Department of Pharmaceutical Sciences and Technology

Syllabus for Ph.D. Entrance Test

M.Pharm to PhD (Tech).

BRANCH: - **PHARMACEUTICS**

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
Peptide and protein based DDS: Chemistry and special features of peptide and protein molecules, stability, analysis, Formulation and evaluation Barriers to peptide and protein delivery; Routes of delivery, Toxicity, immunogenicity, vaccines and gene based DDS.
Pulmonary DDS – Physiological basis and formulation considerations. Design of Pressurized aerosols, Dry powder DDS, Devices for administration and evaluation. Intrauterine Devices, Intravaginal drug delivery systems, DDS for orthopedic applications Intra coronary stents.
Targeted Drug Delivery Systems: Concept of drug targeting, basis for drug targeting, need for targeting, the physicochemical and physiological basis of targeting, RES, Receptor mediated drug targeting, Targeting to the brain, Targeting in cancer and infectious diseases ,Ligands for targeted delivery, In vitro cell culture techniques for evaluation of drug permeation from DDS In vitro / ex vivo models for evaluation of Drug absorption

BRANCH :- **PHARMACOLOGY**

General Pharmacology, Chemotherapeutic Agents, Screening Models for Analgesics, Anti-Inflammatory, Diabetes (in vivo, in vitro), Cancer, Hypertension, Diuretics, Purgatives, Depression, Anxiety. Therapeutic Agents for ANS, CNS, GIT, Respiratory, Blood & Blood forming Agents,
Diseases: Peptic Ulcers, hepatitis
Diseases: Hypertension, CCF, Arrhythmia, angina pectoris, IHD, arteriosclerosis.
Diseases: Acute and Chronic renal failure, Glomerulonephritis
Receptor classification
Immunotherapy : immunostimulants Immunodepressants , cytokines
The Eicosanoids : Prostraglandins, Leukotrienes
Pharmacology of Ca, Na, K, Cl channel modulators
Clinical trials – Drug registration
Toxicity: ICH and OECD Guidelines
Importance of Transgenic animal models / knock out mice in screening methods
An overview of regulatory status – Ethical / moral / professional / issues in toxicity

BRANCH **:- PHARMACOGNOSY & PHYTOCHEMISTRY**

Phytochemistry: Properties, structures, classification, methods of extraction, etc. of Carbohydrates, proteins, enzymes, lipids, volatile oils, glycosides (anthraquinone, cyanogenic, steroidal, triterpenoidal, coumarin, flavonoid, glucosinolate, etc.) tannins, alkaloids.
Biosynthesis : Building blocks, reactions involved in the biosynthesis, biosynthesis of building blocks. (acetate, isopenntenyl pyrophosphate, phenyl propane, etc.,) Biosynthesis of secondary metabolites of all class, methods used to investigate biogenetic studies.
Plant growth regulators, Cell cultures as source of drugs.
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.
Fatty acids and their esters - Castor, Chaulmoogra oil, Linseed, Jajoba, Olive oil, Neem, Sesame, Wheatgerm oil, Fish liver oil, Cocoa butter, Kokum butter, Woolfat, Beeswax, Carnauba wax.
Proteins and enzymes - Protein hydrolysate, Gelatin,; Papain, Ficin, Bromelain, **Peptide toxins** : Abrin, Ricin, Snake venom.
Alkaloids: Belladonna, Coca, Datura, Hyoscyamus, Stramonium. Black pepper, Lobelia. Areca, Tobacco. Ephedra. Colchicum, Opium, Ipecac. Cathatharanthus, Cinchona, Ergot, Nuxvomica, Rauwolfia. Vasaka. Pilocarpus. Cocoa , Coffee, Cola, Tea, Aconite. Kurchi, Solanum.
Phenyl propanoids; Asafoetida, Vanilla, Salicin, Capsicum, Ginger, Benzoin, Clove, Nutmeg, Cinnamon, Turmeric. Coumarins : Psoralea, Tonco. Lignans and lignins : Podophyllum, Phyllanthus, Flavonoids: Fagopyrum, Soya isoflavone..
Terpenoids: Abelmoschus, Cardamom, Citrus oils, Coriander, Cummin, Dill, Eucalyptus oil, Fennel, Jatamansi, Lemongrass, Mints, Sandalwood, Turpentine, Wintergreen, Vetiver, Valerian, Artemisia, Pyrethrum, Colophony, Taxus, Shellac, Quassia, Picrorhiza, Andrographis
Triterpenes : Acacia concinna, Bacopa, Colocynth, Gymnema, Hydrocotyl, Licorice, Momordica, Quillaia, Sapiandus. **Carotenoids**: Saffron, Bixa, beta-carotene**.**
Cardioactive glycoside : Digitalis, Nerium, Strophanthus, Squill, Thevetia. Steroidal saponin: Agave, Asparagus, Dioscorea, ,Guggul.
Naphthelene derivatives: Plumbago, Alkanna, Henna. **Anthraquinone**: Aloes, Cochineal, Hypericum, Rhubarb, Rubia, Senna. **Tannins**: Black catechu, Galls, Kinos, Myrobalans, Pale catechu.
Cyanophoric glycosides: Almonds, Wild cherry**; Isothiocyanate glycosides**: Mustard. **Sulphur containing compounds:** Garlic.
Plant Allergens, **Aflatoxin, Marine drugs, Poisonous plants.**
Herbal Health Products: Currently important products used globally.

BRANCH :- **PHARMACEUTICAL CHEMISTRY**

Instrumental methods of analysis: FTIR: Basic theory, instrumentation, qualitative and quantitative analysis; UV-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.
Organic chemistry: Reactive intermediates - carbonium ion, carbanion, free radicals,carbene ,nitrene, oxene; synthetic methodologies frequently used in drug synthesis with emphasis on recent developments in; oxidation, reduction, carbon-carbon bond forming reactions including organometallic and palladium based methods;protection and deprotection methods; synthesis of 5,6,7 membered heterocyclic ring systems containing one or more heteroatoms (N,O and S), asymmetric synthesis;fundamental principles, asymmetric induction; discussion of classic methodologies; Solid phase synthesis- concept, resins, linkers, characterizations;Peptide synthesis- protected amino acids, coupling agents, strategies in synthesis;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.
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;
Molecular Mechanics-General features of force fields, cross terms, force field parameterization Energy minimization – non-derivative and derivative methods, applications of energy minimization,Techniques of searching the conformational space – systematic search, Monte Carlo, Molecular dynamics and distance geometry;
2D-QSAR,History and development of 2-D QSAR, Parameters – lipophilicity and related parameters, electronic parameters, steric parameters, other parameters, Quantitative models – Hansch approach, Free Wilson analysis, the mixed approach, Statistical methods – regression analysis, partial least square and other multivariate statistical methods; Design of test series in QSAR-Some examples of Hansch and other methods;
Physico-chemical properties of drugs and their importance in drugdiscovery, Lipinsky rule of 5,Concept of toxicophores, Insilico calculation of log P, log D values, Modification of leads to incorporate suitable ADMET properties; Drug design by docking, de novo methods, pharmacophore development, 3D QSAR approach; A. Drugs acting by enzyme inhibition, Protease inhibitors – ACE inhibitors and renin inhibitors, reductase inhibitors – HMG-CoA reductase inhibitors,HIV-reverse transcriptase, protease and integrase inhibitors, cyclooxygenase, leukotrienes and lipoxygenase inhibitors, aromatase inhibitors and DHFR inhibitors,
3D structure of examples of GPCR and PDE receptors with emphasis on functionalmapping of ligand binding sites.