Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/M.TECH (BT-OLD)/SEM-3/MBT-304C/2011-12

2011

BIOPHARMACEUTICALS

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) Which is the first Interleukin to be medically approved by FDA ?

a) IL-2 b) IL-4

c) IL-6 d) IL-10.

ii) Lymphotoxin is another name for

a) TNF-alpha b) TNF-beta

c) TGF-beta d) Interleukins.

iii) The factor responsible for wound healing is

a) TNF b) FGF

c) PDGE d) IL-7.

iv) Milk intolerance therapy uses

a) Amylase b) Glucose oxidase

c) Proteolytic enzyme d) Lactase.

v) Blood clotting process is linked to

a) Vitamin *B*12 b) Vitamin *C*

c) Vitamin *K* d) Blood pH.

vi) A 'biosimilar' drug is different from a 'generic' drug in which of the following aspects ?

a) Active ingredients of biosimilars are huge molecules with intricate structures

b) Minute variations in production protocol of biosimilars yield small differences

c) Safety and therapeutic indices of biosimilars different from the originals

d) All of these.

vii) The 'prior art' of a standard new drug discovery / development patent application draws information mainly from

a) published research articles

b) pre-existing patents

c) unpublished research articles and patents in process of approval

d) (a) and (b).

viii) In pharmacokinetics, the current plasma level of the drug is given by

a) $[\text{ Drug }]_{plasma} = \text{Dose}/(\text{ Volume })_{plasma} \propto e^{-kT}$

b) $[\text{ Drug }]_{plasma} = \text{Dose}/(\text{ Volume })_{plasma}$

c) $[\text{ Drug }]_{plasma} = \text{Dose} \propto (\text{ Volume })_{plasma}$

d) $[\text{ Drug }]_{plasma} = \text{Dose}/(\text{ Volume })_{plasma} \propto e^{+kT}$.

ix) Purification protocol of a biopharmaceutical in the IPC stage of drug development is important for which of the following reasons ?

a) It is the basis of subsequent pilot scale purification system development

b) It is the basis of subsequent process scale purification system development

c) It is the basis of subsequent Quality Control (QC) identity tests

d) All of these.

x) Humatrope is the

a) recombinant human glucagons

b) recombinant human growth hormone

c) recombinant human *t*PA

d) recombinant human *h*CG.

xi) OKT3 is the

a) first MAbs got the approval as drug

b) first MAbs purified

c) first gene therapy product in the market

d) first polyclonal Ab in the market.

xii) Insulin Lispro is

a) first recombinant fast-acting insulin analogue

b) first recombinant slow-action insulin analogue

c) first recombinant human insulin

d) all of these.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. Using the two modes of pulmonary drug delivery and ocular drug delivery as examples, explain (a) the primary parameters that decide choice / preference of a drug delivery route. (b) Why is parenteral administration preferred for life-saving drugs ? Use appropriate equations in your answer.3 + 2

3. Describe the use and mechanism of action of Anti-D immunoglobulin acts as a biopharmaceutical.

4. Illustrate on the therapeutic uses of Asperginase and Erythropoietin.

5. Mention the applications of Erythropoietin as a biopharmaceutical.

6. a) What are the major medical / biomedical tests conducted on a potential new biopharmaceutical during the pre-clinical phase of drug development ?

   b) Itemize how a pharmacokinetic and pharmacodynamic profile of a new biopharmaceutical is obtained.

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

7. Describe with diagram the production of monoclonal antibodies.

8. Describe the process of artificial blood substitute for oxygen transfer.

GROUP – C
(Long Answer Type Questions)

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

9. a) Explain in tabular form the various phases of the clinical trial process with relevant parameters.

   b) Enhanced knowledge of disease pathways is providing new opportunities for the rational development of combination therapies for disease conditions including cancer, cardiovascular disease and infectious disease. Why is it necessary for good regulatory agencies to provide guidance to develop better clinical trial design for proof of concept Phase II studies of these combination therapies ?

   c) Part of reputable worldwide pharmaceutical GMP is comprehensive documentation. Outline 3 reasons for such a necessity. What are the 4 main categories of pharmaceutical plant documentation ? Itemize the main categories of SOP documentation in this area. 5 + 6 + 4

10. a) Write the names of four different biopharmaceuticals which are human hormones and their therapeutic uses.

    b) Describe with diagram the proteolytic processing of pro-insulin to mature insulin.

    c) Describe in detail with diagram, the production of human insulin by *r*DNA technology.

    d) Write commercial names of three different recombinant human hormones and names of the company which produce these hormones. 4 + 3 + 5 + 3

11. a) Discuss on the importance of cytokine therapy with a relevant example in cancer therapeutics. 5

    b) Write short notes on any *two* of the following : 2 × 5

        i) Platelet derived growth factor

        ii) Fibroblast growth factor

        iii) Epidermal growth factor.

12. a) Draw a simple diagram of the signal transduction process mediated by the JAK-STAT pathway. What are the essential elements of the signal transduction pathway elicited by IFN-γ ? What are the cell types that participate in various immune type responses that is presented by this interferon ? 3 + 2 + 2

    b) Define the concept of biosimilar drugs. Cite three examples of biosimilar drugs. What technical, medical and commercial reasons prompted the spurt in development of biosimilar drugs ? Why were new GMP and IPR guidelines necessary for biosimilar drugs ?

    2 + 2 + 2 + 2

13. What are different blood clotting disorder diseases ? Show genesis of different blood cells from hematopoietic stem cells ? Write a short note on production of glycoprotein pharmaceuticals using CHO-cell line. 4 + 6 + 5

14. a) Describe the blood coagulation cascade.

    b) Write the names of three biopharmaceuticals which are used as thrombolytic agents and the names of the company which produce these agents.

    c) Write the mechanism of action *t*PA as thrombolytic agent (with a diagram only).

    d) How can you produce *t*PA by *r*DNA technology ?

3 + 3 + 4 + 5