

**ANIMAL CELL CULTURE & ANIMAL BIOTECHNOLOGY  
(BIOT 4135)**

**Time Allotted : 2½ hrs**

**Full Marks : 60**

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

*Candidates are required to answer Group A and  
any 4 (four) from Group B to E, taking one from each group.*

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

**Group – A**

1. Answer any twelve:

**12 × 1 = 12**

*Choose the correct alternative for the following*

- (i) The human fibroblast is a classic example of  
(a) stable primary cell lines (b) established cell lines  
(c) cell transformations (d) none of these
- (ii) Disaggregating of cells can be performed by  
(a) Physical disruption (b) Enzymatic digestion  
(c) Treating with chelating agents (d) All of the above
- (iii) Sodium bicarbonate is added to animal cell culture media to  
(a) keep cells stuck to the plastic  
(b) promote the uptake of CO<sub>2</sub> into animal cells  
(c) maintain the correct pH when CO<sub>2</sub> is present  
(d) keep iron soluble
- (iv) Nonideal reactors are determined by  
(a) Reynold's number (b) mixing time  
(c) dispersion number (d) Residence time distribution.
- (v) In Monod chemostat model, it is to be noted that near washout, the reactor is very sensitive to variation in  
(a) D (dilution rate) (b) S (substrate conc.)  
(c) X (cell mass conc.) (d) None of these
- (vi) Which of the following gene editing tool is not a nuclease?  
(a) ZFN, (b) TALEN,  
(c) Cre-Lox, (d) CRISPER/Cas9
- (vii) For making transgenic animals in fertilized egg the best place to insert trans-gene is in?  
(a) female pronuclei, (b) cytoplasm,  
(c) male pronuclei, (d) cleavage cell

- (viii) An humanized antibody is one in which the  
 (a) heavy and light chains are from human.  
 (b) heavy chain id from human and light chain is from mouse.  
 (c) light chain is from human and heavy chain from mouse.  
 (d) CDR's are from mouse and the rest is from human.
- (ix) In the case of monoclonal antibody production by hybridoma technology, myeloma cells used lack the enzyme hypoxanthine-guanine-phosphoribosyl transferase (HGPRT) such that fused cells can only survive when selected on hypoxanthine-aminopterin-thymidine (HAT) What is the role of aminopterin in this medium?  
 (a) To be used as cell cycle inhibitor of myeloma cells.  
 (b) To block the pathway of nucleotide synthesis.  
 (c) To facilitate fusion of myeloid B cells and antibody producing B cells.  
 (d) To facilitate production antibody producing B cells
- (x) Which one of the following statements is incorrect about hybridoma production?  
 (a) Hybridoma cells can use hypoxanthine and thymidine.  
 (b) DNA synthesis in myeloma cells is blocked by aminopterin.  
 (c) Hybridoma cells are made to produce polyclonal antibodies.  
 (d) Polyethylene glycol is used to fuse myeloma cells to B-cells 2

*Fill in the blanks with the correct word*

- (xi) In Monod Chemostat Model,  $D_{max}$ , the dilution rate for maximum cell output can be evaluated by \_\_\_\_\_.
- (xii) In Monod Chemostat Model as  $D \rightarrow 0$ ,  $S \rightarrow$  \_\_\_\_\_ and  $X \rightarrow$  \_\_\_\_\_.
- (xiii) CRISPR/Cas9 is \_\_\_\_\_ tool.
- (xiv) In SCID treatment by gene therapy defective gene is replaced by normal \_\_\_\_\_ gene.
- (xv) Serum supplies \_\_\_\_\_ in animal cell culture media.

### **Group - B**

2. (a) What are the different types of methods used for disaggregation of animal tissue or organ fragment? What are the different enzymes used for disaggregation of animal tissues. [[CO1](Remember /LOCQ)]
- (b) Explain the procedure involved in warm and cold trypsinization for the preparation of primary culture from animal tissue fragment? [[CO2](Remember/HOCQ)]
- (c) Write three important advantages of cold trypsinization over warm trypsinization. [[CO2](Apply/IOCQ)]
- (2 + 2) + (2.5 + 2.5) + 3 = 12**
3. (a) Draw and write names three type of animal culture vessels for the following types of animal cell cultivation systems: (i) Static cultivation system, (ii) Semi-dynamic cultivation system, (iii) Dynamic cultivation system. [[CO1](Remember/LOCQ)]

