EX/BP 604T/2025

B. Pharmacy Third Year, Second Semester Examination, 2025

Biopharmaceutics and Pharmacokinetics

Time: Three hours **Full Marks: 75**

*Answer **five** questions taking at least **two** from **group-A** and at least **one** from **group-B** and **Group-C***

Group A

1. (a) Determine Ka by Wagner-Nelson method. Describe the Residual method for determination of Ka. 4+4 =8

(b) Deduce the time-concentration equation for drugs that follow non-linear elimination kinetics. 3

(c) A drug eliminates following nonlinear kinetics administered to a patient with two different doses, 300 and 500 mg, in two different situations. The values for Vmax of the drug in the patient are 55 mg and 85 mg/h. Calculate the Km of the drug in the patient. 4

2 (a) What are compartmental models? Which compartmental model is most acceptable? A drug is administered in blood and distributed in brain, liver and kidneys. It is eliminated through kidney. Using a compartmental model, derive the rate equations of all the compartments. 2+1+4 = 7

(b) A drug is metabolized in blood and then eliminated through urine, following an intravenous dose. Using a two-compartmental model, determine a relationship drug metabolized against time. 4

(c) Steady-state plasma concentration of the drug 18 mg/L in a patient. The apparent volume of distribution of the dose is 25 L, and the elimination rate is 0.14 h^{-1}. Find time taken by the drug to achieve 95% of the steady-state plasma concentration in the patient? When the rate of elimination is 0.11 h^{-1}, determine the rate of infusion. 4

3. Write short notes on: 5X3 = 15

(a) Assumptions of multi-compartmental models

(b) Chemical equivalent, pharmaceutical equivalent, bioequivalent, and therapeutic equivalent

(c) Flip-flop phenomenon

Group-B

4. Define absolute and relative bioavailability? Where did the 80-125% bioequivalence come from? What do you mean by clearance? How distribution and binding characteristics influences on drug clearance? Give examples of indicators used to determine GFR. Enumerate enterohepatic cycling of drugs. 2+2+2+2+2+5=15

5. Define sink condition. Write note on USP Dissolution Apparatus-I. How the bioavailability of poorly water-soluble drugs can be improved? 2+3+10=15

Group-C

6. What is passive diffusion? Express passive diffusion mathematically. Prove that passive diffusion follows first-order kinetics. What are absolute surface area and effective surface area? Write three reasons for the decrease in the dissolution rate due to reduced effective surface area. Discuss the absorption of drugs from non-oral extravascular routes, such as buccal/sublingual and rectal administration. 1+2+2 +2+3+5 = 15

7. i) Discuss Plasma protein-drug binding.

ii) Consider the distribution of salicylic acid having a pKa of 3.0 between the blood and gastric fluid. Assume that the pH of gastric fluid is 1.2 and the pH of blood is 7.4. Determine the percent ionization and unionization of salicylic acid in the gastric fluid and blood.

8+7=15