JKKN College of Pharmacy, Kumarapalayam

Pharm D Programme Outcome

PO 1: Foundational Human Systems Knowledge: By understanding the intricate dynamics of human systems, graduates will apply this foundation in therapeutic contexts, critically analyze deviations, evaluate patient responses, and innovate to promote optimal health and wellness.

PO 2: Pharmaceutical Proficiency & Clinical Decision-Making: Graduates, equipped with a comprehensive understanding of medications, will apply best practices in drug conceptualization and therapeutic principles. They will critically analyze drug interactions and patient conditions, evaluate therapeutic and clinical outcomes, and innovate in crafting patient-centered care and medication strategies.

PO 3: Natural and Synthetic Products Chemistry Expertise: Equipped with profound insights into molecular interactions, chemical principles, and microbiology in pharmacy, graduates will analyze and utilize their knowledge for drug synthesis and the identification of potential natural products. They will critically dissect molecular dynamics, evaluate the chemical, therapeutic, and Pharmaceutical application of microbiology, and utilize for drug development, including natural product exploration.

PO 4: Integrated Patient Care, and Ethical Practices: Graduates will excel as Pharmaceutical Care experts, optimizing medication use across diverse patient populations. Also apply their skills to ensure safety and effectiveness of medications in patients. They will uphold the highest standards of ethical practice, maintaining integrity in both research and patient care, and adhering to regulatory requirements.

PO 5: Economic Acumen in Healthcare and Formulation: Understanding the complexities of healthcare economics and drug formulation costs, graduates will assess treatment modalities and formulation viability, implement cost-effective production strategies, evaluate therapeutic and economic outcomes, and develop/innovate to deliver value-driven care and efficient drug formulations.

PO 6: Continual Learning & Professional Development: Recognizing the evolving nature of pharmaceutical sciences, graduates will be committed to lifelong learning. They will apply new knowledge to their practice, critically analyze emerging trends, evaluate their continuous professional development, and innovate in their personal and professional growth strategies.

PO 7: Leadership and Management: Graduates will apply foundational management concepts in pharmacy operations, analyze operational challenges, evaluate team dynamics, and take leadership roles in healthcare/patient care teams, contributing to field advancements through effective leadership and collaboration.

PO 8: Adapting to Technology: Graduates will demonstrate an ability to handle/use various tools, apparatus, instrument, equipment or machinery pertinent to the pharmaceutical domain with practical knowledge and apply modern pharmacy tools/softwares and calculation methods, especially for personalized medication, population Pharmacokinetics and dose adjustments in renal or liver failure patients, ensuring enhanced and accurate patient care in a rapidly evolving technological landscape

PO 9: Communication & Patient Counseling: Graduates will be adept at conveying complex pharmaceutical information in understandable terms to patients and other healthcare professionals. They will apply effective communication strategies, critically analyze patient feedback, provide counselling to the patents and evaluate the outcome of counselling.

PO 10: Community Engagement & Environmental Sustainability: Graduates will actively participate in community health initiatives, demonstrating a commitment to societal well-being, while also advocating for and implementing environmentally sustainable practices in pharmaceutical care.

PO 11: Critical thinking and innovative Problem Solving: Graduates will drive research by understanding rigorous methodologies and applying analytical and critical thinking skills. They will adeptly identify and dissect complex pharmaceutical/community challenges, critically evaluate research findings, and innovate in providing effective, evidence-based solutions, contributing novel insights to the pharmaceutical field.

PRINCIPAL
J.K.K.NATTRAJA COLLEGE OF PHARMACY
KOMARAPALAYAM - 638 183.

J.K.K. NATTRAJA COLLEGE OF PHARMACY

Course outcome for Pharm.D

Course of study for I Year

Course code **Name of the subject and course outcome**

1.1 **Human Anatomy and Physiology**

CO CODE	COURSE OUTCOME	COGNITIVE LEVEL
CO1	Explain different terminology, anatomy and physiology, and pathology of each body system and how they interrelate to maintain homeostasis.	C1
CO2	Classify and explain different types of tissue, skeletal system, and joints, Haemopoietic and lymphatic system, homeostatic mechanism and its altered physiology	C2
CO3	Explain the anatomy and Physiology of cardiovascular, respiratory, digestive, nervous, urinary, and reproductive systems and its disorders	C3
CO4	Explain the Anatomy and Physiology of the endocrine system and sense organs and their disorders	C4
CO5	Describe the Physiology of muscle contraction and its disorders, sport physiology, Drugs and athletics	C5

Human anatomy and physiology - practical

CO CODE	COURSE OUTCOME	PSYCOMOTOR LEVEL
CO1	Demonstrate the ability to identify epithelial tissue through visual observation and labeling.	P1
CO2	Achieve accurate identification of connective tissue components	P2
CO3	Apply acquired knowledge to understand the purpose and usage of appliances in hematological experiments.	P3
CO4	Perform a W.B.C. count using appropriate techniques and equipment.	P4
CO5	Execute an R.B.C. count, demonstrating precision in measurement and technique.	P5

J.K.K. NATTRAJA COLLEGE OF PHARMACY Komarapalayam 638 183

PRINCIPAL
J.K.K.NATTRAJA COLLEGE OF PHARMACY
KOMARAPALAYAM - 638 183.

1.2 Pharmaceutics

Course Outcome Number	Course Outcomes	Cognitive Level
CO 1	Recall and summarise the fundamental principles of pharmaceutics, including drug formulation, delivery systems, and dosage forms.	C1
CO 2	Explain and Demonstrate knowledge of various pharmaceutical dosage forms, their preparation methods, and their applications in drug delivery.	C2
CO 3	Apply principles of pharmaceutical calculations to determine appropriate drug dosages and formulations	C3
CO 4	Analyse factors influencing drug stability, solubility, and bioavailability.	C4
CO 5	Evaluate the physicochemical properties of drugs and their implications for formulation development.	C5
CO 6	Design and propose of proficiency in compounding pharmaceutical preparations accurately and safely. Understand regulatory requirements and quality control measures in pharmaceutical manufacturing. Apply principles of pharmaceutics to solve practical problems in drug formulation and delivery.	C6

J.K.K. NATTRAJA COLLEGE OF PHARMACY Komarapalayam 638 183

PRINCIPAL
J.K.K.NATTRAJA COLLEGE OF PHARMACY
KOMARAPALAYAM - 638 183.

1.3 Medicinal Biochemistry

Course outcome number	Course Outcomes	Cognitive level
CO1	Remembering the fundamental concepts related to biochemistry, including the structure of the cell and its biochemical organization, as well as the transport processes across cell membranes and also the significance of energy-rich compounds like ATP and Cyclic AMP in biological systems.	C1
CO2	Understanding of enzyme-related concepts, including enzyme definition, nomenclature, IUB classification, factors affecting enzyme activity, and enzyme inhibition and also comprehend the roles of isoenzymes, coenzymes, and their connection to deficiency diseases.	C2
CO3	Applying their knowledge to explain carbohydrate metabolism processes, including glycolysis, the citric acid cycle (TCA cycle), HMP shunt, glycogenolysis, glyconeogenesis, and glycogenesis and to discuss metabolic disorders like diabetes mellitus and glycogen storage diseases.	C3
CO4	Analyzing lipid metabolism, including the oxidation of saturated fatty acids, ketogenesis, and the biosynthesis of fatty acids and lipids, metabolism of cholesterol and the hormonal regulation of lipid metabolism. Furthermore, they will assess defective lipid metabolism in conditions such as atherosclerosis and fatty liver.	C4
CO5	Evaluating the processes related to biological oxidation, including the coenzyme systems involved, the electron transport chain, its mechanisms in energy capture, and its regulation and inhibition and concepts of uncouplers of the electron transport chain and oxidative phosphorylation.	C5

J.K.K. NATTRAJA COLLEGE OF PHARMACY Komarapalayam 638 183

PRINCIPAL
J.K.K.NATTRAJA COLLEGE OF PHARMACY
KOMARAPALAYAM - 638 183.

