

**GURU NANAK INSTITUTE OF PHARMACEUTICAL SCIENCE AND
TECHNOLOGY**
BACHELOR OF PHARMACY (B .PHARM)
ACADEMIC YEAR- 2024- 2025

COURSE OUTCOME (CO) STATEMENTS
SEMESTER I

Subject	CO label	CO Statement	BTL
R21_PT105T	CO_R21_PT105.1	Analyze the gross morphology and functional relationships among organs of the human body systems.	4
	CO_R21_PT105.2	Differentiate the homeostatic mechanisms regulating body systems and their associated imbalances.	4
	CO_R21_PT105.3	Correlate the microscopic structure of tissues, organs and bones with their physiological functions.	4
	CO_R21_PT105.4	Apply hematological techniques such as blood grouping, cell counting and pressure measurement to interpret clinical parameters.	3
	CO_R21_PT105.5	Evaluate the coordinated functioning of body systems in maintaining physiological homeostasis.	5
R21_PT101T	CO_R21_PT101.1	Apply standardization procedures to prepare accurate molar and normal solutions for analysis.	3
	CO_R21_PT101.2	Analyze the principles underlying acid-base, non-aqueous, precipitation and complexometric titrations.	4
	CO_R21_PT101.3	Differentiate the sources and types of analytical errors affecting accuracy and precision of results.	4
	CO_R21_PT101.4	Calculate the concentration of analytes from volumetric and electrochemical titration data.	3
	CO_R21_PT101.5	Evaluate the suitability of conductometric, potentiometric and polarographic methods for quantitative drug analysis.	5
R21_PT106T	CO_R21_PT106.1	Apply posology principles governing pediatric dose calculation based on age, weight and body surface area.	3
	CO_R21_PT106.2	Differentiate flocculated and deflocculated suspension systems based on their stability characteristics.	4
	CO_R21_PT106.3	Formulate monophasic and biphasic liquid dosage forms, suppositories and semisolid preparations following standard procedures.	6
	CO_R21_PT106.4	Evaluate the physical, chemical and therapeutic incompatibilities encountered during formulation of dosage forms.	5
R21_PT103T	CO_R21_PT103.1	Analyze the sources and types of impurities in pharmaceutical substances using limit test principles.	4
	CO_R21_PT103.2	Apply buffer equations governing the pH and isotonicity of pharmaceutical formulations.	3
	CO_R21_PT103.3	Differentiate gastrointestinal agents such as antacids, cathartics and antimicrobials based on their mechanism of action.	4

Subject	CO label	CO Statement	BTL
	CO_R21_PT103.4	Compare the therapeutic uses of expectorants, emetics, haematinics, astringents and antidotes.	4
R21_PT184T	CO_R21_PTB184.1	Correlate the composition of blood and lymph with their functions in the circulatory and immune systems.	4
	CO_R21_PTB184.2	Apply physiological principles underlying the digestion, respiration and excretion of nutrients and waste in the human body.	3
	CO_R21_PTB184.3	Analyze the neural and chemical mechanisms involved in coordination and regulation of body functions.	4
	CO_R21_PTB184.4	Evaluate the physiological processes of plant nutrition, photosynthesis and respiration in relation to growth and development.	5
R21_PTM183T	CO_R21_PTM183.1	Apply partial fraction and logarithm techniques to simplify pharmaceutical rate equations.	3
	CO_R21_PTM183.2	Analyze matrices and determinants involved in systems of linear pharmacokinetic equations.	4
	CO_R21_PTM183.3	Formulate differential equations representing pharmacokinetic and chemical kinetics processes.	5
R21_PT195P	CO_R21_PT195P.1	Classify the axial and appendicular bones of the human skeletal system based on their location and features.	4
	CO_R21_PT195P.2	Determine blood parameters such as WBC count, RBC count, hemoglobin content, and blood group using standard hematological techniques.	3
	CO_R21_PT195P.3	Measure bleeding time, clotting time, and erythrocyte sedimentation rate using standard laboratory procedures.	3
	CO_R21_PT195P.4	Record heart rate, pulse rate, and blood pressure in human subjects using standard clinical techniques.	3
R21_PT191P	CO_R21_PT191P.1	Perform limit tests for chloride, sulphate, iron, and arsenic in pharmaceutical substances.	3
	CO_R21_PT191P.2	Standardize volumetric solutions such as sodium hydroxide, sulphuric acid, and potassium permanganate using primary standards.	3
	CO_R21_PT191P.3	Assay pharmaceutical compounds using acid-base, redox, complexometric, and precipitation titration methods.	4
R21_PT196P	CO_R21_PT196P.1	Prepare monophasic and biphasic liquid dosage forms following standard formulae.	3
	CO_R21_PT196P.2	Compound powders, granules, and effervescent formulations using geometric dilution and blending techniques.	6
	CO_R21_PT196P.3	Manufacture semisolid dosage forms such as ointments, creams, and gels using appropriate excipients.	3
R21_PT193P	CO_R21_PT193P.1	Perform limit tests for chlorides, sulphates, iron, lead, arsenic, and heavy metals in pharmaceutical substances.	3
	CO_R21_PT193P.2	Confirm the identity of inorganic pharmaceutical compounds such as magnesium hydroxide, ferrous sulphate, and calcium gluconate using qualitative tests.	3
	CO_R21_PT193P.3	Prepare inorganic pharmaceuticals such as boric acid, potash alum, and ferrous sulphate using standard synthetic methods.	3

