to check and regulate the normal functions of Human body.
Communication and soft skill development	10. Determine the techniques for identification, counting, determination of various integral components of the body, Determination of platelets, Arneth Index
	1. Significance of different Career Skills important for job application
	2. Basic concept of communication and Channels of communication
	3. Modern Technology for Communication
	4. Application of theoretical concepts of communication into routine practice
	5. Explain role of various soft skills in business and academic work
Remedial Biology	6. Identify the various components of personality and Introduction to Phonetics
	Student should understand
	1. Classification and salient features of five kingdoms of life
	2. Basic components of anatomy & physiology of plant
	3. Basic components of anatomy & physiology animal with special reference to human
Dosage form design	4. Morphology of Flowering plants
	5. Components of living world, structure and functional system of plant and animal kingdom
	The Students should know:
	1. Different concepts of dosage form design along with Introduction to novel drug delivery systems
	2. Reasons ore incorporation of drug in dosage form
3. Optimization of drug solubility	
4. Therotical aspects of stability of emulsions and suspensions	
5. Factors affecting solubility	



	6. Uses of Radiopharmaceuticals in pharmacy, their therapeutic and diagnostic applications
	7. Factors affecting solubility and rate of dissolution
	8. Study the label and the shelf life period.
	9. Evaluation parameters for liquids including organoleptic properties like colour, odour, appearance, pH, weight/ml.
	10. Evaluation of organoleptic properties of Powders, Granules, Emulsions, Suspensions, Semisolids, Liquid dosage forms
Remedial Biology (Practical)	1. Introduction to experiments in biology
	a) Study of Microscope
	b) Section cutting techniques
	c) Mounting and staining
	d) Permanent slide preparation
	2. Study of cell and its inclusions
	3. Study of Stem, Root, Leaf, seed, fruit, flower and their modifications
4. Detailed study of frog by using computer models	
5. Microscopic study and identification of tissues pertinent to Stem, Root, Leaf, seed, fruit and flower	
6. Identification of bones	
7. Determination of blood group, blood pressure, tidal volume	
Remedial Mathematics	The Students should know:
	1. Theory and their application in Pharmacy
	2. Solve the different types of problems by applying theory
	3. Important application of mathematics in Pharmacy
	4. Functions of different mathematical terms like partial fraction, logarithms, limits & continuity
	5. Matrices & Determinant
	6. Calculus functions like
	a) Derivative
	b) Analytical geometry like straight line & integration
	c) Differential equations application in solving pharmacokinetic equations
d) Laplace transform	
Pharmacognosy	1. Relevance of biology to Pharmaceutical sciences
	2. Clarify principles of genetics and its application in crop improvement
	3. Explain basic components of plant cell, and general process of cell division.
	4. Cell differentiation & plant tissues
	5. Explain modes of nutrition & how these influence in evolution of chemical defense in autotrophs.
	6. Plant Physiology and Plant taxonomy
	7. Explain Ecology and Environment
	8. Specific staining reagents required for particular part of plant
	9. To study microscopical details of epidermal structures, cell inclusions
	10. To study morphology & microscopy of parts of plants
Pharmaceutical Analysis I	1. Introduction and significance of Analytical Chemistry to Pharmaceutical Sciences
	2. Statistical Treatment of Analytical Data
	3. Explain basic concepts and principles of aqueous and non-aqueous acid base titrations.
	4. Define different terms, basic principles of precipitation titrations, Complexometric titrations, Oxidation - Reduction Reactions and Titration
	5. Introduction to calibration, care and use of balances
	6. Cleaning, care and calibration of volumetric apparatus
	7. Explain and understand the use of laboratory equipments in Analytical Chemistry laboratory along with safety measures
	8. Develop skill in titrimetric analysis for estimation of analyte as per pharmacopoeia
	9. Detail knowledge of Principle and procedures used in different titrations like aqueous, non-aqueous, precipitation, complexometric, redox titration methods.
	10. The principle and Gravimetric determination of of analyte.



