U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

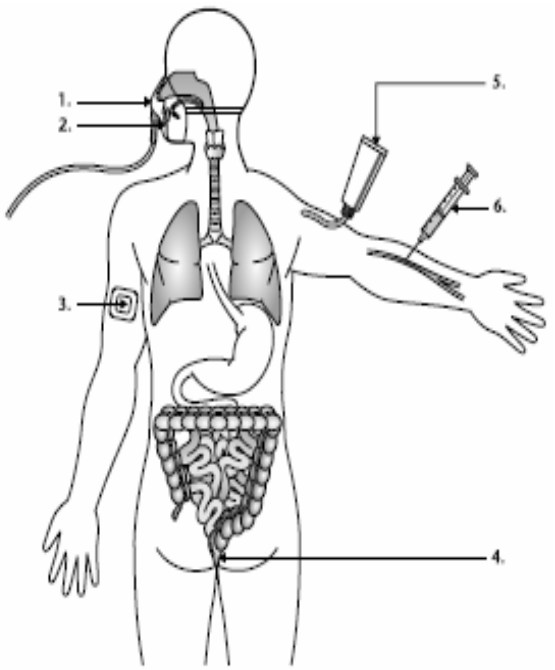
Autonomous Institute Affiliated to VTU

June 2025 Semester End Main Examinations

Programme: B.E. **Semester: VI**
Branch: Biotechnology **Duration: 3 hrs.**
Course Code: 23BT6PETAP **Max Marks: 100**
Course: Toxicology & Pharmacology

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

			UNIT 1	*CO*	*PO*	Marks
1	a)	 (i) Identify the routes of administration marked in the figure above.(3M) (ii) Differentiate between intravenous and intramuscular administrations(4M) (iii) Why are Drugs administered intravenously (IV) are considered to have 100% absorption into the systemic circulation (1M)	*CO1*	*PO 1*	**8**
	b)	A drug causes extreme irritation to soft tissues (subcutaneous tissue) when the drug comes in contact with these tissues. What is the more likely route of administration to be used and why?	CO1	*PO1*	**6**
	c)	What is bioavailability? List and explain any two factors affecting bioavailability of a drug.	CO1	*PO 1*	**6**
OR						
2	a)	Although oral administration of a drug is by far the easiest route of drug administration, it is not acceptable under certain situations. Why? Give reasons (any 3)	CO1	*PO 1*	**6**

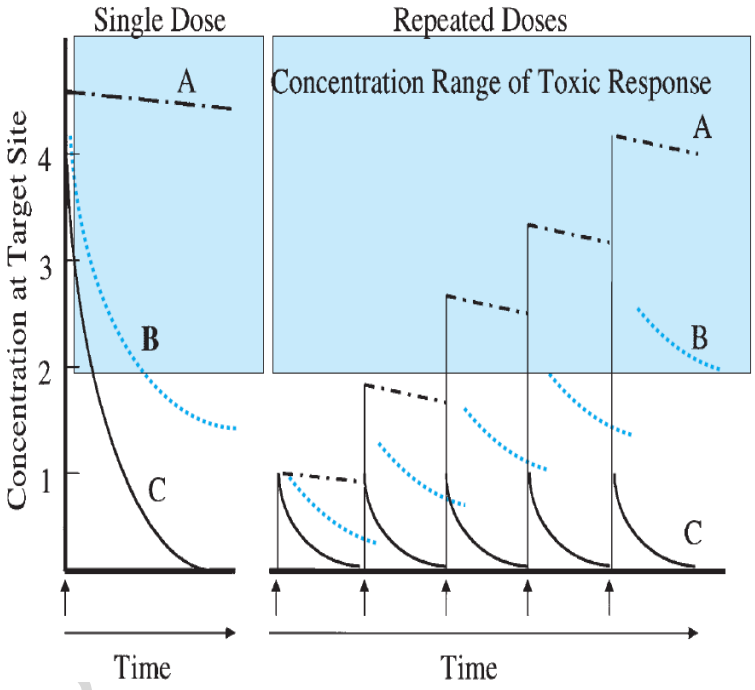
	b)	The route of administration critically effects the ADME properties of drug. Justify	CO1	*PO 1*	**8**
	c)	What is bioequivalence? What are the conditions that determine the bioequivalence of two drugs which are systematically absorbed in vivo?	CO1	*PO 1*	**6**

