

**SPECIAL SUPPLE B.TECH/BT/8<sup>TH</sup> SEM/BIOT 4246/2018**  
**MEDICAL AND PHARMACEUTICAL BIOTECHNOLOGY**  
**(BIOT 4246)**

**Time Allotted : 3 hrs**

**Full Marks : 70**

*Figures out of the right margin indicate full marks.*

*Candidates are required to answer Group A and  
any 5 (five) from Group B to E, taking at least one from each group.*

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

**Group – A**  
**(Multiple Choice Type Questions)**

1. Choose the correct alternative for the following: **10 × 1 = 10**
- (i) Which of the following pharmaceutical is typically NOT produced by direct chemical synthesis?
- |                |                |
|----------------|----------------|
| (a) Zidovudine | (b) Cimetidine |
| (d) Virtron    | (d) ketamine.  |
- (ii) Warfarin, a coumarin derivative, is therapeutically used as an
- |                    |                        |
|--------------------|------------------------|
| (a) antipyretic    | (b) analgesic          |
| (c) anti-coagulant | (d) anti hypertensive. |
- (iii) 2DGE is run so that proteins are separated on the basis of the following two properties
- |                               |  |
|-------------------------------|--|
| (a) size and pH               |  |
| (b) size and shape            |  |
| (c) shape and pI              |  |
| (d) shape and hydrophobicity. |  |
- (iv) Ion exchange based HPLC systems are used in biopharmaceutical analysis in which of the following categories?
- |   |  |
|---|--|
| (a) detecting deamidated forms of the biopharmaceutical   |  |
| (b) quantifying deamidated forms of the biopharmaceutical |  |
| (c) analysing impurities unrelated to the product         |  |
| (d) all of the above.                                     |  |
- (v) Which of the following amino acid residues are hydrolysed by acid incubation?
- |                   |                   |
|-------------------|-------------------|
| (a) Tryptophan    | (b) Aspartic acid |
| (c) Phenylalanine | (d) Histidine.    |

- (vi) A carrier for a peptide vaccine may be one that is used for the vaccination itself. An example of such a carrier is  
 (a) influenza hemagglutinin (b) tetanus toxoid  
 (c) plasmodium falciparum (d) tobacco mosaic virus.
- (vii) The first liver enzyme to rise in the blood when the bile duct gets obstructed is  
 (a) Alkaline phosphatase (b) Lactate dehydrogenase  
 (c) Gamma-glutamyltransferase (d) Alanine transaminase
- (viii) In a typical immunoassay, a target antigen is detected down to a  
 (a) milligram (b) microgram  
 (c) p.p.m. (d) parts per hundred.
- (ix) Which of the following is a recombinant erythropoietin?  
 (a) Proleukin (b) Neorecormon  
 (c) C-GSF (d) PDGF.
- (x) A non-invasive biosensor recognizes which of the following diagnostic fluids  
 (a) Sweat (b) Saliva  
 (c) Blood (d) both (a) and (b).

### Group - B

2. (a) Name four categories of tests that are undertaken on a potential new drug during pre-clinical trials. What are the properties that are generally measured to establish the pharmacokinetic profile of a drug? Define bioavailability of a drug using two common drug administration modes as examples.
- (b) Explain how recombinant DNA technology has assisted the production of pharmaceutically important proteins? *Use examples to illustrate each aspect of improvement.*
- (2 + 3 + 2) + 5 = 12**
3. (a) Give three examples of corticosteroids that find common clinical use. What are their clinical indications? Draw the chemical structure of the common antibiotic tetracycline. What is its mode of action? Give examples of two semi-synthetic and two natural tetracyclines.

- (b) What are the biological effects of interferons? Tabulate the producer cells of IFN- $\alpha$ , IFN- $\beta$  and IFN- $\gamma$ . Name three medical conditions that are ameliorated by the use of interferons.

$$(1.5 + 1.5 + 2 + 1 + 1) + (1 + 2 + 2) = 12$$

### Group - C

4. (a) What is a vaccine made of and how does it work? Name 3 cell culture systems from which viral vaccines are propagated.

- (b) What is the physiological mechanism behind the action of a DNA vaccine?

$$(2 + 3 + 2) + 5 = 12$$

5. (a) Explain in simple terms how the subject of pharmacogenomics has influenced modern medical treatment?

- (b) What is the basis of monoclonal antibody production by hybridoma technology?

- (c) Name and briefly describe three clinical applications of monoclonal antibodies.

$$4 + 3 + 5 = 12$$

### Group - D

6. (a) How is proteomics utilized in new drug development? Name two diseases where the the development of biomarkers have been particularly prolific. What are the requirements of an ideal biomarker? What are the characteristics of a protein that make it a definite biomarker?

- (b) How does size exclusion (SE) HPLC find use in the pharmaceutical industry? Briefly outline its operating principles.

$$(3 + 1 + 2 + 2) + (2 + 2) = 12$$

7. (a) Name four types of immunoassays. Draw a flowchart to represent the development, optimization and validation of an immunoassay.

- (b) What are the biotechnological utilities of peptide nucleic acid?

- (c) Name seven methods to characterize protein-based finished product biopharmaceuticals (*three of them must be separation technology based methods*).

$$(2 + 4) + 3 + 3 = 12$$

**Group - E**

8. (a) What are the differing characteristics of invasive and non-invasive biosensors? Explain with 2 examples in each category.

(b) Draw a schematic diagram of *an optical biosensor* explaining its operating principles. How can such a biosensor be used for DNA detection?

**(4 + 2) + (4 + 2) = 12**

9. (a) What are the enzymes in blood plasma that are indicators of myocardial infarction? How have they been used for clinical diagnostics? Explain using time-course curves for the respective enzymes.

(b) How have multiwalled carbon nanotubes been used to make a glucose micro-sensor? Explain the essential operation of a glucose biosensor with a diagram and biochemical reaction involved.

**(3 + 4) + (2 + 3) = 12**