Course name (S.Y.B.Pharm)	Course outcomes
Physical Pharmaceutics	Student should know about:
	1. Different physicochemical properties of substance or drugs.
	2. Principles of pharmaceutical sciences in the field of pharmaceutics and Mathematical problems related to them.
	3. Knowledge in Physical principles of states of matter and Phase rules
	4. Know about crystallization as well as various parameters along with Solubility and factors affecting solubility of drugs
	5. Applications of thermodynamics in the pharmacy
	6. Determination of effect of pH on partition coefficient and determination of molecular weight
	7. Different types of flow in order to identify and choose suitable flow characteristics for the formulation
	8. Types, properties and applications of colloids in the formulations
	9. Fundamentals and pharmaceutical applications of rheology
10. Physicochemical properties of drugs and assessment of physical stability	
Pharmaceutical Microbiology	1. Define microbiology & classify microbes into various categories
	2. Aware about historical developments and contributions of scientists in the field of microbiology.
	3. Know the recent advances in microbiology.
	4. Compare and contrast the various structural features, biology & characteristics of microbes.
	5. Know the modes of reproduction in bacteria, growth characteristics, requirements.
	6. Describe isolation & counting methods of microorganisms and study morphology of bacteria by simple staining, negative staining & gram staining
	7. To prepare and sterilize nutrient broth, nutrient agar, slants, stabs and plates.
	8. Describe vaccine manufacturing process
	9. Isolate microorganism by streak plate technique & count them by pour plate technique.
	10. Observe motility of bacteria by hanging drop technique
Pharmaceutical Biochemistry	1. To know the metabolism process of various biomolecules like proteins, lipids, carbohydrates and nucleic acids.
	2. To understand, classification, function, biological importance of various bio-molecules
	3. To know different qualitative tests & applications of various bio-molecules.
	4. To understand the correlation of metabolism, process, steps involved in metabolism of carbohydrates, lipids, protein and nucleic acid
	5. To understand correlation with other pharmaceutical sciences.
	6. Understand role of biochemical processes in cell metabolism
	7. To identify proteins, amino acids and carbohydrates by various qualitative as well as quantitative chemical tests.
	8. To separate, identify and characterize proteins from various samples like egg, milk, etc and understand principle behind the technique.
	9. To determine vitamins present in fruit or juice e.g. Ascorbic acid
	10. To know action of salivary amylase on starch and Estimation of serum amylase
Pharmaceutical Organic Chemistry	1. Molecular representations and their description and interconversions
	2. Significance of Stereochemistry in biological activity
	3. Conformational analysis, Rearrangement, Pericyclic reactions
	4. Chemistry of carbohydrates amino acids and polypeptides
	5. Procedures for binary mixture separation and qualitative analysis of compound
	6. Synthesis of organic compounds by rearrangement reactions and Demonstration of techniques like column chromatographic separation and TLC
	7. Know schemes of synthesis and reactions of drugs containing heterocyclic rings
	8. Explain various techniques of combinatorial chemistry & understand its applications in synthesis of organic compounds and peptides
	9. Demonstration of microwave assisted reaction of organic compounds
	10. Quantitative determination of reactive groups e.g. Phenolic hydroxyl, ester, carboxyl, carbonyl, primary amine, amide and nitro groups



Pharmacology-I	Student should know about:
	1. Basics of Pharmacology, Nature and sources of drugs and route of drug administration,
	2. Process of new drug discovery and development process
	3. Study in deep pharmacokinetic and pharmacodynamics of drugs, 4. Study varies types of receptor, drug receptor
	4. Interaction, drug toxicity, drug interaction and adverse drug reactions.
Pharmacognosy & Phytochemistry	5. Principles of Therapeutics, Adverse drug reactions and Clinical Pharmacology
	1. Explain meaning & significance of Pharmacognostic parameters & Pharmacognostic study of crude drugs.
	2. Explain the significance of secondary metabolites production in plants & other organisms & deduce their significance as medicinal molecules.
	3. Explain primary metabolites from source along with its Pharmaceutical & industrial applications.
	4. Demonstrate skill of plant material sectioning, staining, mounting & focusing
	5. Draw morphological & microscopical diagrams & be able to label component / parts .
	6. Able to handle various equipments as per SOPs such as spectrophotometer.
	7. Explain historical significance & contribution of alkaloids in modern drug discovery & their marketed semisynthetic derivatives/ analogues
	8. Conduct extractions/isolations & explain significance of use of various chemicals & physical conditions
9. Determination of solubility, specific gravity, optical rotation & refractive index of volatile oils.	
Environmental sciences	1. Know the basics of environment like ecology, ecosystem, food chain, food web and ecological pyramids.
	2. Know the different natural sources and their conservation to save the environment.
	3. Know the different factors of environmental pollution and measures to minimize these factors
	4. Biodiversity and its conservation
	5. Role of individual in conservation of natural resources.
	6. Know the Environmental Pollution and Quality management.
Pharmaceutical Analysis-II	Student should know about:
	1. Interpret the data obtained through experimentation and report the results as per regulatory requirements
	2. Take appropriate safety measures while handling instruments, chemicals and apparatus
	3. Understand introduction & types of Electro-analytical Techniques
	4. Calibration of various instruments like pH meter, Conductometer, Refractometer and Polarimeter
	5. Understand the basic principles, instrumentation and applications of various analytical techniques
	6. Calibrate various analytical instruments for separation and assay of various chemicals, APIs and formulations as per Pharmacopoeial standards
	7. To study Miscellaneous techniques like Karl Fischer Titration
	8. To measure optical rotation and specific optical rotation of some sugars
	9. To determine pKa of some monobasic, dibasic or tribasic acids of pharmaceutical importance



