PAPER III - BIOPHARMACEUTICS AND PHARMACOKINETICS

Goal: To train the students in the area of biopharmaceutics and pharmacokinetics to work efficiently in the R&D Dept of industry, to take part in clinical research (clinical trials)

Objectives: Upon completion of the course, the candidate shall have the ability to:

- Calculate Pharmacokinetics parameters from the given data.
- Apply the principle of Pharmacokinetics in new drug development as well as in the design of new formulations.

COURSE DESCRIPTION

THEORY **50 Hours (T:2Hours/Week)**

1. **ABSORPTION OF DRUGS** **(8 Hrs.)**
   (Marks allotment : 20)

   Structure of cell membrane, Gastro-intestinal absorption of drugs, mechanisms of drug absorption, Factors affecting drug absorption: Biological, Physiological, Physico-chemical and Pharmaceutical. Absorption of drugs from non-per oral routes, Methods of determining absorption: *In-vitro, in-situ* and *in-vivo* methods.

2. **BIOAVAILABILITY** **(7 Hrs.)**
   (Marks allotment : 15)

   Objectives and consideration in bioavailability studies, Concept of equivalence, Measurement of bioavailability, Determination of the rate of absorption, Bioequivalence protocol and its importance, Bioequivalence studies.

3. **DISSOLUTION** **(3 Hrs.)**
   (Marks allotment : 10)

   BCS Classification, Noyes-Whitney's dissolutions rate law, Study of various approaches to improve dissolution of poorly soluble drug, *In-vitro* dissolution testing models, *In-vitro* release kinetic models, similarity and dissimilarity factors, biowaivers, *In-vitro- In –vivo* correlation.

4. **PHARMACOKINETICS** **(10 Hrs.)**
   (Marks allotment : 25)

   Basic considerations, Pharmacokinetic models, Compartment modeling: One compartment model - IV bolus, IV infusion, Extravascular; Multi Compartment models; Two compartment model - IV bolus, IV infusion, Extravascular, Three Compartment model in brief, Application of Pharmacokinetics in new drug development and designing of dosage forms and Novel drug delivery systems.

5. NON-LINEAR PHARMACOKINETICS (3 Hrs.)

(Marks allotment : 10)

Causes of non-linearity, Detection of non – linearity, Michaelis-Menten equation, Estimation of K_m and V_{max} with respect to individualization of a drug therapy.

6. NON-COMPARTMENT PHARMACOKINETICS (3 Hrs.)

(Marks allotment : 10)

Statistical moment theory, MRT for various compartment models, Physiological pharmacokinetic models.

7. DRUG DISTRIBUTION (3 Hrs.)

(Marks allotment : 10)

Factors affecting drug distribution, Volume of distribution, Protein binding- factors affecting, significance and kinetics of protein binding and drug displacement interactions.

8. BIOTRANSFORMATION (3 Hrs.)

(Marks allotment : 5)

Phase I (oxidative, reductive and hydrolytic reactions) and Phase II reactions (conjugation), factors affecting biotransformation.

9. EXCRETION OF DRUGS (3Hrs.)

(Marks allotment: 5)

Renal and non-renal excretion. Concept of clearance- renal clearance, organ clearance and hepatic clearance.

10. DOSAGE REGIMEN (7 Hrs.)

(Marks allotment : 20)

Multiple dosing with respect to I.V and oral route, concept of loading dose, maintenance dose, accumulation index, adjustment of dosage in renal and hepatic impairment, individualization of therapy, Therapeutic Drug Monitoring.

PRACTICALS **(T:6 Hours/Week)**

1. Improvement of dissolution characteristics of slightly soluble drugs by Solid Dispersion.
2. Improvement of dissolution characteristics of slightly soluble drugs by Solvent deposition.
3. Improvement of dissolution characteristics of slightly soluble drugs by complexation.
4. Improvement of dissolution characteristics of slightly soluble drugs by solvent evaporation.

5. Comparison of dissolution studies of two different conventional marketed products of same drug. - 2 experiments
6. Influence of polymorphism on solubility.
7. Influence of polymorphism on dissolution.
8. Protein binding studies of a highly protein bound drug.
9. Protein binding studies of a poorly protein bound drug.
10. Permeation study of drug through biological membrane.
11. Calculation of Ka, Ke, $t_{1/2}$, C_{max}, and T_{max} for two sets of data. -2 experiments
12. Calculation of bioavailability from urinary excretion data for two drugs. -2 experiments
13. Calculation of AUC and bioequivalence from the given data for two drugs. -2 experiments

SCHEME OF EXAMINATION

1.	**Synopsis**	**-**	**20 Marks**
2.	**Experiment**	**-**	**40 Marks**
3.	**Calculation**	**-**	**20 Marks**
4.	**Viva-voce**	**-**	**20 Marks**
	Total	**-**	**100 Marks**

REFERENCE BOOKS

1. Biopharmaceutics and Clinical Pharmacokinetics by Milo Gibaldi, 4th edition, Philadephia, Lea and Febiger, 1991.
2. Bio pharmaceutics and Pharmacokinetics-A Treatise, By D. M. Brahmankar and Sunil B.Jaiswal, Vallabh Prakashan Pitampura, Delhi
3. Applied Biopharmaceutics and Pharmacokinetics by Shargel. L and Yu ABC, 2nd edition, Connecticut, Appleton Century Crofts, 1985.
4. Textbook of Biopharmaceutics and Pharmacokinetics, Dr. Shobha Rani R. Hiremath, Prism Books Pvt Ltd, Bangalore, 2000
5. Biopharmaceutics and Clinical Pharmacokinetics by Milo Gibaldi, 2nd edition, Marcel Dekker Inc., New York,1982.
6. Current Concepts in Pharmaceutical Sciences: Biopharmaceutics, Swarbrick. J, Lea and Febiger, Philadelphia,1970.
7. Cilincal Pharmacokinetics, Concepts and Applications: By Malcolm Rowland and Thomas, N. Tozen, Lea and Febrger, Philadelphia, 1995.

8. Dissolution, Bioavailability and Bioequivalence, By Abdou H.M, Mack, Publishing Company, Pennsylvania 1989.
9. Biopharmaceutics and Clinical Pharmacokinetics-An introduction 4th edition Revised and expanded by Rebort F Notari Marcel Dekker Inc, New York and Basel, 1987.
10. Biopharmaceutics and Relevant Pharmacokinetics by John. G. Wagner and M. Pernarowski, 1st edition, Drug Intelligence Publications, Hamilton, Illinois,1971.
11. Encyclopedia of Pharmaceutical Technology, Vol 13, James Swarbrick, James, C. Roylan, Marcel Dekker Inc, New York 1996.

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2. Indian Drugs.
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