Department of Pharmaceutical Chemistry
Faculty of Pharmacy
University of Dhaka
Dhaka-1000, Bangladesh

M. Phil in Pharmaceutical Chemistry

Duration of the Program: 2 Years
(Annual System)
2004 – 2005 onward

Syllabus

COURSES

First Year: Part-I Course work		
Subject No.	**Title**	**Marks**
Paper-I	Advanced Pharmaceutical Analysis	100
Paper-II	Advanced Medicinal Chemistry	100
	Viva voce examination	100
Second Year: Part-II		
	Thesis: Research work (2 Examiners)	
	Viva voce examination (Defending of the thesis)	

M. Phil Part-I Course Works

Paper-I: Advanced Pharmaceutical Analysis 100 Marks

Course contents

1. Chromatographic Methods

Partition Column Chromatography: Theory, stationary and mobile phases in partition chromatography, application to the analysis of drugs and metabolites.
Adsorption Column Chromatography: Theory, stationary and mobile phases in adsorption chromatography, application to the analysis of drugs and metabolites.
Thin-layer chromatography: Theory, types of stationary phases and solvents, visualization and identification, qualitative and quantitative applications to the analysis of drugs and metabolites.
High Performance Liquid Chromatography (HPLC): Theory, stationary and mobile phases, recent advances, applications to the analysis of drugs and metabolites.
Affinity chromatography: Theory, stationary and mobile phases, applications to the analysis of amino acids, proteins and other macromolecules.
Gas Chromatography: Theory, retention properties of stationary phases and derivatization techniques (methylation, acylation, silylation, etc.)
Size Exclusion Chromatography: Theory, types of stationary phases, separation of high molecular weight organic compounds and biopolymers.
Ion Exchange chromatography: Theory, mobile & stationary phases and applications.

2. Electrochemical Methods

Classification of electrochemical methods and principles of electrochemical cells, Nernest equation, potential generation across membranes. Ion-selective electrodes, dropping mercury electrode, rotating platinum, gold and carbon electrodes and their uses.
Controlled-Potential Techniques: Chronoamperometry, Chronocoulometry, D.C. polarography, cyclic voltammetry, rotating disc and rotating ring voltammetry, amperometric titrations.
Controlled-Current Techniques: Chronopotentiometry, cyclic chronopotentiometry, electrochemical sensors, photoelectrochemistry, electrochemical analysis of substances of pharmaceutical and biological interests and electrochemical study of the mechanism of organic reactions.

3. Spectrophotometric Analysis

Instrumentations: Radiation sources, monochromators, detectors, signal processors, read-out devices, single and double-beam spectrophotometers with their internal structures.

Ultraviolet and visible spectrophotometry: Origin of molecular spectra, electronic transitions, solvent and steric effects, charge transfer spectra. Analysis of multicomponent systems, irrelevant absorption corrections.
Difference, derivative and dual-wavelength spectrophotometry: Application in determination of molecular weight, rates of reaction constants and ionization constants; spectrophotometric titrations.
Infrared spectrophotometry: Near infrared spectroscopy, Fourier transform infrared spectroscopy, quantitative analysis using both of these.
Fluorescence Spectrophotometery: Factors influencing and affecting fluorescence, quantitative analysis of single and two component systems, estimation, derivatization reactions, advantages of flourimetric methods.
Transient Absorption Spectroscopy: Flash spectroscopy, transient absorption spectra and life-time measurements of singlet, triplet and radical species.
Atomic absorption spectroscopy: Principle, instrumentation, operation and applications.
Nuclear magnetic resonance spectrometry: Principle, instrumentation, operation technique, solvents used in NMR and 2D-NMR, applications in the determination of structure of organic and organometallic compounds.
Mass spectrometry: Theory, instrumentation, operation and recording of mass spectra, application of mass spectroscopy, analysis of mass spectra of some known molecules.
GC-Mass spectrometry-Application to the analysis of drugs and metabolites and structural studies of some important molecules.