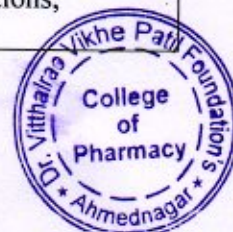
Pathophysiology & Clinical Biochemistry	1. To understand Definitions and Terminologies of pathophysiology.
	2. To gain through knowledge of the definition, epidemiology, etiology, clinical manifestations, pathophysiology,
	3. Complications, diagnosis & plan of treatment for various diseases and disorders.
	4. To understand the importance of different marker enzymes in body ,
	5. Understand the importance and estimation of various markers for liver, kidney and heart diseases
	6. Student will eligible to understand clinical manifestations of diseases of different systems.
	7. To understand different techniques for the estimation blood glucose, CRP etc and its clinical importance
	8. Get idea to operate various instruments in clinical biochemistry laboratory
	9. Students will have knowledge of how to collect blood and method of preservations
	10. Study of qualitative determination of abnormal constituents of urine - sugar, protein, bile salt, bile pigment, ketones bodies
Pharmaceutical Engineering	1. Understand molecular diffusion in gases and liquids
	2. Define drying and know the mechanism, theory & factors affecting it.
	3. Know about evaporation and describe the types of evaporator with their mechanism, instrumentation and applications
	4. Study the principle, theory, mechanism, working and construction of equipments of different unit operations
	5. Focus on graphical representation of various equipment for unit operations
	6. Define drying and classify different types of dryers



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Industrial Pharmacy	1. Understand the general concepts of solid dosage form design & formulation strategies, Explain Concept of formulation design
	2. Learn the concept, types, pharmacopoeial specifications, techniques & equipments used in tablet coating
	3. Describe capsules, types, additives, size selection, manufacturing & .evaluation, equipments, &defects and understand the concept of technology transfer.
	4. Understand the use of various equipments in Pharmaceutics laboratory relevant to tablets, capsules &coating.
	5. Explain formulation, evaluation and labeling of tablets &capsules along with advanced granulation techniques
	6. Preparation and evaluation of tablets by direct compression, Wet granulation, Dry granulation technique
	7. To learn the equipments and apparatus needed for the preparationof tablets and capsules as per SOP.
	8. Explain preparation and evaluation of suspensions, emulsions & semi-solid dosage forms, formulation development, manufacturing, excipients used,
	9. Describe use of ingredients in formulation and category of formulation
	10. Layout and designing of manufacturing facility for suspension, emulsion and semisolids as per schedule M
Pharmaceutical Analysis	1. To understand scope and importance of instrumental methods of analysis in the pharmaceutical industry
	2. To understand principle, instrumentation and applications of various instrumental methods such as UV-VIS, Flourimetry and Phosphorimetry, Nepheloturbidimetry
	3. To know various Analytical Sample preparation techniques and separation techniques based on size, density, complexation
	4. To acquire knowledge of instrumental techniques in quality control evaluation of API and its dosage form
	5. Calibrate various analytical instruments for the assay of various APIs and formulations as per Pharmacopoeial standards
	6. Assay of various APIs and formulations as per Pharmacopoeial standards, Sampling plans, methods of separating analytes from interferents
	7. Understand principles, instrumentation and applications of various chromatographic, thermal, X ray Diffraction and radiochemical techniques
	8. Know validation of analytical instruments & methods as per ICH/USP guidelines, Introduction to equipment qualification
	9. Understand process, interpret the data obtained through experimentation and report the results as per regulatory requirements
	10. Understand principles, instrumentation and applications of Electrophoresis, Thermal Methods of Analysis
Medicinal Chemistry	Student should understand
	1. Significance and establish relevance of Medicinal Chemistry in Pharmaceutical Sciences.
	2. Correlation of physicochemical properties affecting drug action and Pharmacokinetics.
	3. Explain about different types of receptors, forces involved in drug receptor interaction and their signal transduction mechanism.
	4. General aspects of the design & development of drugs with respect to drug metabolism & its significance in drug discovery
	5. Study classification, nomenclature,SAR and MOA, adverse effects of diuretics and drugs acting on autonomic nervous system & cardiovascular system, Local anesthetics, Oral Anti-hyperglycemics, Diagnostic agents



	6. Student should understand and develop skills in various purification techniques of solvents/liquids used in synthesis.
	7. Safety measures while working in medicinal chemistry laboratory. Use of various equipments in medicinal chemistry laboratory.
	8. Prepare acid and basic salts of drugs and evaluation of their physicochemical properties, Recording & interpretation of IR spectrum of synthesized compounds
	9. Performing thin layer chromatography techniques and purification of synthesized compounds by column chromatography, Determination of molar refractivity of compounds
	10. Synthesis, recrystallization of medicinally important organic compounds and understand reaction mechanisms involved in their synthesis
Pharmacology- II	1. General Considerations of Autonomic Nervous system, Sympathetic and Parasympathetic Nervous system with neurotransmitters.
	2. Study of Cholinergic, Anti-cholinergic, Adrenergic, Anti-adrenergic system and drugs with its Biosynthesis, Storage, Release and Metabolism.
	3. Detail Pharmacology of Ganglion Stimulating and Blocking drugs and Neuromuscular blocking drugs, Study General Anesthesia and Local Anesthetics with Stages
	4. Endocrine Pharmacology related to Functions, Receptor and mechanisms of Hormone, study of Drugs Used in Respiratory tract and Gastrointestinal tract disorders
	5. Biosynthesis, Mechanism of Action and Pharmacology of Adreno-corticosteroids and corticosteroid antagonists, Androgens, Antiandrogens, Anabolic Steroids
	6. Study of animal physiology along with their biochemical reference values in various animal species and routes of drug administration.
	7. Introduction to commonly used instruments in experimental pharmacology, Pharmacology of Alcohol and management of chronic alcoholism
	8. Study animal Care and handling of common laboratory animals as per (CPCSEA, OECD) , To Study of analgesic activity, locomotor activity, muscle relaxant property of drugs
	9. Study of various methods for collection of blood, body fluids and urine from experimental animals, physiological salt solutions and drug solution
	10. Recording Concentration Response Curves (CRC) of Acetylcholine, Histamine, Physostigmine and Atropine.
Analytical Pharmacognosy & Extraction Technology	1. Explain principle and fundamental concepts of mass transfer process in extraction, effect of various factors on extraction processes
	2. Understand & explain principle & applications of chromatographic & nonchromatographic separation methods
	3. Explain source of plant material & specific extraction methods for specified phytochemicals
	4. Explain requirement of herbal drug analysis along with significance and Quality control parameters of herbal drugs
	5. Generation of micrometric data: of Leaf constants, Length & width of fibers, diameter of starch grains
	6. Carry out successive extraction and qualitative tests to determine chemical nature of crude drugs
	7. Understand meaning & significance of 'Good Laboratory Practices' learn in theory & demonstrate through laboratory behavior
	8. Determination of Ash values, moisture content, extractive values, swelling index, foaming index, crude fiber content
	9. Detection of adulterants in crude drugs and demonstration of Isolation of phytoconstituents by column chromatography
	10. Explain implication of use of various chemicals/solvents/ conditions; undertake extraction.