Subject	CO label	CO Statement	BTL
R21_PTB185P	CO_R21_PTB185P.1	Prepare permanent microscopic slides of plant and animal tissues using section cutting, mounting, and staining techniques.	3
	CO_R21_PTB185P.2	Examine the cellular structure and organelles of plant and animal cells using microscopic techniques.	4
	CO_R21_PTB185P.3	Classify the morphological parts of flowering plants such as stem, root, leaf, seed, fruit, and flower.	4
	CO_R21_PTB185P.4	Distinguish bones of the human skeletal system using specimens and models.	4
	CO_R21_PTB185P.5	Determine blood group, blood pressure, and tidal volume using standard physiological methods.	3

SEMESTER II

Subject	CO label	CO Statement	BTL
R21_PT215T	CO_R21_PT215.1	Analyze the organization of the nervous system and the mechanism of nerve impulse conduction.	4
	CO_R21_PT215.2	Correlate the anatomy and physiology of the digestive, respiratory and urinary systems with their functional regulation.	4
	CO_R21_PT215.3	Apply the principles of hormone action to endocrine regulation of body functions.	3
	CO_R21_PT215.4	Evaluate the physiological changes occurring during fertilization, pregnancy and parturition.	5
	CO_R21_PT215.5	Justify how interconnected feedback mechanisms maintain physiological homeostasis in the human body.	5
R21_PT213T	CO_R21_PT213.1	Analyze the structural isomerism and reaction mechanisms of alkanes, alkenes, and conjugated dienes.	4
	CO_R21_PT213.2	Differentiate the reactivity of alkyl halides and carbonyl compounds on the basis of nucleophilic substitution and addition mechanisms.	4
	CO_R21_PT213.3	Justify the relative acidity and basicity of carboxylic acids and aliphatic amines using electronic effects.	5
R21_PT214T	CO_R21_PT214.1	Analyze the metabolic pathways and regulatory mechanisms of carbohydrates in physiological and pathological states.	4
	CO_R21_PT214.2	Correlate disorders of lipid, amino acid, and nucleic acid metabolism with their underlying biochemical basis.	4
	CO_R21_PT214.3	Evaluate the catalytic, regulatory, and diagnostic significance of enzymes and coenzymes.	5
R21_PT216T	CO_R21_PT216.1	Analyze the cellular mechanisms of injury, adaptation, and inflammation underlying disease processes.	4
	CO_R21_PT216.2	Correlate the pathophysiological basis of cardiovascular, respiratory, renal, endocrine, and nervous system disorders with their clinical manifestations.	4
	CO_R21_PT216.3	Evaluate the etiology, pathogenesis, and complications of infectious, hepatic, and neoplastic diseases.	5
R21_PTHU282 T	CO_R21_PTHU282.1	Analyze the utilization and conservation strategies of renewable and non-renewable natural resources.	4

Subject	CO label	CO Statement	BTL
	CO_R21_PTHU282.2	Compare the structure and function of different types of ecosystems.	4
	CO_R21_PTHU282.3	Evaluate the causes and impact of air, water, and soil pollution on the environment.	5
	CO_R21_PTHU282.4	Justify the role of individual and community participation in environmental protection and sustainability.	5
R21_PT298P	CO_R21_PT298P.1	Demonstrate physiological examination techniques for the nervous, sensory, and endocrine systems.	3
	CO_R21_PT298P.2	Determine physiological parameters such as vital capacity, body mass index, and blood cell counts using standard instruments.	3
	CO_R21_PT298P.3	Interpret the results of physiological experiments to correlate the structure and function of body systems.	4
R21_PT296P	CO_R21_PT296P.1	Detect elements such as nitrogen, sulphur, and halogens in organic compounds using Lassaigne's test.	3
	CO_R21_PT296P.2	Classify unknown organic compounds based on solubility behavior and functional group tests.	4
	CO_R21_PT296P.3	Determine the melting and boiling points of organic compounds for identification purposes.	3
	CO_R21_PT296P.4	Confirm the identity of unknown organic compounds by preparing derivatives and comparing melting or boiling points with literature values.	4
	CO_R21_PT296P.5	Construct molecular models to depict the three-dimensional structure of organic compounds.	3
R21_PT297P	CO_R21_PT297P.1	Distinguish carbohydrates and proteins in biological samples using qualitative chemical tests.	4
	CO_R21_PT297P.2	Quantify reducing sugars and proteins in biological samples using the DNSA and Biuret methods.	3
	CO_R21_PT297P.3	Determine blood creatinine, blood sugar, and serum cholesterol levels using standard biochemical assays.	3
	CO_R21_PT297P.4	Prepare buffer solutions of specified pH for use in enzymatic reactions.	3
	CO_R21_PT297P.5	Analyze the effect of temperature and substrate concentration on salivary amylase activity.	4

