FACULTY OF LIFE SCIENCES

SYLLABUS

FOR

Interdisciplinary Course
Pharmaceuticals (UG & PG)

(Under Credit Based Continuous Evaluation Grading System)

Examinations: 2014-15

GURU NANAK DEV UNIVERSITY
AMRITSAR

Odd Semester
PHL-051 Drug Design and Drug Development
(For PG Students)

Credits (2-1-0)

1. **Drug Designing:** Objectives and Economic aspects of drug designing. Procedures followed in drug designing. Lead based Method: lead discovery, De novo drug designing, Structure based drug designing. Drug Development- Dissection of drug molecules into biofunctional moieties, biosteric replacement, lead optimization, QSAR and use of various molecular descriptors. Computer aided drug design-Molecular mechanics, designing of ligands for known and unknown receptors, various forces involved in drug receptor interactions, stereo chemical aspects of drug receptors interaction.
2. Introduction to dosage forms, classification, selection of route of administration. Preparation, evaluation and quality control tests for tablets, Hard& Soft gelatin capsules and parenteral dosage forms. Method and design for bioavailability study.
3. **Natural sources of drugs:** Plants, animals, microbes, mineral, marine and plant tissue cultures as sources of biomedicinals.
4. **An introduction to active constituents of natural drugs:** Their classification, properties, general methods of extraction and isolation.
5. **Natural Products as leads for new pharmaceuticals.**
6. **Principles of Experimental Pharmacology:** Basic principles of pharmacological evaluation of new chemical entity, animal models in pharmacological research, some standard techniques used in laboratory animals, euthanasia of experimental animals.Regulations for ethical treatment to laboratory animals. Alternatives to animals. Preclinical, safety and clinical evaluation of new drug.

Reading Material Recommended:

1. Manfred E Wolff, (ed), Burger's Medicinal Chemistry and Drug Discovery, Vol – I Principles and Practice, 5th Ed., Join Wiley and Sons, 1995.
2. J. G Vinter and Mark Gardner, (Eds.) Molecular Modelling and Drug Design, The Macmillan Press Ltd., London, U.K., 1994.
3. Comprehensive Medicinal Chemistry, Pcrgamon press, 1990, Vol. 4.
4. Lachman et. al. Theory and Practice of industrial Pharmacy. Varghese Publishing house. Hind rajasthan Building, Bombay-400014.
5. Trease and Evans Pharmacognosy, Ed. W.C. Evans, 14th Edn, Gopsons Papers Ltd.,Noida, India, 1997.

6. Plant Drug Analysis, H. Wagner, S. Bladt and E.M. Zgainski, Springer Verlag, NewYork, (Latest edition)
7. Pharmacopoeia of India, Govt. of India, Ministry of health and family welfare, Delhi, 1996.
8. Tyler, V.C.Brady, L.R. and Robers, J.E. Pharmacognosy. Lea and Febiger, Philadelphia.
9. Shah, C.S. and Quadry, J.S. Textbook of Pharmacognosy, B.S.Shah Publishers, Ahmedabad.
10. Wilson & Gisvold's Text Book of organic Medicinal and Pharmaceutical chemistry, 10th edition. J. B. Lippincott Co, Philadelphia, USA.
11. W.C. Foye, Principle of Medicinal Chemistry, Lea & Febiger, Philadelphia, USA.(Latest Edition)
12. H.G. Vogel and W.H. Vogel Drug Discovery and Drug Evaluation.Pharmacologicalassays.2nd edition Springer Verlag, Berlin, Germany,1997.
13. M.N. Ghosh, Fundamentals of Experimental Pharmacology,2nd edition, Scientific Book agency, Kolkota, India, 1984.
14. D.R. Laurence and A.L. Bacharach (eds.), Evaluation of Drug Activities: Pharmacometrics Vol.I and I I, Academic Press London, U.K., 1964.