4. Combined Applications of Spectroscopic Techniques

Advanced treatment of major spectroscopic techniques for the characterization of organic and drug molecules by a combined application of Ultraviolet and IR spectroscopy, Optical rotatory dispersion (ORD), Nuclear magnetic resonance spectroscopy, Circular Dichroism and Mass spectrometry. Application of spectroscopic and chemical techniques to the elucidation of the structures of natural products with particular reference to important alkaloids, steroids, saponins, flavonoids and terpenes.

M. Phil Part-I Course Works

Paper-II: Advanced Medicinal Chemistry 100 Marks

Course contents

1. Biomolecules

Unique properties of water, Acids and bases, pH, Salts, Tetravalency of carbon; Other small molecules: sugars, fatty acids, amino acids, nucleotides, Macromolecules, Monomer Polymer concept, Carbohydrates, Lipids, Proteins, Membranes, Nucleic acids; Chemictions in a cell Enzymes, Cofactors and vitamins, Metabolic pathways, Energy Inflow: photosynthesis in plants, Food intake in animals Outflow: Biosynthesis, growth and development, ATP, NADPH and other reductants

2. Protein structure prediction

Primary, secondary and tertiary structure of proteins-SCOP, DALIDD, CATH classification. Interatomic forces and protein structure, covalent interaction, hydrogen bonds, hydrophobic and hydrophilic interaction, charge/dipole interaction, Vander Waals forces, steric interaction. Determining protein structure with X-ray crystallography & NMR spectroscopy. Alpha helices, Beta sheets and turns- Protein Domains- ProDom, PFAM, SMART-Chou Fasman method- p(a), p(b) and p(turn) propensities, Garnier Osguthorpe and Robson(GOR) method. Threading-Homology modeling, CASP, Abinitio prediction. Molecular dynamics & conformational energy calculation, Prediction of function. Introduction to software: JPred, 3DPSSM, PhD, 123D, Modeller, Procheck, Rosetta.

3. General properties, chemistry, biological action, structure activity relationship and therapeutic applications of the following:

Antiseptics: Phenols and related compounds, halogens and halogen compounds, aromatic acid and esters, dyes, nitrofuran derivatives, formaldehyde and its derivatives, mercurochrome and thiomersal.
Sulphonamides: Prontosil, sulphanilamide, sulphapyridine, sulphadimidine, sulfamethoxazole, sulfadiazine and sulfafurazole.
Antimalarials: 4-Aminoquinolines, 8-aminoquinolines, 9-amino acridines, biguanides, pyrimidine analogues, mefloquine andcinchoha alkaloids.
Anthelmintics: Phenols and related compounds, piperazine derivatives, thiabendazole, mebendazole and pyrantal.
Diuretics: Mercaptomerins, merallurides, thiazides, sprironolactones, theophylline, furosemide, acetazolamiode, ethacrynic acid and triameterene.
Antitubercular drugs: Ethambutol, isonicotinic acid, hydrazid, rifampacin, pyrazinamide.
Antiviral drugs: Acyclovir, tromantadine hydrochloride and ribavirin.
Immunosuppressant agents: Azathioprine and cyclosporin.

Hormones: Steroidal hormones (testosterone, progesterone,estrogen, aldosteron and cortisol), proteinous hormones (insulin, glucagon, oxytocin and vassopressin).
Anaesthetics: Local anaesthetics (procaine, lignocaine, eucaine, cocaine and benzocaine), general anaesthetics (cyclopropane, halothane, nitrous oxide, chloroform, thiopental sodium, ketamine, methohexital, thioamylal sodium, fantanyl citrate, tribromo ethanol).

4. Occurrence, properties, preparation and application of the following official inorganic compounds:

Aluminium hydroxide, $mg(oh)_2$, ammonium chloride, sodium carbonate, magnesium carbonate, lithium carbonate, sodium nitrite, calcium gluconate, antimony gluconate, ferrous fumerate, ferrous sulfate and silver nitrate.