Medicinal biochemistry -practical

Course outcome number	Course Outcomes	Psychomotor Level
CO1	Imitate laboratory techniques and procedures effectively while conducting qualitative analysis of normal constituents of urine and qualitative analysis of abnormal constituents of urine.	P1
CO2	Manipulating laboratory equipment and materials during the quantitative estimation of urine sugar by Benedict's reagent method, quantitative estimation of Urine chlorides by Volhard's method, and quantitative estimation of Urine creatinine by Jaffe's method.	P2
CO3	Performing quantitative estimations of Urine Calcium by precipitation method, quantitative estimation of serum cholesterol by Libermann Burchard's method, and quantitative estimations of blood creatinine, blood sugar (Folin-Wu tube method), SGOT, SGPT, Urea in Serum, Proteins in Serum, serum bilirubin, and Glucose by means of Glucose oxidase.	P3
CO4	Articulate and communicate the findings effectively by preparing Folin Wu filtrate from blood, preparing standard buffer solutions and measuring their pH, and conducting experiments on lipid profile tests and the determination of sodium, calcium, and potassium in serum.	P4
CO5	Attain a level of naturalization in laboratory techniques and data interpretation through the study of factors affecting enzyme activity (pH and temperature) and the enzymatic hydrolysis of glycogen/starch by amylases	P5

J.K.K.NATTRAJA COLLEGE OF PHARMACY Komarapalayam 638 183

PRINCIPAL
J.K.K.NATTRAJA COLLEGE OF PHARMACY
KOMARAPALAYAM - 638 183.

1.4 Pharmaceutical Organic Chemistry

COURSE OUTCOME NUMBER	COURSE OUTCOMES	COGNITIVE LEVEL
CO1	**Recall** and identify the structures and physical properties of organic compounds, including polarity, melting point, boiling point, solubility, and intermolecular forces. Memorize the nomenclature rules for various classes of organic compounds.	C1
CO2	Comprehend the theories of acids and bases (Lowry Bronsted and Lewis theories) and their application in organic chemistry. **Understand** the concept of isomerism and its various types.	C2
CO3	**Apply** knowledge of free radical chain reactions of alkanes to predict reaction mechanisms, relative reactivity, and stability. **Apply** concepts of nucleophilic aliphatic substitution mechanisms to analyze reaction kinetics and stereochemistry.	C3
CO4	**Analyze** the mechanisms and relative reactivity of dehydrohalogenation reactions of alkyl halides, including E2 and E1 mechanisms. **Analyze** electrophilic and free radical addition reactions, including reaction mechanisms, rearrangements, and orientation.	C4
CO5	**Evaluate** the theory of resonance and its application in understanding stability and reactivity of organic compounds. **Evaluate** mechanisms of various nucleophilic addition reactions and their importance in organic synthesis.	C5
CO6	**Create** strategies for electrophilic aromatic substitution reactions by determining the effects of substituent groups and predicting reaction outcomes. Design synthetic pathways for complex organic reactions, including aldol condensation, Claisen condensation, and other key transformations.	C6

J.K.K. NATTRAJA COLLEGE OF PHARMACY Komarapalayam 638 183

PRINCIPAL
J.K.K.NATTRAJA COLLEGE OF PHARMACY
KOMARAPALAYAM - 638 183.

Pharmaceutical organic chemistry – practical

COURSE OUTCOME NUMBER	COURSE OUTCOMES	COGNITIVE LEVEL
CO1	Recall the fundamental principles and procedures involved in the synthesis of pharmaceutical organic compounds. Recognize the reagents and conditions necessary for specific organic transformations, such as acetylation, bromination, and nitration.	P1
CO2	Demonstrate comprehension of the underlying chemical reactions in pharmaceutical organic synthesis, including acetylation, benzoylation, and diazotization. Explain the rationale behind selecting appropriate reaction conditions and reactants for a given synthesis.	P2
CO3	Apply the acquired knowledge to execute various organic transformations, including hydrolysis of esters, oxidation of anthracene, and reduction of nitro compounds. Utilize laboratory techniques effectively to perform synthesis and isolation of pharmaceutical compounds.	P3
CO4	Analyze the outcomes of organic reactions by interpreting spectral data (e.g., IR, NMR) and chromatographic results to identify synthesized compounds. Evaluate reaction mechanisms and propose plausible pathways for the formation of specific products.	P4
CO5	Critically evaluate the efficiency and purity of synthesized pharmaceutical compounds through quantitative analysis and comparison with theoretical yields. Assess the feasibility and potential challenges associated with scaling up synthetic processes for industrial production.	P5
CO6	Design novel synthetic routes for the preparation of pharmaceutical intermediates or derivatives, considering principles of green chemistry and efficiency. Formulate research proposals for investigating new methodologies or improving existing synthetic routes in pharmaceutical organic chemistry.	P6

J.K.K.NATTRAJA COLLEGE OF PHARMACY Komarapalayam 638 183

PRINCIPAL
J.K.K.NATTRAJA COLLEGE OF PHARMACY
KOMARAPALAYAM - 638 183.

COURSE OUTCOME NUMBER	COURSE OUTCOMES	COGNITIVE LEVEL
CO1	**Recall** and summarize the fundamental concepts and principles of pharmaceutical inorganic chemistry, including errors in analytical techniques and the theory of indicators.	C1
CO2	**Explain** the different titration techniques, such as volumetric, acid-base, redox, non-aqueous, precipitation, and complexometric titrations.	C2
CO3	**Apply** the principles of gravimetry and limit tests to quantitatively analyze and detect the presence of specific substances in pharmaceutical samples.	C3
CO4	**Analyze** and assess the compatibility, stability, and effectiveness of essential trace elements, antimicrobials, and radio pharmaceuticals in pharmaceutical products.	C4
CO5	**Evaluate** the role of inorganic compounds, such as medicinal gases, acidifiers, antacids, cathartics, and electrolyte replenishers, in pharmaceutical formulations, considering their therapeutic benefits and potential side effects.	C5
CO6	**Design and propose** innovative pharmaceutical aids and dental products by integrating inorganic chemistry principles with pharmaceutical science, considering their formulation, safety, and efficacy.	C6

PRINCIPAL
J.K.K.NATTRAJA COLLEGE OF PHARMACY
KOMARAPALAYAM - 638 183.

Pharmaceutical inorganic chemistry – practical

COURSE OUTCOME NUMBER	COURSE OUTCOMES	PSYCHOMOTOR LEVEL
CO1	Follow the procedures for pharmaceutical compounds, such as ammonium chloride, ferrous sulphate, copper sulphate, calcium gluconate, hydrogen peroxide, and sodium benzoate, utilizing appropriate titration and analytical techniques, and interpret the results effectively.	P1
CO2	Execute and demonstrate the correct procedures for limit tests, including those for chlorides, sulphates, iron, heavy metals, and arsenic, with precision and accuracy..	P2
CO3	Demonstrate the techniques for testing the identity and purity of pharmaceutical substances, such as sodium bicarbonate, barium sulphate, ferrous sulphate, and potassium chloride, and assess the results to ensure compliance with pharmacopoeial standards.	P3
CO4	Apply the gravimetric techniques to estimate barium as barium sulphate, determine the mixture of sodium hydroxide and sodium carbonate, and perform assays for boric acid and borax, oxalic acid and sodium oxalate with precision and attention to detail.	P4
CO5	Perform and create the procedures for preparing pharmaceutical compounds, including boric acid, potash alum, calcium lactate, and magnesium sulphate, ensuring the synthesis meets pharmaceutical standards and safety protocols.	P5

J.K.K. NATTRAJA COLLEGE OF PHARMACY Komarapalayam 638 183

PRINCIPAL
J.K.K.NATTRAJA COLLEGE OF PHARMACY
KOMARAPALAYAM - 638 183.