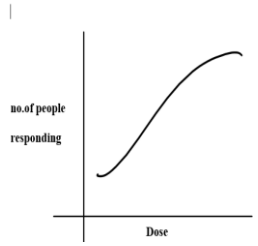
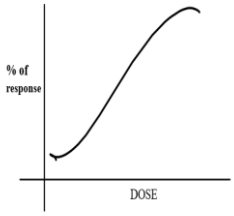
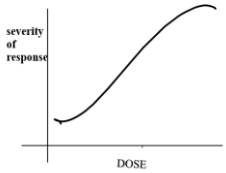
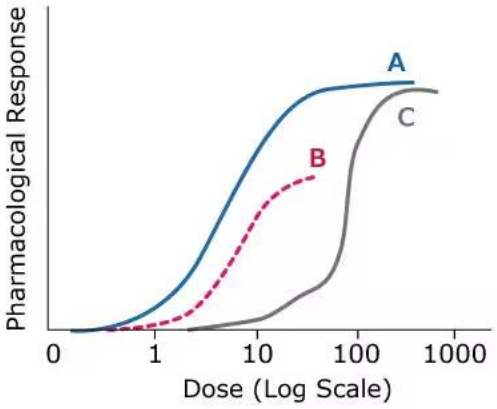
			UNIT 2			
	3	a)	How do the physicochemical characteristics, and competitive binding of drugs affect protein–drug binding? Explain with suitable examples. What is the significance of protein binding?	*CO2*	*PO1*	**10**
		b)	Differentiate between agonists & antagonists with suitable examples. Give a graphical representation of the dose response curves of agonists, partial agonists, antagonist & inverse agonist	*CO2*	*PO1*	**10**
			OR			
	4	a)	"The efficacy of therapeutic antibodies stems from various natural functions of antibodies". Justify this statement explaining their mechanisms of action (any four).	*CO2*	*PO1*	**10**
		b)	List and explain the factors (any 5) affecting drug action	*CO2*	*PO1*	**10**
			UNIT 3			
	5	a)	A drug that is being developed to lower blood pressure is in Phase 1 clinical trials. While the subject is taking the drug, a calcium channel blocker, you note the following symptoms: Decreased cardiac output, significant vasodilation, and a weakening of skeletal muscle strength. In addition, as the study is continued a worrisome elevation of SGPT and SGOT are noted. Which of these would you ascribe to type A and which to type B ADRs? Defend your decisions.	*CO3*	*PO5*	**8**
		b)	What is an antidote? List any three mechanisms of action brought about by them	*CO3*	*PO5*	**5**
		c)	What are the key factors to be considered for administration of drugs to neonatal and why?	*CO3*	*PO5*	**7**
			OR			
	6	a)	A 25-year-old man presents to the emergency department with a toothache. During the evaluation, the physician determines that the patient has been taking large doses of over-the-counter acetaminophen (paracetamol) along with an acetaminophen–hydrocodone product for the past 5 days. His daily dose of acetaminophen has been 12 g per day (maximum recommended dose, 4 g per day). He has no other medical problems and typically consumes two beers a day. The patient has no symptoms beyond his toothache, is not icteric, and has no hepatomegaly or right-upper-quadrant tenderness. His serum acetaminophen concentration 8 hours after the most recent dose is undetectable. His serum alanine aminotransferase concentration is 75 IU per liter, his serum bilirubin concentration is 1.2 mg per deciliter (20.5 μmol per liter) (indicative of hepatic injury). The emergency department physician contacts the regional poison-control center, which recommends treatment with acetylcysteine. (i) What is the cause of liver injury in this patient? (ii) How can acetyl cysteine (antioxidant) treatment alleviate the hepatic injury caused? Justify your answers explaining the metabolic pathway involved.	*CO3*	*PO5*	**8**

<table>
<tr><td></td><td></td><td>b)</td><td>What are phase II enzymes? What are the major types of Phase II biotransformation reactions mediated by drug metabolizing enzymes? Name a key enzyme responsible for each reaction type</td><td>CO3</td><td>PO5</td><td>8</td></tr>
<tr><td></td><td></td><td>c)</td><td>Define hepatic clearance. Give a mathematical representation of hepatic clearance and explain the terms.</td><td>CO3</td><td>PO5</td><td>4</td></tr>
<tr><td></td><td></td><td></td><td>UNIT 4</td><td></td><td></td><td></td></tr>
<tr><td></td><td>7</td><td>a)</td><td>The following dose – response from a chronic mouse study is being considered for use in a noncancer risk assessment. Use the data set to answer the questions below.