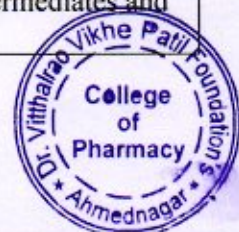
Pharmaceutical Business Management & Disaster Management	1. Pharmaceutical business and Fundamentals of management strategy
	2. Important steps in planning, types of planning, Marketing research, product management.
	3. Decision making and Communication, basic principles of organization
	4. Marketing research and Product management
	5. Sales promotions, procedure for determination of price and types of price
	6. Human resource and development needs, Disaster management, Disaster preparedness and mitigation
Active Pharmaceutical Ingredients Technology	1. Student should know overview of API and fine chemical industry
	2. To understand chemical process kinetics, some classes of reactions with unit processes in synthesis like Nitration, Amination, Esterification, Hydrolysis, oxidation.
	3. Explain factors affecting chemical processes, reaction system, equipments used in API manufacturing and layout of process equipments
	4. Explain techniques and process of synthetic routes and optimization of reactions, Basic knowledge about Material Safety Data Sheet (MSDS) for safety
	5. Principle & industrial process, scale up techniques, Industrial manufacturing methods, flow charts of some APIs like Ranitidine, Atenolol, Amlodipine, Metformin
	6. Brief overview of QA/QC, GMP guidelines in API manufacturing, various ICH Guidelines (ICH Q7, Q7A and Q11)
Natural Product Chemistry	1. Explain various physical, chemical, spectroscopic means & methods used in structural elucidation of natural products.
	2. Understand and Explain tools & techniques used in study of biosynthetic pathways in plants.
	3. Explain source, chemistry & applications of drugs from marine origin. He/she should be able to compare & contrast marine & terrestrial sources of medicinal materials.
	4. Explain difficulties in elucidation of biosynthetic pathways in plant with their merits & demerits.
	5. Characterization & structure elucidation of certain classes of secondary metabolites by physical, chemical and spectral methods
	6. Natural product based drug discovery, Natural products used as Pharmaceutical excipients & of allied industrial utility
	7. Extract & subsequently conduct experiments to derive various physical constants required in characterization of natural products.
	8. To record UV/IR spectrum of pure natural products and given sample & Interpretation of natural products from their IR & NMR spectra
	9. Demonstration of characterization of phytoconstituents by using HPLC
	10. Detection of adulterants in lipid samples and Analysis of sugars in natural gums by TLC
Bioorganic Chemistry and Drug Design	1. Understand the significance of Bioorganic Chemistry
	2. Basic consideration, Molecular Adaptation, Molecular Recognition and establish relevance of Bioorganic Chemistry in drug design and discovery.
	3. Various approaches of Bioorganic Chemistry in rational drug design of enzyme inhibitors



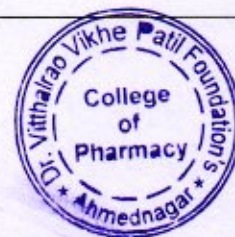
	4. Various drug targets like enzymes, nucleic acid and receptors, their biochemical features, physiological & patho-physiological roles and their significance in drug design.
	5. Pro-drug concept in drug design, Lead discovery & optimization
	6. Molecular docking strategies & different methods of docking, Mechanism based drug design including quantum mechanics, molecular mechanics and molecular modeling
Pharmaceutical Biotechnology	1. Define Biotechnology & illustrate its scope in pharmacy
	2. Know the basics of biotechnology techniques and the various systems used like Genetic Engineering techniques, Recombinant DNA technology.
	3. Know the method of genetic engineering for production of rDNA products including monoclonal antibodies.
	4. Know the information about the application of genetic engineering in animals, Introduction to Human Gene Therapy
	5. Enzyme Technology; Immobilization of enzyme & its applications,
	6. State the application of Fermentation Technology regarding Fermentation process in production of vitamins and antibiotics