1.6 Remedial Mathematics

CO's	Course Outcomes
CO1	Understand the concepts and solve problems in algebra, Trigonometry and Analytical Geometry.
CO2	Solve applied problems using differential calculus and Integral calculus
CO3	Solve applied problems using differentiation equation.
CO4	Express equation of Laplace transform in Pharmacy applications.

1.6 Remedial Biology

Course outcome number	Course Outcomes	Cognitive level
CO1	Recall and describe fundamental concepts, including the definition and characteristics of living organisms, diversity in the living world, binomial nomenclature, and the five kingdoms of life.	C1
CO2	Understand morphology of different parts of flowering plants, including roots, stems, inflorescence, flowers, leaves, fruits, seeds, and the general anatomy of monocotyledons and dicotyledons.	C2
CO3	Apply their knowledge of blood composition, blood groups, coagulation, lymph composition, and the human circulatory system, including the structure of the heart and blood vessels, cardiac cycle, cardiac output, and ECG.	C3
CO4	Critically analyze human alimentary canal and digestive glands, digestive enzymes, digestion, absorption, assimilation of digested food, human respiratory system, breathing mechanism and regulation, gas exchange, and respiratory volumes.	C4
CO5	Evaluate modes of excretion, the human excretory system, urine formation, the renin-angiotensin system, the nervous system, neuron structure, nerve impulse generation and conduction, brain structure and function, and the endocrine system.	C5
CO6	Synthesize their knowledge of human reproductive system parts, spermatogenesis, oogenesis, menstrual cycle, essential minerals, photosynthesis, plant respiration, growth and development, cell structure, and cell organelles.	C6

J.K.K. NATTRAJA COLLEGE OF PHARMACY Komarapalayam 638 183

PRINCIPAL
J.K.K.NATTRAJA COLLEGE OF PHARMACY
KOMARAPALAYAM - 638 183.

Course of study for II Year

Course code **Name of the subject and course outcome**

2.1 Pathophysiology

Course Outcome Number	Course Outcomes	Cognitive Level
CO 1	Recall and list the fundamental principles of cell injury, inflammation, and diseases of immunity, including their causes, pathogenesis, and morphological features.	C1
CO 2	Explain the concepts of inflammation, immunity, and cancer, and describe the differences between benign and malignant tumors, as well as the histological diagnosis of malignancy.	C2
CO 3	Apply the knowledge of wound healing and factors influencing wound repair, shock mechanisms, and biological effects of radiation in clinical scenarios.	C3
CO 4	Analyze the pathophysiology of common diseases such as hypertension, diabetes mellitus, and renal failure, as well as the environmental and nutritional factors contributing to these conditions.	C4
CO 5	Evaluate the management strategies for infectious diseases, including sexually transmitted diseases, pneumonia, hepatitis, and urinary tract infections, considering the effectiveness of different treatment options.	C5
CO 6	Develop a comprehensive understanding of the course content and create an integrated approach to the diagnosis and management of complex medical conditions, taking into account multiple factors that contribute to disease pathogenesis.	C6

J.K.K.NATTRAJA COLLEGE OF PHARMACY Komarapalayam 638 183

PRINCIPAL
J.K.K.NATTRAJA COLLEGE OF PHARMACY
KOMARAPALAYAM - 638 183.

2.2 Pharmaceutical Microbiology

Course outcome number	Course Outcomes	Cognitive level
CO1	**Outline** the fundamentals of microbiology and the major divisions of the microbial world, elucidating the relationships among different microorganisms.	C1
CO2	**Summarizing** knowledge of various methods for classifying microbes, including bacteria, fungi, viruses, rickettsiae, and spirochetes. Describe the nutritional requirements, growth conditions, and cultivation techniques for these microorganisms.	C2
CO3	**Demonstrate** laboratory techniques for the isolation, identification, and counting of bacteria. Demonstrate proficiency in using staining techniques and biochemical reactions for bacterial identification.	C3
CO4	**Classify** different methods of sterilization, including their merits and demerits. Describe sterilization methods for pharmaceutical products and the process of sterility testing. Explain the principles of validation.	C4
CO5	**Evaluate** disinfectants, antiseptics, fungicidal, and virucidal agents, considering factors affecting their activation and mechanism of action. Analyze bactericidal, bacteriostatic, and virucidal activities, as well as the evaluation of preservatives in pharmaceutical preparations. Discuss immunity, antigens, antibodies, and the immunization program.	C5
CO6	**Programming** various diagnostic tests, including Schick's Test, Elisa test, Western Blot test, Southern Blot, PCR, Widal test, QBC, Mantoux test, and peripheral smear for malarial parasite identification. Discuss microbial culture sensitivity testing, microbiological assays, and the standardization of vaccines and sera. Study infectious diseases like Typhoid, Tuberculosis, Malaria, Cholera, Hepatitis, Meningitis, Syphilis & Gonorrhea, and HIV.	C6

J.K.K.NATTRAJA COLLEGE OF PHARMACY Komarapalayam 638 183

PRINCIPAL
J.K.K.NATTRAJA COLLEGE OF PHARMACY
KOMARAPALAYAM - 638 183.

Pharmaceutical microbiology -practical

Course outcome number	Course Outcomes	Cognitive level
CO1	**Follow** the procedure for the apparatus used in experimental microbiology, sterilizing glassware and preparing media, motility characters and methods of isolation of pure culture.	P1
CO2	**Carry out** the staining techniques to identify the different types bacteria.	P2
CO3	**Complete** the procedure for enumerating the microorganism (total count and viable count)	P3
CO4	**Apply** the skills acquired about Biochemical testing for the identification of micro-organisms.	P4
CO5	**Determine** the minimum inhibitory concentration, RWC.	P5

2.3 Pharmacognosy & Phytopharmaceuticals

Course outcome number	Course Outcomes	Cognitive level
CO1	Outline the history, scope of pharmacognosy, cell wall constituents, primary and secondary metabolites.	C1
CO2	Explain the source, active constituents, method of preparation, method of cultivation, collection techniques and uses of different crude drugs.	C2
CO3	Classify the crude drugs, carbohydrates, proteins, lipids and method of adulteration.	C2
CO4	Apply the knowledge acquired about macroscopical, microscopical and powder analysis for the identification of crude drugs, extraction of fixed oils by suitable methods.	C3
CO5	Analyze the quantity of proteins by appropriate method of analysis.	C4
CO6	Evaluate the purity and quality of fixed oil by applying the suitable method of chemical analysis.	C5
CO7	Create visual representations, such as charts, diagrams, and key features of macroscopical, microscopical and powder analysis for crude drugs.	C6

J.K.K. NATTRAJA COLLEGE OF PHARMACY Komarapalayam 638 183

PRINCIPAL
J.K.K.NATTRAJA COLLEGE OF PHARMACY
KOMARAPALAYAM - 638 183.

