SYLLABUS FOR Ph.D. ENTRANCE TEST IN PHARMACY

(A) PHARMACEUTICAL CHEMISTRY

Unit I

1) Physicochemical properties in relation to drug action; metabolic transformation of drugs and its role in development of new drug molecules; metabolic antagonism.
2) Stereochemical aspects of drug receptor interactions and mechanism of drug interaction. Isosterism and bioisosterism as guides to structural variations; Concepts of conformational analysis and its role in design and development of new drug molecules.
3) Principle of drug design: Analogue synthesis versus rational design; discovery of lead compounds, Pharmacophoric identification, Prodrugs and soft drug.

Unit II

QSAR and introduction to molecular modeling.
Following name reactions and their application in the synthesis of some medicinal agents.
(a) Claisen- Schmidt reaction.
(b) Perkins reaction
(c) Friedal Craft Reaction
(d) Aldol condensation
(e) Mannich reactions.
(f) Beckmann's rearrangement.
(g) Wagner-Meerwein rearrangement
(h) Wittig Reaction
(i) Oppenaur oxidation.
(j) (Meervein- pondroff-verley) M.P.V. Reduction.

Unit III

Natural products as leads for new pharmaceuticals obtained from terrestrial and microbial sources will be discussed in the light of various degradative and synthetic approaches. Important members representing the following classes of natural products shall be discussed.

a) Alkaloids:

General introduction and classification, isolation and purification methods, general methods employed for determining the structure of alkaloids, constitution of morphine, reserpine and quinine.

b) Steroids:

General introduction, stereochemistry, nomenclature and structure elucidation of sterols (cholesterol), sapogenin (diosgenin) and cardiac glycosides.

c) Amino Acids, Peptides and Nucleic acids :General introduction, synthesis of peptides and amino acids. End group analysis, structural features of Insulin, vasopressin and oxytocin.

d) Antibiotics: Classification of antibiotics, structural details of penicillins and tetracyclines, polypeptide antibiotics.

e) Flavonoids: Detailed chemical account of rutin and quercetin.
f) Triterpenoids: A general chemical treatment and structural elucidation of terpenoids
g) Coumarins: General methods of isolation and structural determination of Xanthotoxin and psoralene.

Unit IV

1. Cardiovascular Agents: Anti-hypertensive agents, antiarrhythmic agents, antihyperlipidemic agents, antianginal agents.
2. Psychopharmacological agents: Antipsychotic Agents: Introduction, Biochemical basis of mental disorders, Development of antipsychotic agents: Phenothiazines, Butyrophenones: Atypical antipsychotic agents. Antidepressant Drugs: Introduction, Development of tricyclic antidepressants, Monoamine oxidase inhibitors; Selective serotonin-reuptake inhibitors; Atypical antidepressants, Lithium salts. Antianxiety Agents: Introduction, medicinal Chemistry of benzodiazepines; SAR of benzodiazepine derivatives, medicinal chemistry of non-benzodiazepines; serotonin-reuptake inhibitors, development of meprobamate and analogues; atypical anxiolytic agents.

Unit V

1.Chemotherapy: Antiviral agents including the development in chemotherapy of AIDS.
2. Drugs for neoplastic diseases.
3. Drug affecting immune responses.
4.Radioprotective drugs.
5.Analgesics and anti inflammatory agents, Prostaglandins, Non steroidal drugs,Steroidal drugs, Endorphins.
6. Diuretic agents.
7.Chemistry of cell membrane; Signal transduction and G. Proteins.

(B) PHARMACOLOGY

Unit I

Basic Principles in Drug Therapy: Drug-receptor interaction, Cellular Transduction Mechanisms, Adverse Drug Reactions, Drug therapy in elderly, Drug Therapy during pregnancy and lactation, Gene therapy, Chiral Pharmacology.

Unit II

Drugs acting on the Autonomic Nervous System and Central Nervous System: Neurotransmitter in ANS and CNS, Muscarinic Receptor (Agonists and Antagonists), Cholinesterase Inhibitors, Agents acting at the skeletal muscle and autonomic ganglia, Sympathomimetic Drugs and Adrenergic receptor antagonists.

Drugs in the treatment of Anxiety, Depression, Psychosis, Mania, Epilepsy and Parkinsonism, Opioid analgesics and antagonists, Drug addiction and drug abuse.