SEMESTER III

Subject	CO label	CO Statement	BTL
R21_PT314T	CO_R21_PT317T.1	Analyze the principles of fluid flow, size reduction, and size separation for selection of suitable pharmaceutical machinery.	4
	CO_R21_PT317T.2	Compare heat transfer, evaporation, and distillation methods employed in pharmaceutical processing operations.	4
	CO_R21_PT317T.3	Justify the selection of drying, mixing, filtration, and centrifugation equipment based on process requirements.	5
	CO_R21_PT317T.4	Evaluate materials of plant construction and corrosion prevention strategies for pharmaceutical equipment design.	5

Subject	CO label	CO Statement	BTL
R21_PT394P	CO_R21_PT394P.1	Purify organic compounds through recrystallization and steam distillation techniques.	3
	CO_R21_PT394P.2	Standardize reagents to determine the acid, saponification, and iodine values of oils.	3
	CO_R21_PT394P.3	Synthesize aromatic compounds through acylation, halogenation, and nitration reactions.	3
	CO_R21_PT394P.4	Prepare carboxylic acid derivatives via oxidation and hydrolysis reactions.	3
	CO_R21_PT394P.5	Construct azo dyes and condensation products using diazotization, coupling, Claisen–Schmidt, and Perkin reactions.	3
R21_PT316T	CO_R21_PT316T.1	Explain the mechanisms and factors governing the solubility of drugs in various solvent systems.	2
	CO_R21_PT316T.2	Classify the states and physicochemical properties of matter relevant to pharmaceutical systems.	2
	CO_R21_PT316T.3	Analyze surface and interfacial phenomena to characterize the behavior of surface-active agents.	4
	CO_R21_PT316T.4	Evaluate the stability constants of pharmaceutical complexes and their significance in drug action.	5
	CO_R21_PT316T.5	Formulate buffered isotonic solutions by applying buffer equation and buffer capacity principles.	3
R21_PT396P	CO_R21_PT396P.1	Determine the solubility and pKa values of drugs using standard experimental methods.	3
	CO_R21_PT396P.2	Measure the partition coefficients of compounds between immiscible solvent systems.	3
	CO_R21_PT396P.3	Measure the surface tension and HLB number of surfactants using standard techniques.	3
	CO_R21_PT396P.4	Calculate the Freundlich and Langmuir adsorption constants from experimental adsorption data.	4
	CO_R21_PT396P.5	Evaluate the stability constants and donor–acceptor ratios of drug complexes by solubility and pH titration methods.	5
R21_PT319T	CO_R21_PT319T.1	Describe the methods used for cultivation, isolation, and preservation of microorganisms.	2
	CO_R21_PT319T.2	Identify bacteria using staining techniques and biochemical tests.	3
	CO_R21_PT319T.3	Compare various sterilization methods to determine their suitability for pharmaceutical processing.	4
	CO_R21_PT319T.4	Apply microbiological assay methods for the standardization of antibiotics and vitamins.	3
	CO_R21_PT319T.5	Evaluate the microbial stability of pharmaceutical formulations and the applications of cell culture technology.	5
R21_PT399P	CO_R21_PT399P.1	Operate laboratory equipment used for sterilization and aseptic processing.	3
	CO_R21_PT399P.2	Perform staining techniques to identify bacterial morphology.	3
	CO_R21_PT399P.3	Isolate pure bacterial cultures using streak plate and subculturing techniques.	3
	CO_R21_PT399P.4	Assay antibiotic potency using the cup plate method.	3

Subject	CO label	CO Statement	BTL
	CO_R21_PT399P.5	Examine pharmaceutical products and water samples for sterility and microbial contamination.	4
R21_PT317T	CO_R21_PT317T.1	Explain the principles of fluid flow measurement and particle size reduction/separation used in pharmaceutical processing.	2
	CO_R21_PT317T.2	Compare heat transfer and evaporation equipment used in pharmaceutical manufacturing.	4
	CO_R21_PT317T.3	Distinguish drying and mixing techniques applicable to pharmaceutical formulations.	4
	CO_R21_PT317T.4	Select suitable filtration and centrifugation methods for pharmaceutical separation processes.	5
	CO_R21_PT317T.5	Recommend appropriate construction materials and corrosion-control measures for pharmaceutical plants.	5
R21_PT397P	CO_R21_PT397P.1	Determine radiation and heat transfer coefficients through experimental verification of heat transfer laws.	3
	CO_R21_PT397P.2	Calculate drying, moisture content, and humidity parameters using standard experimental techniques.	3
	CO_R21_PT397P.3	Analyze the effect of size reduction and size separation parameters on particle characteristics of pharmaceutical materials.	4
	CO_R21_PT397P.4	Evaluate the factors affecting filtration, crystallization, and mixing uniformity in pharmaceutical unit operations.	5
R21_PTC381T	CO_R21_PT381T.1	Apply number system conversions and database concepts in the design of pharmaceutical information systems.	3
	CO_R21_PT381T.2	Analyze the applications of computers, bioinformatics tools, and databases in drug information management and clinical pharmacy practice.	4
	CO_R21_PT381T.3	Evaluate computerized data analysis systems such as CDS, LIMS, and TIMS for use in pharmaceutical preclinical development.	5
R21_PTC382P	CO_R21_PT382P.1	Design web pages and questionnaires using computer applications for pharmaceutical information dissemination.	6
	CO_R21_PT382P.2	Construct databases in MS Access for storage, retrieval, and management of patient and drug information.	6
	CO_R21_PT382P.3	Generate reports and queries from pharmaceutical databases for effective data management and record keeping.	3