Pharmacognosy and Phytopharmaceuticals-practical

Course outcome number	Course Outcomes	Psychomotor Level
CO1	Follow the procedure for histochemical identification of the various cell wall constituents and cell inclusions.	P1
CO2	Carry out the chemical tests to identify the different unorganised crude drugs.	P2
CO3	Complete the analytical procedure for determining the saponifiable and unsaponifiable matter.	P3
CO4	Apply the skills acquired about macroscopical, microscopical and powder analysis for the identification of crude drugs	P4
CO5	Determine the quality of given oil by performing acid value, iodine value and saponification value.	P5

J.K.K.NATTRAJA COLLEGE OF PHARMACY Komarapalayam 638 183

PRINCIPAL
J.K.K.NATTRAJA COLLEGE OF PHARMACY
KOMARAPALAYAM - 638 183.

2.4 Pharmacology-I

Course outcome number	Course Outcomes	Cognitive level
CO1	Recall and articulate key concepts in general pharmacology, including definitions and scope of pharmacology, routes of drug administration, pharmacokinetics, pharmacodynamics, factors modifying drug effects, toxicity types, pre-clinical evaluations, and drug interactions.	C1
CO2	Understand the pharmacology of drugs acting on the ANS, including adrenergic and antiadrenergic drugs, cholinergic and anticholinergic drugs, neuromuscular blockers, mydriatics, miotics, drugs used in myasthenia gravis, and drugs used in Parkinsonism.	C2
CO3	Apply their understanding of drugs acting on the cardiovascular system, including antihypertensives, anti-anginal drugs, anti-arrhythmic drugs, drugs for congestive heart failure therapy, and drugs for hyperlipidemia.	C2
CO4	Categorize the pharmacology of drugs acting on the CNS, including general anesthetics, sedatives, hypnotics, anticonvulsants, analgesic and anti-inflammatory agents, psychotropic drugs, alcohol, CNS stimulants, cognition enhancers, and local anesthetics.	C3
CO5	Evaluate the pharmacology of drugs acting on the respiratory tract, including bronchodilators, mucolytics, expectorants, antitussives, and nasal decongestants, considering their mechanisms and clinical relevance.	C4
CO6	Building their knowledge by comprehensively understanding hormone pharmacology, including thyroid and antithyroid drugs, insulin, insulin analogues, oral hypoglycemic agents, sex hormones, oral contraceptives, oxytocin, and other stimulants and relaxants and pharmacology of autocoids such as histamines, antihistaminics, 5-hydroxytryptamine, its antagonists, and lipid-derived autocoids.	C5

J.K.K. NATTRAJA COLLEGE OF PHARMACY Komarapalayam 638 183

PRINCIPAL
J.K.K.NATTRAJA COLLEGE OF PHARMACY
KOMARAPALAYAM - 638 183.

2.5 Community Pharmacy

Course outcome number	Course Outcomes	Cognitive level
CO1	**Recall** fundamental principles of community pharmacy practice in India, including legal and ethical considerations.	C1
CO2	**Describe** the role and responsibilities of a community pharmacist in the healthcare system of India, highlighting their contributions to patient care and public health.	C2
CO3	**Apply** knowledge of pharmaceuticals, dosage forms, and therapeutic guidelines to assess and manage common health conditions encountered in community pharmacy settings.	C3
CO4	**Analyze** medication-related problems in a hospital setting, such as drug interactions, adverse drug reactions, and medication errors, and propose suitable interventions..	C4
CO5	**Evaluate** the impact of community pharmacy services on patient adherence, health outcomes, and cost-effectiveness, using appropriate assessment tools and research methods.	C5
CO6	**Develop** and implement pharmaceutical care plans, patient counseling strategies, and health promotion initiatives tailored to the specific needs of diverse patient populations in the community pharmacy setting.	C6

2.6 Pharmacotherapeutics-I

Course outcome number	Course Outcomes	Cognitive level
CO1	**Identify** the patient-specific parameters relevant in initiating drug therapy, and monitoring therapy (including alternatives, time-course of clinical and laboratory indices of therapeutic response and adverse effects)diseases.	C1
CO2	**Describe** the pathophysiology and management of cardiovascular, respiratory, Ophthalmic and endocrine diseases.	C2
CO3	Prepare individualized therapeutic plans based on diagnosis.	C3
CO4	**Analyze** the controversies in drug therapy of cardiovascular, respiratory, Ophthalmic and endocrine diseases.	C4
CO5	**Evaluate** the available guidelines of Rational prescribing.	C5
CO6	**Develop** clinical skills in the therapeutic management of these conditions.	C6

J.K.K.NATTRAJA COLLEGE OF PHARMACY Komarapalayam 638 183

PRINCIPAL
J.K.K.NATTRAJA COLLEGE OF PHARMACY
KOMARAPALAYAM - 638 183,

Pharmacotherapeutics-I practical

Course outcome number	Course Outcomes
CO1	**Follow** the patient-specific parameters relevant in initiating drug therapy, and monitoring therapy (including alternatives, time-course of clinical and laboratory indices of therapeutic response and adverse effects)
CO2	**Build** the therapeutic approach to management of these diseases including reference/ source to the latest available evidence.
CO3	**Demonstrate** patient – centred care to diverse patients using the evidence-based medicine.
CO4	**Develop** communication skills through clinical activities.
CO5	**Create** a Patient specific Treatment Plan.

J.K.K.NATTRAJA COLLEGE OF PHARMACY Komarapalayam 638 183

PRINCIPAL
J.K.K.NATTRAJA COLLEGE OF PHARMACY
KOMARAPALAYAM - 638 183.

Course of study for III Year

Course code **Name of the subject and course outcome**

3.1 Pharmacology-II

Course outcome number	Course Outcomes	Cognitive level
CO1	Outline the structures and functions of the components of the cell, Chromosome structure, cell cycle, Gene structure, Gene expression and Transcription factors.	C1
CO2	Remembering the mechanisms of action of drugs affecting blood and blood-forming agents, such as thrombolytics, anticoagulants and antiplatelet agents.	C1
CO3	Understanding the principles of drug actions in the renal system, including diuretics and antidiuretics.	C2
CO4	Apply the principles of chemotherapy to classify and differentiate between various antimicrobial agents, including antibiotics, antiviral agents, and anthelmintic drugs.	C3
CO5	Analyse the mechanism of action and therapeutic uses of immunosuppressants and stimulants.	C4
CO6	Create explanations of the processes of DNA replication, cell signalling, RNA processing, and Protein synthesis.	C6

J.K.K. NATTRAJA COLLEGE OF PHARMACY Komarapalayam 638 183

PRINCIPAL
J.K.K.NATTRAJA COLLEGE OF PHARMACY
KOMARAPALAYAM - 638 183.

PHARMACOLOGY - II (PRACTICAL)

Course outcome number	Course Outcomes	Psychomotor Level
CO1	Imitate proper technique for handling and restraining mice, rats, guinea pig, and rabbits.Imitate ethical principles and regulations governing the use of animals in research.	Imitation (P1)
CO2	Manipulate laboratory appliances with precision for experimental setups. And demonstrate proficiency in the manipulation of physiological salt solutions in pharmacological experiments.	Manipulation(P2)
CO3	Apply precision in performing bioassays for Ach using the interpolation and three-point methods. And Analyse and interpret bioassay data accurately.	Manipulation(P2)
CO4	Articulate the principles and protocols for the use of anaesthetics in laboratory animals. Also Articulate the importance of precision in drug dosing and administration.	Precision (P3)
CO5	Naturalize the knowledge gained in laboratory settings to real-world pharmacological applications.	Articulation

J.K.K.NATTRAJA COLLEGE OF PHARMACY Komarapalayam 638 183

PRINCIPAL
J.K.K.NATTRAJA COLLEGE OF PHARMACY
KOMARAPALAYAM - 638 183.

