



Name : .....

Roll No. : .....

Invigilator's Signature : .....

**CS/B.PHARM (NEW)/SEM-6/PT-611/2013  
2013**

**PHARMACEUTICS ( BIOPHARMACEUTICS &  
PHARMACOKINETICS )**

Time Allotted : 3 Hours

Full Marks : 70

*The figures in the margin indicate full marks.*

*Candidates are required to give their answers in their own words  
as far as practicable.*

**GROUP – A**

**( Multiple Choice Type Questions )**

1. Choose the correct alternatives for any *ten* of the following :

10 × 1 = 10

- i) When hepatic extraction ratio of a drug is one, its clearance is said to be
- a) intrinsic capacity limited
  - b) perfusion rate limited
  - c) hepatic blood flow independent
  - d) none of these.



- ii) In curve stripping technique, flip-flop kinetics refers to the case where
- a)  $K_a/K_e > 3.0$                       b)  $K_a/K_e < 0.3$   
c)  $0.3 < K_a/K_e < 3.0$             d)  $K_e/K_a < 0.3$ .
- iii) Which of the following mechanisms is responsible for GI absorption of Vitamin B1 and B2 ?
- a) Passive diffusion                      b) Active Transport  
c) Facilitated diffusion                d) Pore transport.
- iv) The total number of micro-constants that can be calculated for a  $n$ -compartment model is
- a)  $2n$     b)  $2n - 1$   
c)  $2n + 1$                                         d)  $n - 1$ .
- v) The slope of a  $\log (\% \text{ unabsorbed})$  versus time plot is  $-0.4$ . Find out the first order absorption rate constant ( $K_a$ ).
- a)  $0.9212 \text{ hr}^{-1}$                                 b)  $1.1515 \text{ hr}^{-1}$   
c)  $0.8212 \text{ hr}^{-1}$                                 d)  $1.1212 \text{ hr}^{-1}$ .
- vi) Which of the following drugs shows rapid and pH independent absorption ?
- a) Oxazepam                                      b) Aspirin  
c) Imipramine                                    b) Chloroquine.
- vii) Which of the following lubricants promotes dissolution ?
- a) Magnesium stearate  
b) Purified talc  
c) Sodium lauryl sulphate  
d) Finely divided talc.



viii) Facillated Diffusion is

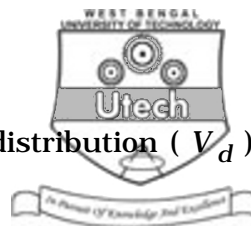
- a) Downhill process where energy is not required
- b) Downhill process where energy is required
- c) Uphil process where energy is not required
- d) Uphill process where energy is required.

ix) Orally administered Sabin Polio Vaccine and Large Protein Molecules are absorbed by

- a) Phagocytosis
- b) Pinocytosis
- c) Ion Pair Transport
- d) None of these.

x) Formula used for calculating Mean Residence Time (MRT) is

- |   |   |
|---|---|
| a) $\frac{\int_0^{\infty} C dt}{\int_0^{\infty} Ct dt}$ | b) $\frac{\int_0^t C dt}{\int_0^t Ct dt}$ |
| c) $\frac{\int_0^{\infty} Ct dt}{\int_0^{\infty} C dt}$ | d) $\frac{\int_0^t Ct dt}{\int_0^t C dt}$ |



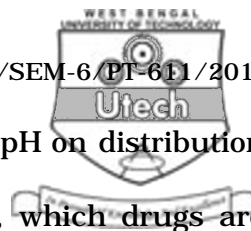
- xi) If a drug has a very small volume of distribution (  $V_d$  ), it is likely that this drug
- a) has short biological half life
  - b) does not accumulate in various tissues and organs
  - c) not bioavailable
  - d) will not be effective.
- xii) If the pKa value of a weakly basic drug is 8.4, then its percentage ionization in intestine ( intestinal pH = 7.4 ) is
- a) 90.99
  - b) 90.09
  - c) 90.19
  - d) 90.91.

### GROUP - B

#### ( Short Answer Type Questions )

Answer any *three* of the following.  $3 \times 5 = 15$

2. Explain why *in vivo* drug dissolution is always faster than *in vitro* drug dissolution.
3. After intravenous infusion of a drug it requires 6.6 biological half lives for the plasma concentration (  $C$  ) to reach 99% of the steady state concentration (  $C_{ss}$  ). Prove the statement mathematically.