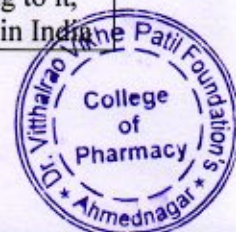
Course name (Final B.Pharm)	Course outcomes
Sterile Products	1. Describe the General requirements, routes of administration, significance of tonicity adjustment and sterility and Pre-formulation of sterile products.
	2. Describe various packaging materials used, factors influencing choice of containers, official quality control tests and methods of evaluation for sterile products
	3. Describe the GMP and design of Parenteral Production Facility, environmental control zones, heating ventilation air conditioning (HVAC), HEPA filter and laminar area.
	4. Explain Classification and formulation of SVPs, Pilot plant scale up for SVPs
	5. Explain Large Volume Parenterals (LVPs), Types, concept of formulation, influence of physiological factors, stabilization of LVPs, Parenteral Nutrition
	6. Describe Blood Products and types of different Surgical products,
	7. Formulation and Pharmacopoeial evaluation of SVPs, LVPs, and ophthalmic preparations
	8. Accelerated stability testing of a SVP or LVP marketed samples
	9. Expertise in sealing of ampoules and Evaluation of marketed preparations
	10. Importance and validation of aseptic area
Pharmaceutical Analysis-V	The students will able to get knowledge of Spectroscopic (FTIR, NIR, Raman, NMR, ESR, Mass) & Chromatography (HPLC, Gas, Flash, Super critical fluid chromatography)
	techniques in terms of -
	1. Principle and instrumentation
	2. factors affecting
	3. Pharmaceutical applications
	4. Spectrophotometric estimation of two-component formulations by simultaneous analysis (simultaneous equation method, Q-method)
	5. IR-Spectral interpretation of aliphatic and aromatic compounds
	7. Operate and calibrate various analytical instruments for the assay of various APIs and formulations as per Pharmacopoeial standards
	8. Validation of analytical methods as per ICH guidelines
Medicinal Chemistry	1. History and general aspects of the design & development of drugs including classification, nomenclature, structure activity relationship (SAR)
	2. Mechanism of action, adverse effects, therapeutic uses and recent developments of following categories such as-
	3. Antibiotics, Antineoplastic agents including recent drugs and monoclonal antibodies, Anti-infective agents such as Antitubercular & Antileprotic agents, Antifungal agents etc.
	4. Synthesis of medicinally important compounds/drug intermediates with recrystallization of each compound and monitoring reactions over TLC
	5. Purification of above synthesized compounds by Column chromatography and interpretation & spectral characterizations of synthesized compounds by IR and ¹ H-NMR
	6. Understand reaction mechanisms involved in synthesis of medicinally important organic compounds.
	7. History and general aspects of the design & development of drugs including classification, nomenclature, structure activity relationship (SAR)
	8. Mechanism of action, adverse effects, therapeutic uses, and recent developments of following categories of drugs such as-
	9. Antihistaminic agents and proton pump inhibitors, Autacoids, NSAIDs, analgesics & antipyretics, Narcotic agents, Steroids and Steroidal Drugs, Hormones
	10. Synthesis of following medicinally important compounds/drug intermediates and Interpretation of IR spectra of synthesized compounds



Pharmacology	1. Deep knowledge about pharmacology and pharmacotherapy, pharmacokinetics, drug interactions of drugs used in infectious diseases
	2. Classification, MOA, antibacterial spectrum, resistance, therapeutic uses, adverse effects and contraindications of various antibiotics viz. Penicillins, cephalosporines etc.
	3. To study the Pharmacology of Drugs acting on other infectious diseases like antitubercular agents, Antimalarials, anthelmintics and antiamoebics, Antiviral and antifungals
	4. Classification, MOA, antibacterial spectrum, resistance, therapeutic uses, adverse effects and contraindications of antineoplastic drugs
	5. Drugs acting on Uterus: Pharmacology of uterine stimulants and relaxants, Thyroid and antithyroid drugs and also Functions, Receptor and mechanisms of Hormone actions
	6. Analyze the rational and irrational fixed dose combinations based on various parameters.
	7. Understand the importance of isolated preparation, mechanism of action of drugs on isolated tissues, expertise in performing bioassay of drugs.
	8. Basic aspects of drug safety and Pharmacovigilance in relation to monitoring and reporting of Adverse Drug reactions (ADRs)
	9. Clinical trials, ethics and practice of Good Clinical Practice involved in clinical trials and Clinical Data Management (CDM)
	10. To study the problems based on paired and unpaired Student 't' test, nonparametric test and To solve statistical problems using suitable software
Natural Drug Technology	1. Explain various guidelines issued by WHO in relation with cultivation, collection, storage etc.
	2. Explain in vitro screening methods and its applications for biological evaluation of natural products
	3. Explain various factors affect on level of secondary metabolites and applications of Plant Tissue Culture in production of secondary metabolites
	4. Overview of novel drug delivery systems for herbal drugs including Novel drug delivery approaches like Liposomes & Phytosomes, Novel Vesicular Herbal Formulations
	5. Explain concept of health & pathogenesis, philosophical basis, diagnosis & treatment aspects of Ayurveda, Unani, Siddha & Homoeopathic system of medicine.
	6. Method of preparation of Ayurvedic dosage forms; significance of novel drug delivery of natural products; herbs used in cosmetic preparation & methods of their formulations
	7. Prepare, label & evaluate herbal formulations, Preparation and evaluation of skin care and hair care cosmetic products
	8. Evaluation of marketed cosmetic & nutraceutical formulations
	9. Perform Preformulation and spectral (UV and/ IR) study of isolated compounds
	10. Conduct in vitro assays for correlation with biological efficacy.
Bio-pharmaceutics & Pharmacokinetics	1. Understanding the concept of biopharmaceutics and its applications in formulation development along with its importance in dosage form design.
	2. Learning various compartmental models and non compartmental analysis methods.
	3. Studying pharmacokinetic processes and their relevance in efficacy of dosage form
	4. Learning Non-Linear Pharmacokinetics and Biopharmaceutical classification system
	5. Understanding concept and mechanisms of dissolution and in vitro- in vivo correlation
	6. Methods of assessing bioavailability & bioequivalence study and introduction to various study designs