3.2 Pharmaceutical Analysis

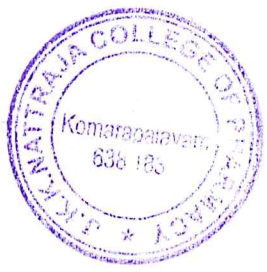
Course outcome number	Course Outcomes	Cognitive level
CO1	**Recall** and explain the fundamental concepts and principles related to pharmaceutical analysis, including the sources of quality variation, the control of quality variation, and the importance of quality control in the pharmaceutical industry.	C1
CO2	**Understanding** of the theoretical aspects and underlying principles of various analytical techniques, such as chromatography, electrometric methods, and spectroscopy, and their applications in pharmaceutical analysis.	C2
CO3	**Apply** their knowledge of chromatography techniques, including column chromatography, TLC, paper chromatography, ion-exchange chromatography, and gas chromatography, to separate and analyze pharmaceutical compounds. They will also apply electrometric methods to perform potentiometry, conductometry, polarography, and amperometric titrations in practical scenarios.	C3
CO4	**Analyze** the results of analytical techniques, such as absorption spectroscopy, infrared spectroscopy, fluorimetric analysis, flame photometry, atomic absorption spectrometry, atomic emission spectroscopy, NMR, mass spectrometry, polarimetry, X-ray diffraction, and thermal analysis. They will interpret data and spectra to identify pharmaceutical compounds and assess their quality.	C4
CO5	**Evaluate** how compliance with these guidelines contributes to the safety and efficacy of pharmaceutical products. evaluate the limitations and deviations of analytical techniques, such as Beer-Lambert's Law and its applications, the effects of solvents on absorption spectra, factors affecting fluorescence, and potential sources of error in various analytical methods.	C5
CO6	**Create** a design and propose analytical protocols and methods based on the principles and techniques discussed in the course. They will create analytical plans for the identification and quantification of pharmaceutical compounds and apply their knowledge to solve complex analytical problems.	C6

J.K.K.NATTRAJA COLLEGE OF PHARMACY Komarapalayam 638 183

PRINCIPAL
J.K.K.NATTRAJA COLLEGE OF PHARMACY
KOMARAPALAYAM - 638 183.

Pharmaceutical analysis (Practical)

Course outcome number	Course Outcomes	Cognitive level
CO1	**Replicate** and perform basic separation and identification techniques, such as paper chromatography for the separation and identification of amino acids.	P1
CO2	**Manipulate** laboratory equipment and perform techniques like TLC for the separation and identification of sulpha drugs with precision	P2
CO3	**Precision** in handling and adjusting experimental conditions, particularly in investigating the effects of pH and solvent on the UV spectrum of a given compound.	P3
CO4	**Articulate** their skills in comparing UV spectra, demonstrating their proficiency in recognizing differences between the UV spectra of compounds and their derivatives	P4
CO5	**Naturalization** by independently performing advanced techniques like determining dissociation constants of indicators using UV-Visible spectroscopy and conducting complex conductometric titrations of mixtures of acids with strong bases.	P5



PRINCIPAL
J.K.K.NATTRAJA COLLEGE OF PHARMACY
KOMARAPALAYAM - 638 183.

3.3 Pharmacotherapeutics-II

Course outcome number	Course Outcomes	Cognitive level
CO1	Recall and explain the guidelines for the rational use of antibiotics and surgical prophylaxis in the management of infectious diseases. Describe the pathophysiology and clinical features of infectious diseases such as tuberculosis, meningitis, and respiratory tract infections.	C1
CO2	Understand the pathophysiology and clinical manifestations of dermatological conditions such as psoriasis, scabies, eczema, and impetigo.	C2
CO3	Apply pharmacotherapeutic principles to select appropriate antibiotics for specific infectious diseases.	C3
CO4	Analyze the basic principles of cancer therapy and cancer chemotherapeutic agents. Create a treatment plan for breast cancer and leukemia patients, integrating knowledge of chemotherapy and considering patient-specific factors. Analyze the treatment options for musculoskeletal disorders, including rheumatoid arthritis, osteoarthritis, and gout, considering patient-specific factors.	C4
CO5	Evaluate the selection and use of pharmacotherapeutic agents for the management of dermatological disorders, taking into account patient response and adverse effects. Evaluate the appropriateness of antifungal and antiviral treatments for various fungal and viral infections, considering patient factors and potential drug interactions. Evaluate the pharmacological management of renal disorders, including acute and chronic renal failure, and assess the role of renal dialysis in these conditions. Critically assess and recognize drug-induced renal disorders, suggesting appropriate interventions.	C5
CO6	Develop a comprehensive understanding of the pharmacological management of HIV and opportunistic infections, including the use of antiretroviral therapy.	C6

-

J.K.K.NATTRAJA COLLEGE OF PHARMACY Komarapalayam 638 183

PRINCIPAL
J.K.K.NATTRAJA COLLEGE OF PHARMACY
KOMARAPALAYAM - 638 183.

Pharmacotherapeutics - II (practical)

Course outcome number	Course Outcomes	Psychomotor Level
CO1	Demonstrate accurate and aseptic drug preparation techniques specific to tuberculosis and meningitis medications, ensuring safe handling and administration.	Imitation (P1)
CO2	Proficiently calculate and administer dosages for antibiotics used in treating respiratory tract infections and gastroenteritis, considering patient weight and condition.	Manipulation (P2)
CO3	Exhibit precise and sterile medication administration skills for patients with endocarditis and septicemia, including intravenous drug administration and monitoring.	Precision (P3)
CO4	Formulate individualized treatment plans for urinary tract infections, protozoal infections (e.g., malaria), and HIV with opportunistic infections, incorporating patient-specific factors and therapeutic considerations.	Articulation (P4)
CO5	Apply critical thinking and evidence-based decision-making in complex cases involving fungal infections, viral infections (e.g., hepatitis), and sexually transmitted diseases (e.g., gonorrhea and syphilis), adapting to evolving patient conditions.	Naturalization (P5)

J.K.K.NATTRAJA COLLEGE OF PHARMACY Komarapalayam 638 183

PRINCIPAL
J.K.K.NATTRAJA COLLEGE OF PHARMACY
KOMARAPALAYAM - 638 183.

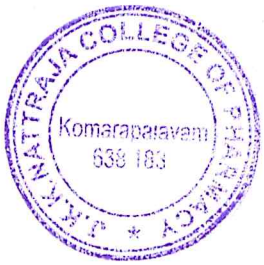
3.4 Pharmaceutical Jurisprudence

CO CODE	COURSE OUTCOME	COGNITIVE LEVEL
CO1	Understand the various concepts of the pharmaceutical legislation in India	C1
CO2	Learn the knowledge on schedules and functioning of various committees in the Drug and Cosmetic Act and rules	C2
CO3	Understand the labelling requirements and packaging guidelines for drugs and cosmetics	C3
CO4	Understand the Drug policy, DPCO, Patent and design act	C4
CO5	Know about narcotic and psychotropic drugs, its productions and drug abuse, its controlling.	C5
CO6	Understand the concepts of Dangerous Drugs Act, Pharmacy Act and Excise duties Act	C6
CO7	Explain other laws as prescribed by the Pharmacy Council of India from time to time including International Laws	C7

PRINCIPAL
J.K.K.NATTRAJA COLLEGE OF PHARMACY
KOMARAPALAYAM - 638 183.