Even Semester
PHL052-Pharmacokinetics & Biopharmaceutics
(For PG Students)

Credits (2-1-0)

1. Introduction to Pharmacokinetics and Biopharmaceutics, various terms used, Absorption, distribution, metabolism and excretion of drugs. Biological half life, Apparent volume of distribution
2. Fluid compartments, circulatory system and protein binding.
3. Compartment models
   3.1 One Compartment Open Model: Pharmacokinetics of single dose administration as applied to intravenous (rapid) and oral administration, Intravenous transfusion, Multiple intravenous and oral administration.

   3.2 Two Compartment Open Model: Pharmacokinetics of single and multiple dose administration, Intravenous transfusion.

4. Curve fitting- area under blood level curves
5. Urinary excretion studies, Sigma minus plot

Section B

6. Pharmacokinetic basis of sustained release formulations
7. Clinical Pharmacokinetics
   7.1 Hepatic elimination of drugs, Drug metabolism and its kinetics using one compartment and two compartment models. Liver extraction ratio and its relationship with absolute availability, Relationship between blood flow, Intrinsic clearance and hepatic clearance.

   7.2 Dosing of drugs in infants, elderly and obese patients.

   7.3 Dosage regimen adjustment in patients with and without renal failure. Dosage adjustments in uremic patients

Section C

8. Bioavailability and Bioequivalence: Definitions, Terminology, Clinical significance and factors affecting biological performance of drugs. Methods of determination of bioavailability using blood level and urinary excretion data, Parameters used to evaluate bioequivalence.
9. Non linear Pharmacokinetics: Concepts, Reasons for non-linear behavior and methods to ascertain non-linear kinetics.

BOOKS RECOMMENDED:

1) M. Gibaldi and D. Perrier (Eds), Pharmacokinetics 2nd Edition, Marcel Dekker Inc., New York, U.S.A., 1984.
2) L.Shargel and A.B.C.Yu. (Eds) Applied Biopharmaceutics and Pharmacokinetics, 5th Edition, Prentice Hall International, London, U.K.
3) R, E.Notari (Ed) Biopharmaceutics and Clinical Pharmacokinetics: an Introduction,4th Edition, Marcel Dekker Inc., New York,USA,2005(Indian Reprint).

Odd Semester

PHL001: Pharmaceutical Chemistry-I: Organic Chemistry

(For UG Students)

Credits (2-1-0)

1. **Structure and Properties:** Electronegativity. Dipole moment, Inductive and field effects. Covalent bonding. Hybridization, Multiple bonds. Bond lengths, bond angles and bond energies. Delocalized chemical bonding. Hyperconjugation. Tautomerism. Hydrogen bonding. Addition compounds. Organic acids.
2. **Stereochemistry (Basic Concepts):** Optical activity, Chirality, Enantiomers, Diastereomers, Relative and absolute configuration. D/L and R/S nomenclature. Racemic mixture and resolution. Geometrical isomerism. E/Z system of nomenclature. Conformations in open chain systems.
3. **Aliphatic Nucleophilic Substitution:** SN1, SN2, SNi and neighbouring groupmechanisms. Substitution at allylic, trigonal and vinylic carbon atoms. Effect of substrate structure, attacking nucleophile, and leaving group on reactivity. Hydrolysis of esters.
4. **Elimination Reactions:** E1, E2, E1-CB, E2-CB mechanisms, Saytzeff and Hoffman rules. Pyrolytic eliminations, Cleavage of quaternary ammonium hydroxides.
5. **Addition to Carbon/Carbon and Carbon/Hetero Multiple Bonds:** Electrophilic, nucleophilic and free radicals addition to carbon-carbon and Carbon/Hetero multiple bonds, orientation and stereochemistry.
6. **Alkanes:** Nomenclature, Physical properties, Industrial source and Preparation. Halogenation, combustion and pyrolitic reactions.
7. **Cycloalkanes:** Nomenclature, Physical properties, Industrial source and Preparation. Bayer's Strain theory, Conformations of cyclohoxanes and its monosubstituted derivatives.
8. **Alkenes, Dienes and Alkynes:** Nomenclature, physical properties, industrial source preparation and addition reactions. Polymerization of dienes. Acidity of alkynes.
9. **Alcohols:** Alkyl Halides and Ethers: Nomenclature, General methods of preparation, physical properties, chemical reactions and applications.
10. **Aldehydes and Ketones :** Structure, nomenclature, physical properties, industrial source, preparation and reactions. Acid/base promoted halogenation of ketones. Active Methylene compounds: Ethyl acetoacetate and diethyl malonate: synthesis and applications in organic synthesis. Michael, Mannich, Grignard, Reformatsky, Wittig and Perkin reactions. Aldol, Knoevengal and Bonzoin condensations.