SEMESTER IV

Subject	CO label	CO Statement	BTL
R21_PT414T	CO_R21_PT414T.1	Differentiate optical isomers of organic compounds on the basis of configuration and elements of symmetry.	4
	CO_R21_PT414T.2	Analyze geometrical and conformational isomerism in organic molecules and their stereochemical consequences.	4
	CO_R21_PT414T.3	Justify the relative aromaticity, reactivity, and medicinal significance of five- and six-membered heterocyclic compounds.	5

Subject	CO label	CO Statement	BTL
	CO_R21_PT414T.4	Apply named reactions and reduction techniques for the synthesis of organic compounds.	3
R21_PT416T	CO_R21_PT416T.1	Explain the classification and general properties of colloidal dispersions.	2
	CO_R21_PT416T.2	Analyze the flow behavior of Newtonian and non-Newtonian systems using rheological principles.	4
	CO_R21_PT416T.3	Formulate stable suspensions and emulsions based on interfacial and rheological properties.	3
	CO_R21_PT416T.4	Determine the particle size and derived properties of powders using micromeritic techniques.	3
	CO_R21_PT416T.5	Evaluate the stability of pharmaceutical products using reaction kinetics and accelerated stability testing.	5
R21_PT496P	CO_R21_PT496P.1	Determine the particle size and size distribution of powders by sieving and microscopy.	3
	CO_R21_PT496P.2	Measure the density, porosity, and flow properties of powders.	3
	CO_R21_PT496P.3	Measure the viscosity of liquids and semisolids using capillary and rotational viscometers.	3
	CO_R21_PT496P.4	Analyze the effect of suspending agents and their concentration on sedimentation volume.	4
	CO_R21_PT496P.5	Evaluate the stability of pharmaceutical formulations using reaction kinetics and accelerated testing.	5
R21_PT418T	CO_R21_PT418T.1	Explain the principles of pharmacokinetics and pharmacodynamics governing drug action.	2
	CO_R21_PT418T.2	Analyze the mechanisms of receptor-mediated drug action and the factors influencing drug response.	4
	CO_R21_PT418T.3	Classify drugs acting on the peripheral nervous system according to their mechanism of action.	3
	CO_R21_PT418T.4	Correlate the pharmacological actions of CNS-acting drugs with their therapeutic applications.	4
	CO_R21_PT418T.5	Evaluate the clinical significance of adverse drug reactions, drug interactions, and pharmacovigilance.	5
R21_PT498P	CO_R21_PT498P.1	Demonstrate standard laboratory techniques and animal handling procedures as per CPCSEA guidelines.	3
	CO_R21_PT498P.2	Determine the effect of drugs on locomotor activity, muscle coordination, and ciliary motility using appropriate experimental models.	3
	CO_R21_PT498P.3	Evaluate the anticonvulsant, anxiolytic, and antipsychotic activity of drugs using standard screening methods.	5
	CO_R21_PT498P.4	Interpret experimental pharmacological data to assess the local anesthetic and CNS-modulating activity of drugs.	4
R21_PT412T	CO_R21_PT412T.1	Classify crude drugs on the basis of alphabetical, morphological, taxonomical, and chemical systems.	3
	CO_R21_PT412T.2	Evaluate the quality of crude drugs using organoleptic, microscopic, and chemical methods.	5