3.5 Medicinal Chemistry

Course outcome number	Course Outcomes	Cognitive level
CO1	**Recall** and describe the fundamental concepts in medicinal chemistry, including quantitative structure-activity relationship (QSAR), prodrugs, combinational chemistry, computer-aided drug design (CADD), and antisense molecules.	C1
CO2	**Demonstrate** an understanding of the mechanisms of action and synthesis of various classes of drugs, such as anti-infective agents, sulphonamides, antimalarials, antibiotics, antineoplastic agents, cardiovascular agents, and others, while also comprehending the importance of chemical nomenclature and brand names.	C2
CO3	**Apply** the principles of medicinal chemistry to evaluate and differentiate between local anti-infective agents, preservatives, antifungal agents, urinary tract anti-infectives, anti-tubercular agents, antiviral agents, antiprotozoal agents, anthelminthics, antiscabies, and antipedicular agents, considering their mechanisms and therapeutic applications.	C3
CO4	**Analyze** and assess the structure-activity relationships (SAR) and mechanisms of action of specific drug classes, such as cardiovascular agents (anti-hypertensive, antianginal, vasodilators, antiarrhythmic, antihyperlipidemic), coagulants, anticoagulants, endocrine agents, hypoglycemic agents, thyroid and antithyroid agents,	C4
CO5	**Evaluate** the therapeutic efficacy, side effects, and market relevance of key drugs within each class studied, critically assessing their clinical use and potential for drug-drug interactions.	C5
CO6	**Apply** knowledge of medicinal chemistry concepts to propose novel drug candidates or modifications to existing drugs, considering emerging trends in drug development and the application of computational tools in drug design, including QSAR and CADD.	C6



PRINCIPAL
J.K.K.NATTRAJA COLLEGE OF PHARMACY
KOMARAPALAYAM - 638 183.

Medicinal chemistry (Practical)

Course outcome number	Course Outcomes	Cognitive level
CO1	**Imitate** and accurately replicate the essential steps and techniques involved in the assays of important drugs. They will demonstrate proficiency in conducting drug assays with precision and adherence to established protocols.	P1
CO2	Develop strong **manipulation** skills, enabling them to prepare medicinally important compounds and intermediates needed for the synthesis of drugs. They will demonstrate the ability to handle chemicals, equipment, and instruments effectively and safely.	P2
CO3	**Precision** in their practical work. They will be capable of conducting monograph analysis of important drugs with a high degree of accuracy and reproducibility. They will also determine partition coefficients, dissociation constants, and molar refractivity of compounds with precision for QSAR (Quantitative Structure-Activity Relationship) analysis.	P3
CO4	**Articulate** their experimental procedures clearly and concisely, both in written reports and verbal explanations. They will effectively communicate their findings, observations, and results related to the assays, preparations, and analyses of important drugs.	P4
CO5	**Naturalization** through repeated practice and hands-on experience, students will reach a level of naturalization in their medicinal chemistry skills. They will become adept at independently designing and executing experiments related to drug assays, compound preparation, and monograph analysis. They will also gain proficiency in the application of QSAR principles.	P5

J.K.K.NATTRAJA COLLEGE OF PHARMACY Komarapalayam 638 183

PRINCIPAL
J.K.K.NATTRAJA COLLEGE OF PHARMACY
KOMARAPALAYAM - 638 183

3.6 Pharmaceutical Formulations

Course outcome number	Course Outcomes	Cognitive level
CO1	Describe the fundamental concepts and classifications of pharmaceutical dosage forms, including tablets, capsules, liquid orals, parenterals, ophthalmic preparations, and controlled/novel drug delivery systems.	C1
CO2	Demonstrate an understanding of the key principles involved in the formulation of different types of tablets, capsules, liquid oral preparations, and ophthalmic preparations. Explain the factors affecting absorption and anatomy of the skin in the context of ointments and jellies.	C2
CO3	Apply knowledge to practical situations by formulating tablets using various granulation techniques, evaluating tablet excipients, and conducting quality control tests for tablets, including coated tablets as well as capsules	C3
CO4	Analyze the stability of suspensions, emulsions, and solutions, identifying factors that affect their stability. Also analyze the containers used for parenteral preparations and understand the principles of sterilization in parenteral formulation.	C4
CO5	Evaluate the quality of different pharmaceutical dosage forms, including tablets, capsules, and liquid orals, based on established quality control tests and standards. Assess the suitability of various ointment bases and jellies and evaluate the method of preparation and packaging for suppositories.	C5
CO6	Apply knowledge to create various dosage form including controlled and novel drug delivery systems.	C6

J.K.K.NATTRAJA COLLEGE OF PHARMACY Komarapalayam 638 183

PRINCIPAL
J.K.K.NATTRAJA COLLEGE OF PHARMACY
KOMARAPALAYAM - 638 183.

Pharmaceutical formulations – practical

Course outcome number	Course Outcomes	Psychomotor Level
CO1	Able to demonstrate the basic techniques involved in the manufacture of various tablet types, including ordinary compressed tablets using wet granulation, tablets prepared by direct compression, soluble tablets, and chewable tablets, by imitating the step-by-step procedures.	P1
CO2	Develop the skill of formulating and filling hard gelatin capsules, showcasing their ability to manipulate the pharmaceutical ingredients and equipment required for this process with precision.	P2
CO3	Master the precise techniques involved in the manufacture of parenterals, including the preparation of ascorbic acid injection, calcium gluconate injection, sodium chloride infusion, and dextrose and sodium chloride injection/infusion, ensuring the accurate measurement and handling of ingredients and equipment..	P2
CO4	Able to articulate their knowledge and skills by conducting quality control tests (QC tests) for pharmaceutical formulations, including tablets, capsules, and injections, demonstrating their ability to communicate and explain the evaluation processes effectively.	P3
CO5	Apply their knowledge and skills to formulate two different liquid oral preparations (Paracetamol Syrup and Antacid Suspensions - Aluminum hydroxide gel) and evaluate them by assay, fostering a natural and seamless integration of their practical pharmaceutical knowledge.	P4
CO6	Demonstrate precision in formulating semisolid preparations, including Salicylic acid and benzoic acid ointment and Diclofenac gel, and evaluate them by assay, ensuring accurate measurements and adherence to formulation procedures.	P5

J.K.K.NATTRAJA COLLEGE OF PHARMACY Komarapalayam 638 183

PRINCIPAL
J.K.K.NATTRAJA COLLEGE OF PHARMACY
KOMARAPALAYAM - 638 183.

Course of study for IV Year

Course code **Name of the subject and course outcome**

4.1 Pharmacotherapeutics-III

Course outcome number	Course Outcomes	Cognitive level
CO1	**Recall** and list the key pharmacological mechanisms of action for commonly prescribed drugs in various therapeutic classes.Recall essential drug interactions, adverse effects, and contraindications associated with specific medications.	C1
CO2	**Describe** the fundamental pharmacokinetic and pharmacodynamic principles underlying drug therapy.Explain the rationale behind the selection of specific drug regimens in the treatment of common diseases.	C2
CO3	**Apply** pharmacotherapeutic principles to develop patient-specific drug therapy plans for various medical conditions.Apply evidence-based guidelines to make appropriate drug therapy recommendations.	C3
CO4	**Analyze** patient case scenarios to identify potential drug-related problems and propose solutions.Analyze the scientific literature to critically evaluate the efficacy and safety of new drug therapies.	C4
CO5	**Evaluate** the cost-effectiveness of different drug treatment options. Evaluate the therapeutic outcomes of patients on complex medication regimens, making appropriate adjustments as needed.	C5
CO6	**Develop** comprehensive medication management plans for patients with multiple comorbidities.Develop strategies for optimizing medication adherence and patient education in diverse healthcare settings.	C6

J.K.K.NATTRAJA COLLEGE OF PHARMACY Komarapalayam 638 183

PRINCIPAL
J.K.K.NATTRAJA COLLEGE OF PHARMACY
KOMARAPALAYAM - 638 183.