- (b) (i) Explain the principle of flowcytometry and different parts of flowcytometer with a diagram. (ii) Explain the application of flowcytometry to analyse human blood cells based on their size, with standard experimental result. [[CO2](Explain/IOCQ)]
- (c) Write the principle of MTT assay for testing of cytotoxicity of chemical X for animal cell culture. [[CO2](Remember/LOCQ)]
- (3 × 1.5) + (2 + 2) + 3.5 = 12**

### Group - C

4. (a) Why CO<sub>2</sub> incubator is required for animal cell culture? [[CO4](understand/LOCQ)]
- (b) How do you control CO<sub>2</sub> partial pressure in CO<sub>2</sub> incubator? [[CO4](Remember/LOCQ)]
- (c) Why perfusion system is needed for animal cell culture reactor? [[CO4](understand/LOCQ)]
- (d) How much CO<sub>2</sub> partial pressure is generally maintained in CO<sub>2</sub> incubator. [[CO4](Remember/LOCQ)]
- 2 + 4 + 4 + 2 = 12**
5. (a) Monod model is an empirical model – justify the statement. [[CO4](Justify/LOCQ)]
- (b) Animal cells are growing to produce antibody in a CO<sub>2</sub> incubator. Doubling time of the cells as recorded  $t_d = 1.95$  hrs. The saturation constant for the substrate is  $K_S = 1.15$  kg/ m<sup>3</sup> and yield coefficient  $Y_{X/S} = 0.45$ . For a chemostat operation with a feed rate ( $S_0 = 33$  kg/m<sup>3</sup>) calculate the following: (i) Cell concentration when the dilution rate,  $D = 0.65 D_{max}$  output. (ii) Substrate concentration when the dilution rate,  $D$  is  $0.70 D_{max}$ . (iii) Maximum dilution rate for maximum output of cells. [[CO4](Evaluate/HOCQ)]
- 3 + (3 + 3 + 3) = 12**

### Group - D

6. (a) Write the names different physical, chemical and biological based gene transfer methods into animal cell. Describe the principle and steps of gene transfer into animal by calcium phosphate precipitation method. [[CO5](Remember/LOCQ)]
- (b) Explain the principle of stable and transient transfection in animal cell with labelled diagram. [[CO5](Explain/IOCQ)]
- (c) Explain the steps of production of multimeric proteins in mammalian cell system, based on (i) Two-gene expression vector, with labelled diagram, (ii) bicistronic vector system. [[CO5](Explain/IOCQ)]
- (2 + 2) + (1.5 × 2) + (2.5 + 2.5) = 12**
7. (a) What is genome editing? Write the names of four modern techniques for genome editing. Describe steps of the most popular techniques of genome editing with diagram. [[CO5](Analyse/HOCQ)]
- (b) Write about the application of gene editing in gene therapy. [[CO5](Apply/IOCQ)]
- (c) Write the names three different biopharmaceutical produced from transgenic animals. Explain the strategy and steps of production anyone of the biopharmaceutical you mentioned transgenic animals. [[CO5](Remember-explain/IOCQ)]
- (1 + 1 + 3) + 2 + (2 + 3) = 12**

## Group - E

8. (a) Using only a labelled diagram describe the steps of ES cell collection. *[(CO6)(Remember/LOCQ)]*
- (b) Describe the approaches of stem cell therapies for neurological disease using transplantation of neural stem cells. *[(CO6)(Remember/LOCQ)]*
- (c) Explain with examples the differences between biopharmaceuticals and biosimilars. *[(CO6)(Explain/IOCQ)]*
- (d) With labelled diagrams describe the steps of Baculovirus and insect cell expression system for biomanufacturing of biopharmaceuticals. *[(CO6)(Apply/IOCQ)]*
- 3 + 3 + 2 + 4 = 12**
9. (a) What is organ culture? objective of it? How does it differ from organotypic culture? *[(CO6)(Remember/LOCQ)]*
- (b) What are the limitation of using adult stem cell? *[(CO6)(Remember/LOCQ)]*
- (c) What is regenerative medicine? How stem cells can be used as a source of neurons for transplantation in Parkinsonism's disease? *[(CO6)(Apply/IOCQ)]*
- (1 + 3) + 3 + (1 + 4) = 12**
- 

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	45.83	34.37	19.79