Pharmaceutical Jurisprudence	1. Basic principles, purpose, significance and relevance of Pharmaceutical laws in India like History of Pharmaceutical Legislation in India & Code of Pharmaceutical Ethics
	2. Study of qualifications for membership of the Board and it's responsibilities inspection method.
	3. Study of various laws governing the manufacturing, sale, research & usage of drugs.
	4. Knowledge about Patents and various regulatory systems along with procedure for patent application and IPR
	5. Aim, Objectives and Salient features of various acts related to pharmacy and Introduction to Standard Institutions and Regulatory Authorities like ICH, WHO, USFDA, MHRA
Advanced Drug Delivery System	1. Describe the Fundamental Concept of Modified Drug Release and Pre requisites of drug candidates, along with various approaches and classification
	2. Basic concept of optimization along with Formulation development and evaluation of sustained release formulations
	3. Describe. Introduction, formulation, merits, demerits, application and evaluation of Novel Drug Delivery Systems.
	4. Explain Therapeutic Aerosols along with typical formulations from, metered dose, intranasal and topical applications.
	5. Explain concept of microencapsulation, merits, demerits and application, Types of Microencapsulation and Evaluation of microcapsules.
	6. Describe Polymers with respect to introduction to polymers, classification, types, selection, application and examples
	7. Formulation and evaluation of transdermal, gastroretentive formulation
	8. Details of Microencapsulation technique related to Types of Microencapsulation, merits, demerits and applications
	9. Evaluation of marketed preparations like sustained release tablets/capsules, matrix type transdermal drug delivery system
	10. Demonstration of Optimization studies by Design expert software like 2 ³ factorial design
Cosmetic science	1. Understand the concepts of cosmetics along with classification, Packaging and additives in Cosmetics
	2. Explain formulation , manufacturing, equipments & evaluation of cosmetics such as creams like cold cream, vanishing cream etc. & powder cosmetics
	3. Explain the concept of cosmeceuticals along with Fundamentals and Scope of Cosmetic Science
	4. Explain formulation of cosmetics for hair, manufacturing & evaluation of hair shampoos, tonics.
	5. Describe formulation of cosmetics for eyes, manufacturing & evaluation of eye mascara, shadow.
	6. Understand formulation of manicure products like nail lacquer, remover.
	7. State the correct use of various equipments in Pharmaceutics laboratory relevant to cosmetics.
	8. Perform formulation, evaluation and labelling of cosmetics along with Market survey of atleast three brands of any cosmetic product
	9. Describe use of ingredients in formulation and category of formulation.
	10. Prepare labels as per regulatory requirements.
Natural Products: Commerce, Industry & Regulations	1. The significance of natural products in daily life.
	2. Classify different segments in market, demand & supply position; export & import potential; position of Indian herbal drug industry in global competition
	3. Government organizations & policies for promotion; their regulation in India & other countries, various regulatory guidelines, ethical issues etc
	4. Explain safe use of natural products, possible toxicities & interaction, toxicities .
	5. Significance of pharmacovigilance systems and WHO guidelines regarding to it, Regulation & Patenting, Licensing requirements for production of herbal drugs in India



Quality Assurance Techniques	Student should understand
	1. The significance of quality assurance techniques & quality in pharmaceutical manufacturing
	2. Current Good Manufacturing Practices in pharmaceutical industry.
	3. Various aspects of documentation, SOPs and records along with Pharmaceutical Validation
	4. The role of validation in assurance of quality in pharmaceutical industry.
	5. Quality by design, QbD, Steps in QbD approach, significance and regulatory guidelines
6. Regulatory Agencies imparting quality standards such as WHO, ICH, USFDA, TGA, MHRA	



