Department of Pharmaceutical Sciences and Technology

Syllabus for Ph.D. Entrance Test

M.Tech to PhD (Tech).

Pharmaceutical Formulation Technology:
Preformulation considerations
Tablets: Advantages of tablets, Granulation: Need for granulation, Methods and equipment, Direct compression, Advances in granulation equipment Single stroke and Rotary Tablet Machines, physics of tablet compression, tablet Tooling Tablets: and compressions of tablets, packaging including materials, quality control, evaluation and official standards, manufacturing equipment, different types of tablets including various processing problems, Excipients in tabletting - Types of tablets: effervescent, lozenges, chewable, buccal and sublingual, dispersible, orodispersible , soluble, Problems in tabletting, Physics of Compression & Compaction.
Capsules: Advantages and limitations of Hard gelatin and soft gelatin capsules, Gelatin extraction and manufacture of Hard gelatin capsules, quality control of hard and soft gelatin, Principles, materials and equipment involved in the formulation, manufacture and filling of hard and soft gelatin capsules and their quality control.
ICH Guidelines for stability evaluation.
Packaging: Machinery and materials for tablets and capsules.
Polymers: Introduction to methods of polymerization of homo and hetero polymers. Mol.weight of polymers, flow characteristics of polymers. Crystallinity and phase transitions, polymers degradation & stabilization, polymer properties and their evaluation, Polymers for controlled release Bioadhesive polymers, stimuli sensitive polymers. Biodegradable polymers, Biodegradation of polymers, enzymatically degradable bonds in synthetic polymers.
Oral DDS: Sustained and Controlled release formulations: Terminologies, Basic Principles & mechanisms of sustained drug release, materials and methods, large- scale manufacture, evaluation and quality control, packaging, Pelletization and design and evaluation of multiparticulate oral systems Gastro retentive DDS, Osmotic DDS, Pulsatile DDS , Colonic DDS, Hydrodynamically balanced DDS including recent advances in oral DDS.
Mucosal DDS: Physiological basis of mucosal delivery with reference to oral mucosal, nasal, vaginal and rectal routes; Bioadhesion and bioadhesive polymers, DDS for mucosal administration.,Methods to evaluate bioadhesion.
Transdermal DDS: Percutaneous absorption and penetration enhancers, development of transdermal gels, patches with reference to manufacturing equipment components and evaluation. Iontophoretic and Sonophoretic DDS.
Ocular DDS: Design of CR ophthalmic DDS including gels, inserts, novel DDS and evaluation.
Dental DDS: DDS for oral conditions, and dental care and therapy including periodontal disease, dental caries etc.
Parenteral DDS: CR Injectables, implants etc. development and evaluation
Colloidal DDS: Specialized DDS like micro / nano emulsions, SMEDDS, Multiple emulsions, sub micron emulsions, liposomes, niosomes, and other vesicular DDS, nanoparticles, their design and development into final dosage forms, issues and consideration.

Medicinal Natural Products and Phytochemistry: Properties, structures, classification, of Carbohydrates, proteins, enzymes, lipids, volatile oils, glycosides (anthraquinone, cyanogenic, steroidal, triterpenoidal, coumarin, flavonoid, glucosinolate, etc.) tannins, alkaloids; General biosynthetic pathways in the formation of secondary metabolites; Methods of investigation in biogenetic studies; Biosynthesis of phenyl propanoids; Isolation, identification, classification, structure determination and important pharmacological activities of flavonoids. Detailed study of rutin including extraction and isolation; Tumour inhibitors from plants; Pesticides of natural origin; Poisonous plants; Plant allergens; Standardization and quality control of herbal drugs and herbal products; Extraction: Methods employed for the extraction of natural products. Types of extracts. Methods used for separation of phytoconstituents.

Advanced Pharmaceutical Technology: Theory of mass transfer with chemical reaction (regimes and examples), model contactors; Kinetics of solid-catalysed gas phase reactions: Diffusion with reaction in porous catalyst, Mechanism of catalytic reactions. Development of rate equations for solid catalysed fluid phase reactions; Estimation of kinetic parameters External/internal mass and heat transfer resistances in catalyst particles; Examples of catalytic transformation and case studies in manufacture of APIs and Intermediates; Types, classification, application of industrial importance, Hydrodynamic characteristics of different reactors; mechanically agitated contactors, slurry reactors, spray columns, loop reactors and modified versions with examples in APIs and Intermediates.
Chemical reaction engineering: Introduction and fundamentals of process modeling and simulation; industrial usage of process modelling and simulation; Macroscopic mass, energy and momentum balances with examples of API manufacture; Process modeling of distributed systems; axial mixing; micro-mixing; diffusion; material and energy balance, fluid flow process instrumentation and control, unit operation-crystallization, extraction, drying, distillation.
Bulk Drug technology: Importance of Development of Bulk Drug Technology; Import, Export of Bulk drugs; Development of Process chemistry; Plant Layout, Plant Design, Utilities, Process Flowsheets, etc; Raw Material Consumption and Cost; Safety, Pollution Control and Effluent Treatment; Good Laboratory and Manufacturing Practices; Quality Assurance and Regulatory Affairs.
Instrumental methods of analysis: FTIR: Basic theory, instrumentation, qualitative and quantitative analysis. **V-VISIBLE**: Basic theory, solvent effects, instrumentation, isolated double bonds, conjugated dienes, carbonyl compounds, aromatic and heteroaromatic compounds. **NMR:** Basic principles, relaxation processes, spin-spin interaction, chemical shifts,interpretation of 1H NMR spectra, correlation-hydrogen bonds to carbon and other nuclei; Instrumentation-Continuous and pulsed NMR, carbon- 13NMR; XRD Crystal geometry and structural determination; Bragg law of X-ray diffraction, powder method; X-ray spectrometers-wide and small angle diffractrometers; Chemical analysis by X-ray diffraction; MS: Basic principle, ionization methods/sources, fragmentation processes in organic compounds, interpretation of mass spectra, molecular weight,molecular formula; Instrumentation- different analyzers; Problems based on the integrated approach of the four spectroscopic techniques of UV, IR, NMR and MS.
Advanced Pharmaceutical Chemistry: Solid phase synthesis: Concept, resins, linkers, characterizations, examples; Peptide synthesis: Protected amino acids, coupling agents, strategies in synthesis with examples of peptide drugs and hormones. Solid phase synthesis and peptide synthesizers; Oligonucleoside Synthesis: Methodologies, solid phase oligonucleosides synthesis; Combinatorial synthesis: liquid phase and solid phase, deconvolution techniques, design of libraries, these to be discussed with illustrative examples of combinatorial libraries; Organic nanomaterial (Single molecular and molecular assemblies): Design, synthetic strategies, characterization and properties. E.g. dendrimers, polymeric nanomaterials, carrier-systems for drug targeting; Fluorescent and imaging materials: Design and synthesis, properties and applications.
Medicinal chemistry: Classification, Mode of action, SAR, and metabolism of the following catagory of drugs- acting on cardiovascular system, CNS, ANS, autacoids,anti-inflammatory, anticancer, antiinfectives, and proton pump inhibitors.