Pharmacotherapeutics-III practical

Course outcome number	Course Outcomes	Psychomotor Activity
CO1	**Follow** proper protocols for patient assessment, including history-taking, physical examination, and reviewing relevant laboratory data to identify the patient's medical condition accurately.	**P1**
CO2	**Carry out** drug dosage calculations with precision, ensuring accurate medication preparation and administration, considering factors such as patient weight, age, and disease state.	**P2**
CO3	**Complete** comprehensive medication reconciliations for patients with complex medication regimens, minimizing the risk of drug interactions and adverse effects.	**P3**
CO4	**Apply** critical thinking and clinical reasoning skills to formulate evidence-based pharmacotherapeutic recommendations, considering patient-specific factors and current guidelines.	**P4**
CO5	**Determine** the most suitable pharmacotherapeutic options for patients with multiple comorbidities, incorporating a holistic approach to patient care, including non-pharmacological interventions and patient education.	**P5**

PRINCIPAL
J.K.K.NATTRAJA COLLEGE OF PHARMACY
KOMARAPALAYAM - 638 183.

4.2 Hospital Pharmacy

Course outcome number	Course Outcomes	Cognitive level
CO1	**Recall** the key principles and regulations governing the practice of pharmacy in a hospital setting in India..	C1
CO2	**Describe** the role of a hospital pharmacist in patient care, including medication dispensing, drug information services, and quality assurance.	C2
CO3	**Apply** pharmacokinetic and pharmacodynamic principles to optimize drug therapy in patients with various medical conditions.	C3
CO4	**Analyze** medication-related problems in a hospital setting, such as drug interactions, adverse drug reactions, and medication errors, and propose suitable interventions..	C4
CO5	**Evaluate** the performance and quality of pharmaceutical services in a hospital pharmacy, including assessing the medication-use process and implementing improvements.	C5
CO6	**Develop** evidence-based pharmaceutical care plans for complex patient cases, considering therapeutic alternatives and patient-specific factors.	C6

J.K.K.NATTRAJA COLLEGE OF PHARMACY Komarapalayam 638 183

PRINCIPAL
J.K.K.NATTRAJA COLLEGE OF PHARMACY
KOMARAPALAYAM - 638 183.

4.3 Clinical Pharmacy

Course outcome number	Course Outcomes	Cognitive level
CO1	**Recall** the fundamental principles of clinical pharmacy theory, including the processes involved in monitoring drug therapy, obtaining medication history, and interpreting laboratory results.	C1
CO2	**Describe** the importance of obtaining comprehensive medication histories and providing patient counselling for effective pharmacotherapy.	C2
CO3	**Apply** knowledge and skills to identify and resolve drug-related problems, ensuring safe and effective medication use.	C3
CO4	**Analyze** selected laboratory results within the context of specific disease states to make informed decisions regarding medication regimens.	C4
CO5	**Evaluate** the reliability and relevance of drug information sources to ensure evidence-based practice in clinical pharmacy.	C5
CO6	**Develop** comprehensive and individualised medication plans based on the integration of medication chart reviews, medication history interviews, and interpretation of laboratory results.	C6

J.K.K. NATTRAJA COLLEGE OF PHARMACY Komarapalayam 638 183

PRINCIPAL
J.K.K.NATTRAJA COLLEGE OF PHARMACY
KOMARAPALAYAM - 638 183.

4.4 Biostatistics & Research Methodology

Course outcome number	Course Outcomes	Cognitive level
CO1	**Recall** key statistical concepts and terminology used in biostatistics and research methodology, such as measures of central tendency, measures of dispersion, and types of data.	C1
CO2	**Describe** the fundamental principles of research design, including the differences between observational and experimental studies, and the importance of randomization and blinding.	C2
CO3	**Apply** statistical techniques to analyze and interpret pharmaceutical data, such as conducting hypothesis tests, calculating confidence intervals, and performing regression analysis.	C3
CO4	**Analyze** and critically evaluate research articles and clinical studies, identifying strengths and weaknesses in study design, statistical methods, and data interpretation.	C4
CO5	**Evaluate** ethical considerations in pharmaceutical research, including issues related to human subjects' protection, informed consent, and conflicts of interest.	C5
CO6	**Develop** a research proposal that includes a clear research question, study design, data collection methods, and a statistical analysis plan, demonstrating creativity and originality in research design.	C6

J.K.K.NATTRAJA COLLEGE OF PHARMACY Komarapalayam 638 183

PRINCIPAL
J.K.K.NATTRAJA COLLEGE OF PHARMACY
KOMARAPALAYAM - 638 183.

4.5 Biopharmaceutics & Pharmacokinetics

Course outcome number	Course Outcomes	Cognitive level
CO1	**Remembering**: Recall and describe the processes of drug absorption, distribution, and elimination. This involves remembering key details and steps involved in these pharmacokinetic processes.	C1
CO2	**Understanding**: Explain the processes of drug absorption, distribution, and elimination. This involves grasping the underlying principles and concepts that govern these processes.	C2
CO3	**Applying**: Calculate various pharmacokinetic parameters from plasma and urinary excretion data by applying a one-compartment model. This involves using knowledge and mathematical skills to apply a specific pharmacokinetic model to real-world data.	C3
CO4	**Analyzing**: Determine various pharmacokinetic parameters from either plasma concentration or urinary excretion data for a drug by applying a multi-compartment model. This requires breaking down complex data and applying mathematical and analytical skills to derive pharmacokinetic parameters in a more complex setting.	C4
CO5	**Evaluating**: Use plasma drug concentration-time data to calculate the pharmacokinetic parameters of a drug product by nonlinear pharmacokinetics. This level involves critical assessment and decision-making based on complex pharmacokinetic data, particularly when nonlinear processes are involved.	C5
CO6	**Creating**: Design bioavailability and bioequivalence studies of drugs or dosage forms. This involves synthesizing information and creating study protocols that adhere to regulatory standards and scientific principles, considering factors such as study design, data analysis, and interpretation.	C6

J.K.K.NATTRAJA COLLEGE OF PHARMACY Komarapalayam 638 183

PRINCIPAL
J.K.K.NATTRAJA COLLEGE OF PHARMACY
KOMARAPALAYAM - 638 183.

BIOPHARMACEUTICS AND PHARMACOKINETICS (Practical)

Course outcome number	Course Outcomes	Psychomotor level
CO1	**Remembering**: Recall the methods used to determine the dissolution characteristics and compare different marketed products of slightly soluble drugs. This involves remembering specific techniques and approaches used in dissolution studies.	P1
CO2	**Understanding**: Explain the principles behind protein binding studies for highly protein-bound and poorly protein-bound drugs. Understand the concept of plasma-protein binding and its relevance in pharmacokinetics.	P2
CO3	**Applying**: Apply the methods and techniques for conducting plasma-protein binding studies on the same drug (highly and poorly protein-bound) at different concentrations while maintaining a constant time point. This involves hands-on application of experimental procedures.	P3
CO4	**Analyzing**: Analyze the results of bioavailability studies conducted on animal or human models. This includes data interpretation, statistical analysis, and drawing conclusions based on the study outcomes.	P4
CO5	**Evaluating**: Evaluate the significance of different pharmacokinetic parameters calculated from plasma and urinary excretion data. Determine how these parameters relate to drug behavior and its effects in the body. Assess the impact of variations in these parameters on drug therapy.	P5
CO6	**Creating**: Design and plan bioavailability studies for commonly used drugs in animal or human models. This involves creating study protocols, selecting appropriate analytical methods, and defining the parameters to be measured in order to assess drug bioavailability.	P6

J.K.K.NATTRAJA COLLEGE OF PHARMACY Komarapalayam 638 183

PRINCIPAL
J.K.K.NATTRAJA COLLEGE OF PHARMACY
KOMARAPALAYAM - 638 183.