Subject	CO label	CO Statement	BTL
	CO_R21_PT412T.3	Describe the cultivation, collection, and conservation practices for medicinal plants.	2
	CO_R21_PT412T.4	Explain the applications of plant tissue culture technology in pharmacognosy.	2
	CO_R21_PT412T.5	Identify the chemical nature, sources, and therapeutic uses of primary and secondary plant metabolites.	3
R21_PT492P	CO_R21_PT492P.1	Analyze crude drugs by chemical and microscopical evaluation techniques for their identification.	4
	CO_R21_PT492P.2	Determine quantitative microscopic parameters such as stomatal index, vein islet number, and palisade ratio for crude drug evaluation.	3
	CO_R21_PT492P.3	Assess the quality of crude drugs based on ash value, extractive value, moisture content, and swelling index.	5
R21_PT413T	CO_R21_PT413T.1	Correlate the physicochemical properties and metabolic pathways of drugs with their biological activity.	4
	CO_R21_PT413T.2	Analyze the structure-activity relationship of adrenergic and cholinergic agents with respect to their mechanism of action.	4
	CO_R21_PT413T.3	Evaluate the structure-activity relationship and therapeutic significance of sedative-hypnotic, antipsychotic, and anticonvulsant drugs.	5
	CO_R21_PT413T.4	Justify the classification of general anesthetics, narcotic analgesics, and anti-inflammatory agents based on their structure-activity relationship.	5
R21_PT493P	CO_R21_PT493P.1	Synthesize medicinally important heterocyclic compounds and intermediates using standard laboratory procedures.	3
	CO_R21_PT493P.2	Determine the purity of official drugs by titrimetric assay methods.	3
	CO_R21_PT493P.3	Calculate the partition coefficient of drugs between two immiscible solvents.	3
	CO_R21_PT493P.4	Validate the quality of prepared drug substances against pharmacopoeial standards.	5
R21_PTHU481T	CO_R21_PTHU481T.1	Analyze the communication process and barriers affecting effective interpersonal communication.	4
	CO_R21_PTHU481T.2	Apply appropriate communication styles and elements for effective verbal and non-verbal interaction.	3
	CO_R21_PTHU481T.3	Compose effective written communications and professional presentations for workplace situations.	6
	CO_R21_PTHU481T.4	Evaluate interview techniques and group discussion strategies to enhance professional communication skills.	5
R21_PTHU482P	CO_R21_PTHU482P.1	Practice fundamental conversational and pronunciation skills using language laboratory exercises.	3
	CO_R21_PTHU482P.2	Apply effective writing and email etiquette techniques for professional correspondence.	3
	CO_R21_PTHU482P.3	Demonstrate interview handling and presentation skills through simulated laboratory sessions.	3

SEMESTER V

Subject	CO label	CO Statement	BTL
R21_PT516T	CO_R21_PT516T.1	Analyze the physicochemical properties of drug substances to determine their preformulation and stability characteristics.	4
	CO_R21_PT516T.2	Formulate tablets and liquid oral dosage forms by selecting appropriate excipients and manufacturing techniques.	3
	CO_R21_PT516T.3	Compare hard and soft gelatin capsule manufacturing processes based on their formulation requirements and quality control tests.	4
	CO_R21_PT516T.4	Design aseptic manufacturing procedures for parenteral and ophthalmic products in compliance with quality standards.	6
	CO_R21_PT516T.5	Justify the selection of packaging materials and formulation approaches for cosmetics and aerosol products based on stability and regulatory requirements.	5
R21_PT513T	CO_R21_PT513T.1	Classify the therapeutic agents and outline the synthetic route for the selective medicinal compounds of each category	2
	CO_R21_PT513T.2	Articulate on the mechanism of action of agents acting on the autonomous and central nervous system.	3
	CO_R21_PT513T.3	Compare the relationship between the biological activity and structure of therapeutic agents.	6
	CO_R21_PT513T.4	Outline the rational use of antibiotics, antineoplastic and antidiabetic drugs	4
R21_PT518T	CO_R21_PT518T.1	Apply the mechanism of action of cardiovascular drugs to explain their therapeutic use in heart failure, hypertension, angina, and arrhythmia.	3
	CO_R21_PT518T.2	Analyze the pharmacological basis of drugs used in shock, coagulation disorders, and renal dysfunction.	4
	CO_R21_PT518T.3	Interpret the role of autacoids and anti-inflammatory agents in the pathophysiology of inflammatory and gout conditions.	4
	CO_R21_PT518T.4	Correlate the actions of endocrine hormones and their analogues with their clinical applications.	4
	CO_R21_PT518T.5	Demonstrate the principles and techniques of bioassay for standardizing biological drug preparations.	3
R21_PT512T	CO_R21_PT512T.1	Analyze the metabolic pathways and biosynthetic routes of secondary plant metabolites using isotope labeling studies.	4
	CO_R21_PT512T.2	Classify secondary metabolites such as alkaloids, glycosides, and volatile oils based on their chemistry, biosource, and therapeutic applications.	4
	CO_R21_PT512T.3	Evaluate isolation and identification techniques applicable to phytoconstituents such as terpenoids, alkaloids, and resins.	5
	CO_R21_PT512T.4	Apply modern extraction and analytical techniques, including chromatography and spectroscopy, for identification of crude drugs.	3
R21_PT515T	CO_R21_PT515T.1	Apply the provisions of the Drugs and Cosmetics Act and Rules to the import and manufacture of pharmaceutical products.	3