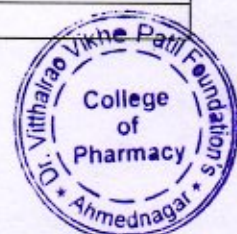
Course name (M.Pharm) Sem-I	Course outcomes
Modern Pharmaceutics (Theory)	The Student should know about-
	1. The concept of preformulation studies
	2. Polymer sciences-Applications, Thermal characterization and Rheology of polymers, Biodegradable polymers.
	3. Stability testing, sterilization process and packaging of dosage forms
	4. Objectives and policies of CGMPs
	5. The concept of Diffusion & Dissolution - Dissolution test, Dissolution model.
	6. Optimization techniques in pharmaceutical formulation
Pharmaceutics (Practical-I)	7. Study of consolidation parameters
	In practical's student should know the-
	1. Analysis of pharmacopoeial compounds and their formulations by UV-Visible spectrophotometer
	2. Preformulation study of tablets.
	3. Intrinsic and saturation solubility.
	4. Effect of pH on the apparent partition coefficient of a drug,
	5. Determine the best compatible additive for a tablet dosage form.
	6. Accelerated stability study,
	7. Formulation and evaluation of mucoadhesive tablets and transdermal patches.
	8. Experiments based on HPLC, flame photometry, fluorimetry
9. To perform in vitro dissolution profile of CR/SR marketed formulation	
Quality Control & Quality Assurance (Theory)	1. Concept and Evolution of Quality Control and Quality Assurance
	2. CGMP guidelines according to schedule M, USFDA
	3. Analysis of raw materials, finished products, packaging materials, in process quality control (IPQC) (ICH Q6 and Q3)
	4. Documentation in pharmaceutical industry
	5. Quality audit plan and reports, Specification and test procedures
	6. Manufacturing operations and controls
Quality Control & Quality Assurance (Practical)	1. Analysis of pharmacopoeial compounds and their formulations by UV-Visible spectrophotometer
	2. Experiments based on HPLC, flame photometry, fluorimetry
	3. Development of stability study protocol
	4. Case studies on- Total Quality Management, Corrective & Preventive actions, Change control, Deviations
Advanced Medicinal Chemistry (Theory)	1. To study different stages of Drug Discovery, Role of Medicinal Chemistry in Drug Research
	2. Prodrug design and analog design, Biological drug targets
	3. Systematic study, SAR, MOA & synthesis of class of drugs like Antihypertensive drugs, Anticonvulsant drugs etc.
	4. Rational design of enzyme inhibitors
	5. Therapeutic values of peptidomimetics, Design of peptidomimetics
Pharmaceutical Chemistry (Practical-I)	1. Analysis of pharmacopoeial compounds and their formulations by UV-Visible spectrophotometer
	2. Experiments based on HPLC, flame photometry, fluorimetry
	3. Synthesis of medicinally important organic compounds along with purification and characterization
	4. To perform reactions of synthetic importance like Claisen-Schmidt reaction, Mannich reaction etc.
	5. Estimation of elements & functional groups in organic natural compounds



Modern Pharmaceutical Analytical Techniques (Theory)	The Student should know about-
	1. Introduction, theory, instrumentation of UV-Visible spectroscopy
	2. Choice of solvents, solvent effect and applications of UV-Visible spectroscopy
	3. The basic principle, instrumentation of FTIR spectrophotometer, sample handling, applications of IR spectroscopy
	4. Principles of FT-NMR with reference to ¹³ C NMR, Factors affecting chemical shift, Spin-spin coupling
	5. Basic principles and instrumentation (components and their significance). Ionization techniques (FAB, MALDI, SELDI, APCI, APPI, ESI and DART). Mass analyzers [Quadrupole, Ion Trap, FT-ICR, TOF and tandem mass (MS-MS)].
Advanced Pharmacology-I	6. Chromatography, Spectrofluorimetry, Electrophoresis, Immunological assays
	1. Explain mechanism of drug actions at cellular and molecular level
	2. Understand adverse effects, contraindications and clinical uses of drugs used in treatment of diseases
	3. General aspects and steps involved in neurotransmission
Pharmacology (Practical-I)	4. Systemic pharmacology, Cardiovascular pharmacology and Central nervous System pharmacology
	1. Analysis of pharmacopoeial compounds and their formulations by UV-Visible spectrophotometer
	2. Simultaneous estimation of multicomponent containing formulations by UV spectrophotometry
	3. Experiments based on HPLC, flame photometry, fluorimetry
	4. Handling of laboratory animals for-
	a) Evaluation of analgesic, anti-inflammatory, local anesthetic, mydriatic and miotic activity.
	b) Evaluation of CNS stimulant, depressant, anxiogenic & anxiolytic, anticonvulsant activity
	c) Evaluation of diuretic activity
	d) Evaluation of antiulcer activity by pylorus ligation method
5. Oral glucose tolerance test	
6. Pharmacokinetic studies and data analysis of drugs given by different routes of administration using softwares	