<table><tr><td>Dose (mg/kg)</td><td>0</td><td>1</td><td>2</td><td>4</td><td>8</td><td>16</td></tr><tr><td>Response</td><td>0</td><td>0</td><td>0</td><td>X</td><td>X</td><td>X*</td></tr></table>X * is a significant increase in hepatic necrosis.

(i) What is the NOAEL ?
(ii) What is the LOAEL?
(iii) What is the RfD?
Justify your answers</td><td>CO4</td><td>PO5,PO12</td><td>6</td></tr>
<tr><td></td><td></td><td>b)</td><td>Identify the type of toxicological interactions in the following conditions
(i) The effect observed when organophosphate insecticides are given together for inhibition of cholinesterase activity
(ii) both carbon tetrachloride and ethanol are hepatotoxic compounds, but together they produce much more liver injury
(iii) Isopropanol, is not hepatotoxic, but when it is administered in addition to carbon tetrachloride, the hepatotoxicity of carbon tetrachloride is much greater than when it is given alone
(iv) when two chemicals counterbalance each other by producing opposite effects on the same physiologic function.
(v) absorption, distribution, biotransformation, or excretion of a chemical is altered so that the concentration and/or duration of the chemical at the target organ are diminished
(vi) when two chemicals that bind to the same receptor produce less of an effect when given together than the addition of their separate effects</td><td>CO4</td><td>PO5,PO12</td><td>6</td></tr>
<tr><td></td><td></td><td>c)</td><td>List and explain the factors (any 4) that influence the development of toxicity.</td><td>CO4</td><td>PO5,PO12</td><td>8</td></tr>
<tr><td></td><td></td><td></td><td>OR</td><td></td><td></td><td></td></tr>
<tr><td></td><td>8</td><td>a)</td><td>The liver is the main organ where exogenous chemicals are metabolized and eventually excreted. As a consequence, liver cells are exposed to significant concentrations of these chemicals which can lead to liver dysfunction, cell injury or organ failure. “Justify this statement explaining the different types of toxic responses shown by liver with suitable examples (any 2)</td><td>CO4</td><td>PO5,PO12</td><td>8</td></tr>
</table>

		b)	Identify the type of toxic response in the following i. An immunologically mediated adverse reaction to a chemical resulting from previous sensitization to that chemical or to a structurally similar one. ii. Reaction to succinylcholine, causing prolonged muscle relaxation and breathing difficulties, result from genetic variations affecting enzyme metabolism. iii. Daughters of mothers who took diethylstilbestrol (DES) during pregnancy face increased risk of vaginal cancer. iv. Carbon tetrachloride produces tolerance to itself by decreasing the formation of the reactive metabolite (trichloromethyl radical) that produces liver injury. v. Teratogenic effect of chemicals. vi. Sneezing due to inhalation of irritant materials.	*CO4*	*PO5,PO12*	**6**
		c)	The graph below shows the relationship elimination rate and frequency of exposure of three drugs. Identify the toxic concentration of the three drugs justifying your answers.  Line A: A chemical with very slow elimination (e.g., half-life of 1 year). Line B: A chemical with a rate of elimination equal to frequency of dosing (e.g., 1 day). Line C: Rate of elimination faster than the dosing frequency (e.g., 5 h). The shaded area is representative of the concentration of chemical at the target site necessary to elicit a toxic response.	*CO4*	*PO5,PO12*	**6**
			UNIT 5			
	9	a)	Define and list the differences between LD_{50} and LC_{50}.	*CO4*	*PO5,PO12*	**8**

		b)	Identify the type of response curves shown below and describe their salient features A: X axis- Dose; Y Axis – no. of people responding  B: X axis- Dose; Y Axis – % of response  C: X axis- Dose; Y Axis – severity of response 	*CO4*	*PO5,PO12*	**12**
			OR			
	10	a)	Define the following terms. (i) Therapeutic index (ii) LC_{50} and LD_{50} (iii) Clonogenic assay (iv) Tachyphylaxis	*CO4*	*PO5,PO12*	**12**
		b)	Identify the nature of the drugs a-c  Based on the dose response curve shown below, answer the following: (i) Which drug(s) has maximum efficacy? (ii) Which drug(s) is more potent? (iii) Which drug(s) has maximal pharmacological activity per dosing? (iv) Which drug(s) initiate a response at lower concentrations?	*CO4*	*PO5,PO12*	**8**

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