Subject	CO label	CO Statement	BTL
	CO_R21_PT515T.2	Analyze the regulatory framework governing the sale, labeling, and packaging of drugs under the Drugs and Cosmetics Act.	4
	CO_R21_PT515T.3	Compare the provisions of the Pharmacy Act, Narcotic Drugs and Psychotropic Substances Act, and Medicinal and Toilet Preparations Act in regulating pharmacy practice.	4
	CO_R21_PT515T.4	Evaluate the regulatory and ethical framework governing drug pricing, advertisement, and pharmaceutical practice in India.	5
R21_PT598P	CO_R21_PT598P.1	Demonstrate the effect of drugs on isolated frog heart and cardiovascular parameters using simulated experiments.	3
	CO_R21_PT598P.2	Determine the diuretic activity of drugs in laboratory animal models using standard protocols.	3
	CO_R21_PT598P.3	Analyze dose-response curves of acetylcholine and the modifying effects of physostigmine and atropine on isolated tissue preparations.	4
	CO_R21_PT598P.4	Estimate the potency of unknown drug samples such as histamine, oxytocin, and serotonin using standard bioassay methods.	3
	CO_R21_PT598P.5	Evaluate the anti-inflammatory and analgesic activity of drugs using models such as carrageenan-induced paw edema.	5
R21_PT592P	CO_R21_PT592P.1	Examine the morphological, histological, and powder characteristics of selected crude drugs for identification.	4
	CO_R21_PT592P.2	Extract active principles such as caffeine, atropine, and sennosides from crude drug sources.	3
	CO_R21_PT592P.3	Separate sugars and herbal constituents using paper chromatography and thin-layer chromatography techniques.	3
	CO_R21_PT592P.4	Analyze crude drugs such as asafoetida, benzoin, and myrrh using chemical identification tests.	4
	CO_R21_PT592P.5	Interpret chromatographic and phytochemical screening data to establish the identity and purity of herbal drugs.	4
R21_PT596P	CO_R21_PT596P.1	Perform preformulation studies to determine the physicochemical properties of drug substances.	3
	CO_R21_PT596P.2	Formulate solid dosage forms such as tablets and capsules meeting pharmacopoeial quality standards.	6
	CO_R21_PT596P.3	Prepare parenteral and ophthalmic products following aseptic processing and quality control procedures.	3
	CO_R21_PT596P.4	Evaluate the quality of pharmaceutical dosage forms and packaging materials as per pharmacopoeial standards.	5

SEMESTER VI

Subject	CO label	CO Statement	BTL
R21_PT613T	CO_R21_PT613T.1	Analyze the structure-activity relationship and mechanism of action of beta-lactam, aminoglycoside, and tetracycline antibiotics.	4
	CO_R21_PT613T.2	Correlate the chemistry and therapeutic action of macrolide antibiotics, antimalarial agents, and the prodrug concept.	4
	CO_R21_PT613T.3	Evaluate the structure-activity relationship, mechanism, and therapeutic significance of antitubercular, antiviral, antifungal, antiprotozoal, anthelmintic, and sulfonamide drugs.	5
	CO_R21_PT613T.4	Justify the application of QSAR and combinatorial chemistry approaches in rational drug design.	5
R21_PT618T	CO_R21_PT618T.1	Apply the mechanism of action of respiratory and gastrointestinal drugs to justify their therapeutic use.	3
	CO_R21_PT618T.2	Analyze the spectrum of activity and mechanism of antimicrobial chemotherapeutic agents.	4
	CO_R21_PT618T.3	Compare the therapeutic approaches for tuberculosis, leprosy, fungal, viral, and parasitic infections.	4
	CO_R21_PT618T.4	Assess the pharmacological basis of immunomodulatory drugs and the chemotherapy of malignancy.	5
	CO_R21_PT618T.5	Examine the principles of toxicology and chronopharmacology in relation to drug safety and biological rhythms.	4
R21_PT612T	CO_R21_PT612T.1	Analyze the sourcing, cultivation, and standardization practices of herbal raw materials and Ayurvedic formulations.	4
	CO_R21_PT612T.2	Assess the health benefits and interaction potential of nutraceuticals and herbal drugs.	5
	CO_R21_PT612T.3	Formulate herbal cosmetics and conventional and novel herbal dosage forms using natural excipients.	6
	CO_R21_PT612T.4	Justify the WHO/ICH evaluation guidelines and GMP (Schedule T) requirements for quality assurance of the herbal drug industry.	5
R21_PT616T	CO_R21_PT616T.1	Analyze the mechanisms of drug absorption and distribution and the factors influencing protein binding.	4
	CO_R21_PT616T.2	Evaluate the bioavailability and bioequivalence of drug products based on elimination kinetics.	5
	CO_R21_PT616T.3	Calculate pharmacokinetic parameters using one- and two-compartment models for various routes of administration.	3
	CO_R21_PT616T.4	Solve dosing-regimen problems involving steady-state drug levels and nonlinear pharmacokinetics.	3
R21_PT619T	CO_R21_PT619T.1	Apply enzyme immobilization techniques and biosensor principles to pharmaceutical production processes.	3
	CO_R21_PT619T.2	Analyze recombinant DNA technology applications in the production of therapeutic proteins, vaccines, and hormones.	4