Books Recommended (Latest editions unless specified):

1. R.T. Morrison and R.N. Boyd. Organic Chemistry, Allyl and Bacon Inc., Boston, USA.
2. I.L. Finar, Organic Chemistry, Vol. I and II, ELBS, Longman.
3. P. Sykes, A Guidebook to Mechanisms in Organic Chemistry, Orient Longman, New Delhi.

Suggested Readings:

1 J. March, Advanced Organic Chemistry, Reaction, Mechanisms and Structure, Wiley Eastern, New Delhi.
2 G. Solomon and C. Fryhle, Organic Chemistry, John Wiley & Sons, 1992.
3 S.H. Pine, Organic Chemistry, McGraw Hill Book.

Even Semester

PHL 002: Pharm. Chem. XI: Pharmaceutical Analysis

(For UG Students)

3 Credits (2-1-0)

1. Non-aqueous Titrations: Theoretical consideration, acid base equilibria in non-aqueous media, titration of acids and bases, indicators, Applications.
2. Complexometric Titrations: Concept of complexation and chelation, Warner's coordination number and electronic structure of complex ions, stability constants, titration curves, masking and demasking agents, types of complexometric titration, metal ion indicators, factors influencing the stability of complexes, EDTA-METAL ion Complexes, Determination of hardness of water.
3. Solvent Extraction: Liquid solid extraction, liquid-lequid extraction, separation of mixtures by extraction, distribution law, successive extraction, the craige method of multiple extractions, contineuous counter-current extraction, effect of various factors on extraction.
4. Chromatography: Introduction, types of chromatography, Liquid- Solid adsorption chromatography, Liquid-Liquid partition chromatography, paper chromatography, Ion exchange chromatography, Thin layer chromatography. Gas chromatography, (introduction, basic GLC apparatus, Carrier gas, sample introduction, columns, solid support, temperature effects), Applications.
5. Electrochemistry: The electric cell, electrode potential, half-cell and its types, sign convention. Nernst equation, the salt bridge, electrochemical- series standard potential, standard hydrogen electrode, measuring relative voltage of half cells, calculations of standard potential, reference electrodes and indicator electrodes

   (a) Potentiometry: Theoretical considerations, ion-selective electrodes, measurement of potential, Location of the end point, analytical applications, direct measurement of metal concentration, differential curve, determination of Ksp, pH measurements, pH meter, relation of pH to potential and applications.

   (b) Conductometric Methods: Introduction measurement of conductance and conducto metric titration.

   (c) Colorimetric Titration's: Principle, controlled potential colorimetry, Cell design, instrumentation, advantages and limitations, electrode selection and applications.

   (d) Polarography: Theory, dropping mercury electrode air current potential relationship. Polarization, choice of electrodes, effect of oxygen, instrumentation and applications.

6. Phase Solubility Analysis: Theory, experimental procedure and applications.

Books Recommended (Latest editions unless specified)

1. J. Bassett, R. C. Denney, G. H. Jeffery, J. Mendham, Vogel's textbook of Quantitative Inorganic Analysis, including Elementary Instrumental Analysis. The English Language book Society and Long man.
2. K.A. Conner, A Textbook of Pharmaceutical Analysis, Willey Interscience publication.
3. H. H. Willard. L. L. Merritt Jr and J. A. Dean, Instrumental Methods of Analysis, Van Nostrand Reinhold, New York, USA.

Suggested Reading (Latest editions).

1. Analytical Chemistry by D. A. Skoog and D. M. West.
2. Principles of Instrumental Analysis by D. A. Skoog and J. J. Lorry.