Unit III

Drugs effecting Cardiovascular function and Digestive System: Diuretics, Congestive heart failure and its treatment, Pharmacotherapy of hypertension, Drugs used in the treatment of coronary artery diseases, Arrhythmia and its management, Drugs used in the treatment of Hyperlipoproteinemias, Anticoagulant, thrombolytic and antiplatelet drugs.

Pharmacotherapy of peptic ulcer, ulcerative colitis, Irritable Bowel Syndrome, Diarrhoea, Constipation, Emetics & antiemetics.

Unit IV

Therapy of Infectious diseases and Endocrinology: General Principles, Antibacterial drugs (Sulphonamides,Penicillins, Cephalosporins, Tetracyclines, Chloramphenicol, Aminoglycosides, Quinolones), Drugs used in the chemotherapy of Protozoal infections, Leprosy, Tuberculosis, Fungal infections, Viral infections, Drugs used in the Chemotherapy of Neoplastic diseases and Immunomodulators.

Hormones of anterior and posterior pituitary gland. Insulin, oral hypoglycemic agents, Adrenocorticotropic hormones, Antithyroid drugs, Androgens and Anabolics. Agents affecting Calcification and bone turnover.

Unit V

Screening methods in Pharmacology and Toxicology: Basic principles, methods of bioassay and important bioassay of drugs, Pharmacological Screening Techniques to evaluate drugs belonging to following categories:

a) Analgesics, anti-inflammatory agents and local anaesthetics.

b) Antihypertensives, antianginals, diuretic and saluretic activity.

c) Antiulcer drugs, antidiabetics, hepatoprotective, nephroprotective and anti-obesity activity.

d) Effects on behavior and muscle coordination, antiepileptics, anti-Parkinsonism, drug
effects on learning and memory.

e) Anticancer activity (In vitro and In vivo)

f) Evaluation of antioxidants (In vitro and In vivo)

Drug Toxicity, Safety Evaluation of new drugs. Regulations for Laboratory animal care and ethical requirements.

(C) PHARMACEUTICS

Unit I

1. **Preformulation Studies**: Timing and goals of preformulation, preformulation methodology, solid state properties, partition coefficient, solubility, dissolution of drug substance & dosage, crystal form and stability, compatibility tests.

2. **Kinetic principles and stability testing**: Order of reaction, influence of pH, temperature, Acid-base catalysis, effect of ionic strength on degradation, dosage forms, influence of packaging component on dosage form stability.
3. **Optimization techniques in pharmaceutics, formulation and processing**: Optimization parameters, statistical design and other application.

Unit II

1. **Documentation**: Relevance and importance of documentation, statuary requirement and procedure for documentation, critical examination of documentation.
2. **Validation**: Regulatory basis, validation of sterile products, solid dosage forms, process validation and non-sterile analytical method validation.
3. **Quality control**: Process control, control of validation, control of manufacturing process, statistical quality control, control charts, sampling plans, automated and process control, dosage form control, testing program and method, product identification systems, adulteration, misbranding, record maintenance, bioavailability, bioequivalence, manufacture's reliability, manufacturer/drug information profile.

Unit III

1. **Preparation of master manufacturing details**: Material handling, blending, granulation, slugging compression, coating of liquid forms, contract manufacturing.
2. **Production and planning management**: Space allocation, environmental factors, material management, sales forecasting, cost control.
3. **Drug and regulatory methods**: Definitions, federal food, drug and cosmetic act, Kafaurver Harre's amendment, new drug application, drug efficacy study, implementation review, OTC drug review, drug listing, drug amendments, patents, copy right, trade marks, drug recalls, product liability, and clinical trial.

Unit IV

1. **Good manufacturing practices**: GMP in manufacturing, packaging and holding of drugs, control of components, containers and closures, production and process control, packaging and labeling control, inspection for compliance with GMP potable water standards, Premises: design, construction, maintenance, equipment, warehousing. ISO 9000 certification.
2. **Polymers and their applications**: Nomenclature, polymer classification, physico-chemical properties, chemistry, blend of polymer and properties of blends, evaluation of polymers and their characterization, mechanism of drug release from polymers, applications of polymers in controlled release of active agents and in other formulations.
3. **Packaging and material sciences**: Packaging design and specifications, packaging validation trials, material of construction, component product validation, regulatory requirements, quality control testing standards, GMP requirement and its deficiencies, in process control during component manufacture documentation, sterilization of packaging components, packaging

and filling equipment, pharmaceutical packaging including sterile working area, customer complaints.