Subject	CO label	CO Statement	BTL
	CO_R21_PT619T.3	Assess hybridoma technology and immunoglobulin-based approaches for monoclonal antibody production.	5
	CO_R21_PT619T.4	Interpret immunoblotting techniques and microbial genetic mechanisms used in biotechnological applications.	4
	CO_R21_PT619T.5	Design fermentation processes for the industrial-scale production of antibiotics and biological products.	6
R21_PT611T	CO_R21_PT611T.1	Relate the principles of quality assurance, quality control, and total quality management to ICH and QbD frameworks in pharmaceutical industries.	4
	CO_R21_PT611T.2	Assess the design and organizational requirements of premises, personnel, and equipment as per cGMP guidelines.	5
	CO_R21_PT611T.3	Apply Good Laboratory Practice principles while conducting quality control tests on pharmaceutical packaging materials.	3
	CO_R21_PT611T.4	Manage complaints, product recalls, and documentation processes in accordance with quality systems.	3
	CO_R21_PT611T.5	Validate analytical instruments and processes using calibration and qualification protocols.	3
R21_PT693P	CO_R21_PT693P.1	Synthesize medicinally important compounds and intermediates using conventional and microwave-assisted techniques.	3
	CO_R21_PT693P.2	Determine the purity of official drugs through titrimetric assay methods.	3
	CO_R21_PT693P.3	Calculate physicochemical descriptors of drug molecules, such as logP, molecular weight, and hydrogen bond donors/acceptors, using computational software.	3
	CO_R21_PT693P.4	Evaluate the drug-likeness of molecules based on Lipinski's Rule of Five.	5
R21_PT698P	CO_R21_PT698P.1	Calculate drug doses and pharmacokinetic parameters from experimental pharmacological data.	3
	CO_R21_PT698P.2	Determine the anti-ulcer, antiallergic, and gastrointestinal motility-modulating activity of drugs using standard animal and tissue models.	3
	CO_R21_PT698P.3	Evaluate the acute toxicity, skin/eye irritation potential, and pyrogenicity of test substances as per regulatory protocols.	5
	CO_R21_PT698P.4	Analyze experimental pharmacological data using biostatistical methods such as the t-test, ANOVA, and Chi-square test.	4
R21_PT692P	CO_R21_PT692P.1	Perform preliminary phytochemical screening and quality evaluation of crude drugs and Ayurvedic preparations.	3
	CO_R21_PT692P.2	Formulate herbal cosmetic and pharmaceutical dosage forms incorporating standardized plant extracts.	6
	CO_R21_PT692P.3	Determine the alkaloid, phenolic, and aldehyde content of herbal drugs by analytical methods.	3

SEMESTER VII

Subject	CO label	CO Statement	BTL
R21_PT711T	CO_R21_PT711T.1	Explain the principles and instrumentation of UV-visible spectroscopy, fluorimetry, IR spectroscopy, flame photometry, atomic absorption spectroscopy, and nepheloturbidometry for pharmaceutical analysis.	2
	CO_R21_PT711T.2	Differentiate chromatographic and electrophoretic techniques on the basis of separation mechanism, methodology, advantages, limitations, and pharmaceutical applications.	4
	CO_R21_PT711T.3	Calculate drug concentration from Beer–Lambert law relationships and instrumental calibration data.	3
	CO_R21_PT711T.4	Interpret spectral and chromatographic features for qualitative identification of pharmaceutical substances.	4
	CO_R21_PT711T.5	Select an appropriate instrumental method for a stated qualitative or quantitative pharmaceutical analysis requirement.	5
R21_PT791P	CO_R21_PT791P.1	Determine absorption maxima and solvent effects for selected organic compounds by UV-visible spectrophotometry.	3
	CO_R21_PT791P.2	Estimate selected pharmaceutical substances by colorimetry, fluorimetry, and UV spectrophotometry.	3
	CO_R21_PT791P.3	Measure sodium, potassium, chlorides, and sulphates by flame photometry and nepheloturbidometry.	3
	CO_R21_PT791P.4	Separate amino acids, sugars, and plant pigments by paper, thin-layer, and column chromatography.	3
	CO_R21_PT791P.5	Interpret chromatographic output from demonstration experiments in HPLC and gas chromatography.	4
R21_PT716AT	CO_R21_PT716AT.1	Describe pilot-plant scale-up considerations for solid, liquid oral, and semisolid dosage forms.	2
	CO_R21_PT716AT.2	Analyze technology-transfer requirements across formulation, packaging, cleaning, analytical methods, qualification, validation, and quality control.	4
	CO_R21_PT716AT.3	Prepare a technology-transfer protocol containing process, documentation, risk-management, and commercialization elements.	6
	CO_R21_PT716AT.4	Assess the regulatory documentation required for IND, IB, NDA, clinical research, bioequivalence studies, and FDA submissions.	5
	CO_R21_PT716AT.5	Evaluate Indian regulatory pathways involving CDSCO, State Licensing Authorities, COPP, and new-drug approval procedures.	5
R21_PT718T	CO_R21_PT718T.1	Classify hospital organizations, pharmacy structures, drug-distribution systems, formularies, and community-pharmacy operations.	2
	CO_R21_PT718T.2	Design an inventory-control and drug-store management plan incorporating procurement, storage, economic order quantity, reorder levels, and expenditure analysis.	6
	CO_R21_PT718T.3	Assess medication-related problems, adverse drug reactions, adherence concerns, and therapeutic-drug-monitoring requirements from patient information.	5