4. What is the influence of change in plasma pH on distribution pattern of a drug ? Based on pKa values, which drugs are most affected and which will be least affected by a change in plasma pH ? Phenobarbital and salicylic acid have almost the same  $K_{o/w}$  but the former shows extensive distribution. Why.

$$1 \frac{1}{2} + 1 \frac{1}{2} + 2$$

5. Why the volume of distribution is apparent ? Can a drug have a value larger than total body water volume ? How ?
6. The amount of drug excreted in urine after an *i.v.* bolus dose of 250 mg of amoxicillin was as follows :

Time (t) in hr.	$X_u$ in mg	$dX_u$	$dt$	$t^*$	$dX_u / dt$	Log ( $dX_u / dt$ )
0	0					
0-2	40					
2-4	60					

After completing the table determine the first order elimination rate constant (  $K_E$  ) and excretion rate constant (  $K_e$  ) of the drug using rate of excretion method.



**GROUP – C**

**( Long Answer Type Questions )**

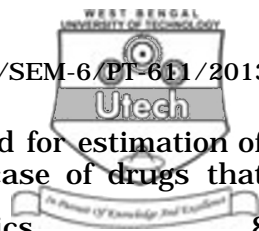
Answer any *three* of the following.  $3 \times 15 = 45$

7. a) Name the parameters examined in urinary excretion data to determine bioavailability. Differentiate between bioavailability and bioequivalence.
- b) The three pharmacokinetic parameters from urinary excretion data of a drug given as 50 mg oral formulations of two different companies, of which A is the innovator's product, are as follows :

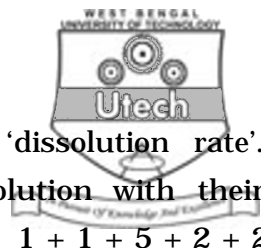
<i>Parameters</i>	<i>Formulation</i>	
	<i>A</i>	<i>B</i>
$(dX_u / dt)_{max}$ ( mg/hr )	6.0	8.0
$(t_u)_{max}$ ( hour )	2.0	1.0
$X_u^\infty$ ( mg )	39.1	35.9

- i) What is the relative availability of formulation B against A ?
- ii) Are the two formulations bioequivalent ?
- iii) If the drug is meant for treatment of an acute condition, which one of the two formulations is better ?
- c) Enlist the elements of a bioequivalence study protocol.

$6 + 6 + 3$



8. a) Enumerate the Loo-Riegelman method for estimation of absorption rate constant ( $K_a$ ) in case of drugs that exhibit two compartment characteristics. 8
- b) The plasma concentration obtained after 4 and 8 hours are 10 and 16  $\mu\text{g/ml}$  respectively after *i.v.* infusion of cefoperazone. If the apparent volume of distribution is 50 litres, then find out the following :
- Elimination rate constant ( $K_E$ )
  - Steady state concentration ( $C_{ss}$ )
  - Infusion rate ( $R_0$ ) to achieve the desired steady state
  - Loading dose to obtain  $C_{ss}$  rapidly. 3 + 2 + 1 + 1
9. a) In compartment modeling what does the term 'open' means ?
- b) Disposition of a drug that follows one compartment kinetics is a mono exponential process. Explain.
- c) The half life of propranolol in a 60 kg patient is 4 hr and  $V_d$  is 5.5 ltr/kg.
- Determine the total systemic clearance of the drug in ml/min.
  - What will be its renal clearance ( ml/min ) if fraction excreted unchanged in urine is 0.047 ?
  - If the drug is eliminated only by hepatic and renal routes, then what will be the hepatic extraction ratio if blood flow to the liver is 1.5 ltr/min ?
  - If the blood flow rate to the liver is reduced to 0.8 ltr/min what will be the new hepatic and total systemic clearance values ( ml/min ) ?
  - What is the % decrease in the overall clearance of the drug ? 1 + 6 + 2 + 2 + 2 + 1 + 1



10. a) Define the term 'dissolution' and 'dissolution rate'. Discuss the three theories of dissolution with their mathematical equations. 1 + 1 + 5 + 2 + 2
- b) If a tablet follows Hixson and Crowell's cubic root law of dissolution having original drug content 343 mg. After 6 hours of dissolution amount of drug released was 279 mg, then calculate the dissolution rate constant. 4
11. a) Based on pH-partition theory, predict the degree of ionization and absorption of weak acidic drug salicylic acid ( $pK_a$  3) in stomach (pH 1.2) and blood (pH 7.4).
- b) Define displacement interaction. What characteristics of the displacer and the displaced drug are important for displacement interactions to be clinically significant ?
- c) Displacement of a drug with a large  $V_d$  from its plasma protein binding site may not produce significant toxic reaction, why ?
- d) How is the Scatchard plot useful in determining the number of binding sites and association constants ?

5 + 5 + 3 + 2

=====