Unit V

1. **Fundamental, design and fabrication of controlled release drug delivery system**: fundamental and rationale of sustained/controlled drug delivery system, factor influencing the design and performance of sustained/controlled drug delivery system, drug targeting, use of polymer in of sustained release of active agents, pharmacokinetics/ pharmacodynamics basis of controlled drug delivery system, regulatory requirements.
2. **Biochemical and molecular biology approaches in controlled drug delivery**: Novel chemical approaches for sustained drug delivery system, design and fabrication of oral controlled release drug delivery system, parenteral products, implantable systems, transdermal patches, ocular, intravaginal, intrauterine system, cardiovascular drug delivery system-coated balloon catheters and coated stents.
3. **Intelligent drug delivery system**: Microparticulate drug carriers, liposome and stealth liposomes, microspheres and cells, selective endocytosis of macromolecular drug carriers, antibodies for drug delivery, resealed erythrocytes, niosomes. Nanopharmaceuticals- Method of preparation, characterization and application of nanoemulsion, nanosuspension, solid lipid nanoparticles (SLN) and self nanoemulsifying drug delivery (SNEDDS)
4. **Advances of pharmacotherapeutics in drug delivery**.

(D) PHARMACOGNOSY & PHYTOCHEMISTRY

Unit I
(Advances in Pharmacognosy)

1. Genetics in Pharmacognosy:
Mendal's laws of hereditary and their application to Pharmacognosy, Chemical races, Selections, Hybridization, Polyploidy, mutation, plant growth hormones, their application and effect on plant growth and its constituents.

2. Chemotaxonomic significance in medicinal plants:
History of Chemotaxonomic developments, chemotaxonomy of higher and lower plants and distribution of certain chemotaxonomical group of constituents in plant kingdom like alkaloids, glycosides and terpenoids, semantides, amino acid sequencing, DNA finger printing..

3. Comparative Phytochemistry:
Relationship between Phytochemistry & Taxonomy. Comparative Phytochemistry of alkaloids, flavonoids and C-glycosides.

Unit II
(**Plant Tissue Culture)**

1. Plant Tissue Culture techniques and its application in relation to Phytopharmaceuticals:
Introduction, techniques of initiation and maintenance of various types of cultures. Immobilized cell techniques, Biotransformation studies including recent developments in production of biological active constituents in static, suspension and hairy root cultures, Bioreactors for production of biologically active constituents and other applications of plant tissue culture techniques.

Unit III
(**Phytochemistry & Biogenesis**)

1. General methods of phytochemical & biological screening, isolation and purification of plant constituents.
2. Natural sources, extraction, purification, isolation and characterization of the following Phytopharmaceuticals.
Alkaloids: Morphine, Quinine
Glycosides: Sennosides, Glycyrrhizine, Asiaticosides, Diosgenin, Solarodine, Rutin
3. Industrially important volatile oils: Natural occurrence, their chemistry, ontogenic variation and trade.
4. Methods of investigation of biogenetic pathways.
5. Biogenetic pathways for the production of phytopharmaceuticals, such as Alkylamine (Ephedra), Pyridine, Piperidine (Lobelia), Tropane (Belladonna), Quinoline (Cinchona), Isoquinoline (Opium), Diterpene (Cannabinoids), Indole (Ergot), Cardiac glycosides, Coumarins and Flavones.

Unit IV
(Cultivation & Standardization of medicinal plants)

1. Preparation of herbarium specifications, use of flora and keys of plant identification, Microtomy and advanced histological techniques as applied to pharmacognostical specimen, pharmacognostical drawings and macro and micro photography. Quantitative microscopy as applied to drug evaluation and pollen grain analysis.
2. Agrotechnology of medicinal plants: Ecotypic, Phenotypic and Genotypic Variability affecting phytopharmaceuticals. Prospects and economics and medicinal and aromatic plants in India. Cultivation methods developed in India for the following plants of commercial significance. Glycyrrhiza, Ipecac, Mentha, Poppy, Psyllium and Senna. Tropane alkaloid and steroid containing plants.
3. Standardization and quality procedures for the assay of plant products including botanical, physicochemical, pharmacological and toxicological parameters.

Unit V
(Application of chromatographic techniques and spectroscopic techniques)

1. Application of chromatographic techniques such as column, paper, TLC, HPTLC, GLC, HPLC and DCCC in the isolation and purification of phytopharmaceuticals.
2. Applications of spectroscopic techniques like UV, IR, NMR, 1HNMR, 13CNMR and Mass spectroscopy for structural elucidation of phytopharmaceuticals.