Subject	CO label	CO Statement	BTL
	CO_R21_PT718T.4	Counsel patients on medication use, adherence, rational therapy, over-the-counter medicines, and special-case precautions.	3
	CO_R21_PT718T.5	Interpret clinical laboratory results and medication information for pharmaceutical-care decisions in hospital and community settings.	4
R21_PT716BT	CO_R21_PT716BT.1	Explain the principles, advantages, limitations, and drug-selection criteria of controlled, mucosal, implantable, transdermal, gastroretentive, targeted, ocular, and intrauterine delivery systems.	2
	CO_R21_PT716BT.2	Compare polymers, microencapsulation approaches, permeation enhancers, osmotic pumps, liposomes, niosomes, nanoparticles, and monoclonal antibodies for novel delivery applications.	4
	CO_R21_PT716BT.3	Select suitable drugs, polymers, routes, and formulation approaches for specified novel drug-delivery objectives.	5
	CO_R21_PT716BT.4	Evaluate physicochemical, biological, permeability, and barrier-related factors governing novel drug-delivery performance.	5
	CO_R21_PT716BT.5	Design a novel drug-delivery system for a specified therapeutic objective with an appropriate formulation rationale.	6

SEMESTER VIII

Subject	CO label	CO Statement	BTL
R21_PT817T	CO_R21_PT817T.1	Explain descriptive statistics, probability distributions, correlation, regression, sampling, and hypothesis-testing concepts in pharmaceutical contexts.	2
	CO_R21_PT817T.2	Calculate measures of central tendency, dispersion, correlation, regression, probability, standard error, and sample-size requirements from pharmaceutical data.	3
	CO_R21_PT817T.3	Apply parametric and non-parametric statistical tests to specified pharmaceutical, industrial, and clinical research problems.	3
	CO_R21_PT817T.4	Analyze research designs, clinical-trial phases, observational studies, experimental studies, blocking, confounding, and statistical power.	4
	CO_R21_PT817T.5	Design a factorial or response-surface experiment with an appropriate software-supported data-analysis workflow.	6
R21_PT818T	CO_R21_PT818T.1	Analyze the social, nutritional, and cultural determinants of health and disease.	4
	CO_R21_PT818T.2	Evaluate strategies for the prevention and control of communicable and chronic diseases.	5
	CO_R21_PT818T.3	Assess the objectives, functioning, and outcomes of national health programs in disease control and welfare.	5
	CO_R21_PT818T.4	Justify the role of community health services and the pharmacist in rural and urban health promotion.	5

Subject	CO label	CO Statement	BTL
R21_PT810AT	CO_R21_PT810AT.1	Analyze consumer and industrial buying behavior in the context of the pharmaceutical market.	4
	CO_R21_PT810AT.2	Formulate product and branding strategies based on product life cycle and portfolio analysis.	6
	CO_R21_PT810AT.3	Evaluate promotional-mix strategies and distribution-channel decisions for pharmaceutical products.	5
	CO_R21_PT810AT.4	Justify pricing strategies and regulatory pricing mechanisms (DPCO, NPPA) in the pharmaceutical industry.	5
R21_PT810BT	CO_R21_PT810BT.1	Describe stages of drug discovery, lead identification, analog-based design, bioisosterism, and rational lead-generation approaches.	2
	CO_R21_PT810BT.2	Interpret SAR, QSAR, physicochemical descriptors, Hansch analysis, Free-Wilson analysis, CoMFA, and CoMSIA results.	4
	CO_R21_PT810BT.3	Apply drug-likeness screening, pharmacophore mapping, molecular docking, and docking-based screening to a specified design problem.	3
	CO_R21_PT810BT.4	Evaluate bioinformatics, chemoinformatics, ADME, chemical, biochemical, and pharmaceutical databases for drug-design decisions.	5
	CO_R21_PT810BT.5	Design a molecular-modeling workflow incorporating energy minimization and conformational analysis for lead optimization.	6
R21_PT810CT	CO_R21_PT810CT.1	Interpret NMR and mass spectral data for the structural elucidation of organic compounds.	4
	CO_R21_PT810CT.2	Analyze thermal and X-ray diffraction data for the characterization of pharmaceutical solids.	4
	CO_R21_PT810CT.3	Calibrate and validate analytical instruments as per ICH and USFDA guidelines.	3
	CO_R21_PT810CT.4	Evaluate the application of radioimmunoassay, extraction, and hyphenated techniques in drug analysis.	5