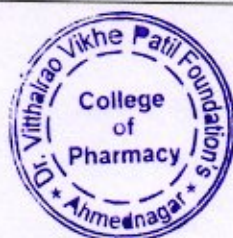


Course name (M.Pharm) Sem-II	Course outcomes
Molecular Pharmaceutics(Nano Tech & Targeted DDS) (Theory)	The Student should know about-
	1. Various approaches for development of Novel Drug Delivery System
	2. Criteria for selection of drugs and polymers for development of NTDS
	3. Targeted Drug Delivery System
	4. Targeting methods: Introduction, preparation & evaluation
	5. Nanoparticles & liposomes : Types, preparation & evaluation
	6. Microcapsules & Microsheres
	7. Pulmonary Drug Delivery Systems
	8. Intranasal route delivery systems
	9. Nucleic acid based therapeutic delivery system
	10. Liposomal gene delivery systems
11. Formulation & evaluation of Novel Drug Delivery Systems	
Pharmaceutics (Practical-II)	In practicals student should know -
	1. Preparation and evaluation of alginate beads
	2. Formulation & evaluation of gelatin microspheres
	3. Formulation & evaluation of liposomes/ niosomes
	4. Compare the dissolution profile of two different marketed products
	5. Improvement of dissolution characteristics of slightly soluble drugs by solid dispersion technique
	6. Bioavailability studies of paracetamol in animals
	7. Formulation data analysis using Design Expert software
8. Development & evaluation of creams, shampoo and toothpaste base	
Advanced Biopharmaceutics & Pharmacokinetics (Theory)	1. Understand basic concepts in Biopharmaceutics & Pharmacokinetics
	2. Critical evaluation of biopharmaceutics studies
	3. Design & evaluation of dosage regimens
	4. Biopharmaceutics consideration in drug product design & in vitro drug product performance
	5. Bioavailability & Bioequivalence
	6. Applications of Pharmacokinetics
Computer Aided Drug Development	1. Computers in Pharmaceutical Research & Development
	2. Computational modeling of Drug Disposition
	3. Computer-aided formulation development
	4. Artificial Intelligence, Robotics & Computational Fluid Dynamics
Advanced Spectral Analysis	1. Woodward Fieser rule for 1,3-butadiene, cyclic dienes & interpretation of compounds of enones
	2. IR interpretation of organic compounds
	3. NMR spectroscopy: 1D and 2D NMR, NOESY & COSY, HECTOR & INADEQUATE techniques
	4. Mass spectroscopy: Mass fragmentation & its rules, isotopic peaks, interpretation of organic compounds
	5. Principle, instrumentation and applications of various Chromatography techniques
	6. Thermal methods of analysis, Raman spectroscopy, Radioimmunoassay
Computer Aided Drug Design	1. Role of CADD in drug discovery, Different CADD techniques & their applications
	2. History & development of QSAR, Applications of QSAR
	3. Statistical methods used in QSAR analysis
	4. Molecular modeling & Docking
	5. Molecular properties & Drug design
	6. Pharmacophore mapping & Virtual screening



Pharmaceutical Manufacturing Technology	1. Pharmaceutical industry developments
	2. Plant layout & Production Planning
	3. Aseptic Process Technology
	4. Advanced sterile product manufacturing technology
	5. Non-sterile manufacturing process technology
	6. Advanced non-sterile product manufacturing technology
	7. Coating Technology
	8. Containers & closures for pharmaceuticals
	9. Quality by Design (QbD)
	10. Process Analytical Technology (PAT)
	11. QbD for drug substances & excipients
	12. Design of experiments, Risk assessment and mitigation/minimization
Pharmaceutical Quality Assurance (Practical-II)	1. Organic contaminants residue analysis by HPLC
	2. Estimation of metallic contaminants by flame photometer
	3. Validation of an analytical method for a drug
	4. Validation of processing area
	5. Qualification of pharma equipment like autoclave, hot air oven, tablet compression machine
	6. Qualification of analytical instruments
	7. Cleaning validation of equipment
	8. Case study on application of QbD
	9. Case study on application of PAT
Advanced Pharmacology-II	1. Explain mechanism of drug actions on cellular & molecular level
	2. Discuss pathophysiology & pharmacotherapy of certain diseases
	3. Understand adverse effects, contraindications & clinical uses of drugs used in treatment of diseases
	4. Endocrine pharmacology
	5. Chemotherapy
	6. GIT pharmacology
	7. Chronopharmacology
	8. Recent Advances in treatment
Pharmacology (Practical-II)	1. To record DRC of agonist using suitable isolated tissue preparation
	2. To study the effects of antagonist/potentiating agents on DRC of agonist using suitable isolated tissue preparation
	3. To determine strength of unknown sample by matching bioassay by using suitable isolated tissue preparation
	4. To determine strength of unknown sample by interpolation bioassay by using suitable isolated tissue preparation
	5. To determine strength of unknown sample by bracketing bioassay by using suitable isolated tissue preparation
	6. To determine strength of unknown sample by multiple point bioassay by using suitable isolated tissue preparation
	7. Acute oral toxicity studies as per OECD guidelines
	8. Acute oral dermal toxicity studies as per OECD guidelines
Pharmaceutical Chemistry (Practical-II)	1. Synthesis of organic compounds by adopting different approaches involving oxidation, reduction, nitration
	2. Comparative study of synthesis of intermediates by different synthetic routes.
	3. Comparison of absorption spectra by UV and Woodward - Fieser rule
	4. Interpretation of organic compounds by FTIR
	5. Interpretation of organic compounds by NMR
	6. Interpretation of organic compounds by MS
	7. Identification of organic compounds using FTIR, NMR and Mass spectra
	8. Preparation of 4-iodotoluene from p-toluidine
	9. To perform microwave irradiated reactions of synthetic importance

Sahakar
Academic Coordinator



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Principal