Syllabus for PET-2026 (Pharmaceutical Sciences)

UNIT I: Research Methodology, Biostatistics, Research Ethics and Publication Ethics

Process of selection of research question including prioritization and feasibility, process of writing a research proposal, scientific writing for thesis and research publications. Review of literature, need for review of literature, primary and secondary sources for review, bibliographic databases, electronic databases, information retrieval, information processing, critical evaluation, organization of materials collected and writing of review, methods of writing references and bibliography. Ethics and biomedical research: General principles on ethical considerations involving human subjects, ethical review procedures, Institutional ethics committee, its organization and functions, general ethical issues. Specific principles for clinical evaluation of drugs/devices/diagnosis vaccines/herbal remedies, specific principles in epidemiological studies, specific principles in human genetic research, specific principles for research in transplantation including fetal tissue implantation, Publication ethics.

UNIT II: Basics of Pharmaceutics, Drug Delivery systems and Regulatory Affairs

Properties of matter, micromeritics, surface and interfacial phenomenon, viscosity, rheology, dispersion systems – principles, properties and applications, classification, preparation, analysis and applications of complexes, kinetics and drug stability. Stoichiometry, Importance of unit processes in manufacturing – fluid flow, heat transfer, evaporation, distillation, drying, size reduction, mixing, filtration and centrifugation, crystallization, humidity control, refrigeration and air conditioning. Materials of plant construction, material handling systems, automated reactors, computer aided manufacturing, industrial hazards and safety systems. Controlled and novel drug delivery systems, drug targeting. Techniques for invitro and in-vivo testing. In vitro – In vivo correlation. Pre-formulation studies. Physical, chemical and therapeutic incompatibilities. General considerations & concepts of chemical kinetics and drug stability. Biopharmaceutical aspects of dosage form design, principles of pharmacokinetics.

Bioavailability and bioequivalence studies, dosage regimens, repetitive dosing and dose adjustments in renal and hepatic failure, individualization of dosage regimen. BCS Classification of drugs, ICH guidelines. Concept of pharmaceutical quality management, requirements of GMP, GLP, GCP, regulatory requirements of drugs and pharmaceuticals.

UNIT III: Pharmaceutical and Medicinal Chemistry

Basic organic chemistry regarding synthesis and reactions of the main organic functional groups, organic stereochemistry, substitution (free radical, nucleophilic, electrophilic); elimination reactions; addition reactions; rearrangement reactions, General pathways of drug metabolism, Basic concepts and application of pro-drug design, Biochemical mechanism of drugs, categories of drug with special reference to SAR, Mode of action, Classification and synthesis of anticancer, NSAIDs, antiinfective, antihistaminic, anxiolytics, sedatives, hypnotics, anticonvulsants, adrenergic antagonists and general anesthetics. Radiolabelling, Drug designing and screening, concepts of QSAR and CADD.

UNIT IV: Pharmacology and Therapeutics of drugs

Types of receptors, drug-receptor interaction including signal transduction, mechanism, drug action, side effects, and contraindications of drugs acting on central nervous system, autonomous nervous system, anticancer agents, NSAIDs, anti-infective, antidiabetic, antihypertensive, antiasthmetic, antiulcers and antihistaminic. Pharmacological screening, general principles, various screening models, screening methodologies (in-vitro and in-vivo tests). Bioassay methods, principles of toxicology, basics of chemotherapy and pathophysiology.

UNIT V: Pharmacognosy and Biotechnology

General methods of extraction, isolation, purification and characterization of natural products. Various separation techniques used for isolation of natural products. Biosynthetic pathways of various metabolites (e.g. Alkaloids, glycosides, tannins, lignans, saponins, lipids, flavonoids, coumarins, anthocyanidines etc.). Quality control of crude drugs, phytochemical screening methods, plant tissue culture. Recombinant DNA technique, Fermentation, Immunology and vaccines.

Enzyme immobilization, Genetics and gene therapy, Fundamentals of cell and molecular biology.

UNIT VI; Pharmaceutical Analysis

Fundamental principles, basic instrumentation, and pharmaceutical applications of UV- Visible spectroscopy, Infrared spectroscopy, PMR, C13 NMR spectroscopy, mass spectroscopy of gas-liquid chromatography, HPLC, HPTLC, Gel chromatography, Electrophoresis and ion-pair chromatography. Introductory principle, instrumentation and application of GC-Mass, HPLC-Mass for complex mixtures.

Theory, methods and applications of enzyme and radioimmunoassay techniques, Thermogravimetric analysis (TGA), Differential scanning calorimetry (DSC), Differential Thermal Analysis (DTA), X-ray diffractometry (XRD), Electron microscopy. Stability indicating assay procedures, analytical method development and validation.Impurity profiling, drug estimation in biological samples. Analytical instrumentvalidation.