4.6 Clinical Toxicology

Course outcome number	Course Outcomes	Cognitive level
CO1	Remembering the general principles involved in the management of poisoning, including key concepts in toxicology and poison classification.	C1
CO2	Understanding the clinical applications of antidotes and how they function to counteract specific poisonings.	C2
CO3	Applying knowledge of supportive care principles to assess and manage patients exposed to toxic substances in clinical settings.	C3
CO4	Analysing the methods and factors involved in gut decontamination and elimination enhancement, considering their appropriateness in various poisoning scenarios.	C4
CO5	Evaluate toxicokinetic and its role in determining the absorption, distribution, metabolism, and excretion of toxic substances in the human body.	C5
CO6	Creating information on the clinical symptoms and management of acute and chronic poisoning with various agents, including pesticides, opioids, heavy metals, venomous snake bites, plants, mushrooms, mycotoxins, food poisonings, and arthropod bites and stings, to develop comprehensive toxicological management strategies.	C6

J.K.K.NATTRAJA COLLEGE OF PHARMACY Komarapalayam 638 183

PRINCIPAL
J.K.K.NATTRAJA COLLEGE OF PHARMACY
KOMARAPALAYAM - 638 183.

Course of study for V Year

Course code **Name of the subject and course outcome**

5.1 Clinical Research

Course outcome number	Course Outcomes	Cognitive level
CO1	**Recall** the Various Approaches to Drug Discovery involves recalling and recognizing the diverse methods and strategies used in the pharmaceutical industry to identify and develop new drugs, including pharmacological, toxicological, regulatory, and ethical aspects, to create a foundation for effective drug development processes.	C1
CO2	**Describe** the Phases of Clinical Trials encompasses explaining the sequential stages involved in clinical research, from initial human testing to large-scale trials, highlighting their objectives, methodologies, and the increasing rigor and scrutiny at each phase to ensure safety and efficacy of new drugs before market approval.	C2
CO3	**Apply** Good Clinical Practice (GCP) Guidelines and Regulatory Requirements involves the practical application of internationally recognized ethical and scientific quality standards in clinical research to ensure the integrity, credibility, and safety of clinical trials, adhering to regulatory obligations and ethical considerations.	C3
CO4	**Analyze** Challenges in Implementing Clinical Trial Guidelines entails a critical examination of the obstacles and complexities faced by researchers, sponsors, and regulatory authorities in the practical implementation of stringent clinical trial guidelines, addressing issues related to ethics, logistics, patient recruitment, and data quality to enhance the efficiency and reliability of drug development processes.	C4
CO5	**Evaluate** Ethical Guidelines in Clinical Research involves a thorough assessment and judgment of the moral and ethical principles that govern human research, considering issues like informed consent, patient rights, confidentiality, and the overall ethical conduct of clinical trials to ensure the highest standards of participant well-being and scientific integrity.	C5
CO6	**Develop** Clinical Study Documents and Understand Informed Consent Process encompasses the creation of essential documentation such as research protocols, case report forms, and informed consent documents, while also comprehending the critical process of obtaining informed consent from study participants, ensuring clarity, transparency, and ethical conduct in clinical research.	C6

J.K.K.NATTRAJA COLLEGE OF PHARMACY Komarapalayam 638 183.

PRINCIPAL
J.K.K.NATTRAJA COLLEGE OF PHARMACY
KOMARAPALAYAM - 638 183.

5.2 Pharmacoepidemiology and Pharmacoeconomics

Course outcome number	Course Outcomes	Cognitive level
CO1	Students will be able to Recall the definition and scope of pharmacoepidemiology, List the aims and applications of pharmacoepidemiology,Identify different outcome measures and drug use measures used in pharmacoepidemiology.	C1
CO2	Students will Explain the concept of risk in pharmacoepidemiology. Describe the methods used in pharmacoepidemiological studies, including their theoretical aspects. Differentiate between prevalence, incidence, and incidence rate.	C2
CO3	Students will Apply the measurement techniques for medication adherence. Use various pharmacoepidemiological methods to analyze real-life case studies. Apply the concept of relative risk, attributable risk, and odds ratio to evaluate pharmacoepidemiological data.	C3
CO4	Analyze different sources of data for pharmacoepidemiological studies, including ad hoc data sources and automated data systems. Critically evaluate the strengths and weaknesses of various pharmacoepidemiological methods. Analyze the relevance of pharmacoepidemiology in the context of special applications, such as vaccine safety and hospital pharmacoepidemiology.	C4
CO5	Evaluate the role of pharmacoeconomic evaluations in formulary management decisions. Critically assess the outcomes of different pharmacoeconomic evaluation methods, including cost-minimization, cost-benefit, cost-effectiveness, and cost-utility. Evaluate the significance and implications of pharmacoepidemiology and risk management, especially in relation to drug-induced birth defects.	C5
CO6	Develop a comprehensive understanding of pharmacoeconomics and its historical evolution. Create a pharmacoeconomic evaluation for a specific drug or intervention, considering various outcome assessments. Synthesize the knowledge gained from the course to effectively utilize pharmacoeconomic software and analyze case studies in the context of healthcare decision-making.	C6

J.K.K.NATTRAJA COLLEGE OF PHARMACY Komarapalayam 638 183.

PRINCIPAL
J.K.K.NATTRAJA COLLEGE OF PHARMACY
KOMARAPALAYAM - 638 183.

5.3 Clinical Pharmacokinetics & Pharmacotherapeutic Drug Monitoring

Course outcome number	Course Outcomes	Cognitive level
CO1	Students will be able to accurately describe and explain the foundational concepts of clinical pharmacokinetics, including the impact of various factors like age, weight, and disease on drug metabolism and the significance of pharmacokinetic drug interactions.	C1
CO2	Students will demonstrate the ability to apply pharmacokinetic principles to design optimal dosage regimens for diverse patient populations, considering various factors like renal and hepatic functions, and integrate knowledge to adapt dosages for patients with specific needs, such as the elderly, pediatrics, and obese patients.	C2
CO3	Students will develop the capability to critically analyze and evaluate the therapeutic drug monitoring (TDM) protocols and pharmacokinetic/pharmacodynamic correlations in drug therapy for managing diverse disease conditions like cardiovascular disease, seizure disorders, psychiatric conditions, and organ transplantations.	C3
CO4	By synthesizing knowledge from different modules, students will be adept at creating individualized, adaptive, and effective drug dosage regimens based on Bayesian theory and population pharmacokinetic data, adjusting for variability due to genetic, age, weight, and interacting drugs.	C4
CO5	Students will acquire proficiency in practically applying the learned principles to adjust dosages in cases of renal and hepatic diseases, taking into account extracorporeal removal of drugs and alterations in pharmacokinetics due to hepatic diseases.	C5
CO6	Learners will be able to comprehend the implications of genetic polymorphism in drug metabolism, transport, and targets, and will integrate pharmacogenetic considerations into pharmacokinetic and pharmacodynamic assessments to optimize therapeutic outcomes.	C6

J.K.K.NATTRAJA COLLEGE OF PHARMACY Komarapalayam 638 183

PRINCIPAL
J.K.K.NATTRAJA COLLEGE OF PHARMACY
KOMARAPALAYAM - 638 183.