

SPECIAL SUPPLE B.TECH/BT/7TH SEM/BIOT 4101/2018

**ANIMAL CELL CULTURE AND ANIMAL BIOTECHNOLOGY
(BIOT 4101)**

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 is used for disaggregation of tissue in animal cell culture?
(a) DNA polymerase (b) RNA polymerase
(c) Trypsin (d) None of these.
- (ii) The primary cell culture becomes a cell line only after
(a) 1st passage (b) 3rd passage
(c) 5th passage (d) none of these.
- (iii) The maximum cell production is achieved in a reactor of the type
(a) HFBR (b) porous microcarrier
(c) air-lift fermentor (d) microencapsulation.
- (iv) The product formation from animal cell culture has the kinetics of the type
(a) growth associated (b) non-growth associated
(c) Monode model (d) combination of (a) & (b).
- (vi) The product commercially produced by animal cell culture is
(a) insulin
(b) tissue plasminogen activator
(c) interferon
(d) hepatitis B vaccine.
- (vii) First human immortal cell line is
(a) H1299 (b) HeLa (c) NIH-3T3 (d) CHO.

- (viii) Phenol red, commonly present in animal cell culture medium and it becomes
- (a) Yellow at pH = 6.5
(b) red at pH = 7.4
(c) both (a) and (b)
(d) none of these.
- (ix) In animal cell culture medium serum provides
- (a) various salts
(b) hormones and growth factors
(c) carbohydrates
(d) none of these.
- (x) Trypan blue dye-exclusion is based on the concept that
- (a) viable cells are permeable to the dye,
(b) only the mitochondria of the viable cells take up the dye,
(c) dead cells are permeable to the dye,
(d) none of these.

Group – B

2. (a) What are the different types of methods used for disaggregation of animal tissue or organ fragment? What are different enzymes used for disaggregation of animal tissue or organ fragment?
- (b) Describe briefly the procedure involved in cold trypsinisation for the preparation of primary culture from animal tissue or organ fragment.
- (c) Write three important advantages of cold trypsinization.
(3 + 3) + 4 + 2 = 12
3. (a) How animal cells are stored in laboratory?
- (b) Discuss the method for thawing and recovering of animal cells from a frozen sample.
- (c) How you can determine the viability and cell number using hemocytometer and trypan blue staining?
4 + 4 + 4 = 12

Group – C

4. (a) Some animal cells are immobilized in a microcarrier beads of sephadex of 8 mm diameter with cells loading of 0.018 kg/m³. 100 such cells are introduced in a 1.5 L CSTR stirred at 20 rpm. The kinetics of the system

can be approximated as first order with rate constant $3.11 \times 10^5 \text{ sec}^{-1}$ per Ks cell mass.

(i) What is the feed rate of substrate ($S_0 = 3.2 \times 10^{-3} \text{ Ks/m}^3$) for 80% conversion of the substrate? (ii) If the diffusivity of substrate the beads is $De = 2.1 \times 10^{-9} \text{ m}^2/\text{s}$, what is the value of Thiele parameter, ϕ ? Comment on the intra particle diffusion effect in the system.

- (b) Explain how perfusion reactor functions to achieve the best performance in the animal cell reactor with respect to product formation.

(5 + 3) + 4 = 12

5. (a) Animal cell culture is carried out in a Bubble column reactor with a volumetric mass transfer coefficient, k_{la} of 10 hr^{-1} at an air flow rate of 4 L/min . If the rate of O_2 uptake by some animal cell culture is $0.2 \text{ mmol O}_2/(\text{gm of dry cell}) (\text{hr})$ and the critical oxygen concentration is above 10% of solution (8ppm) and the cells are grown in the above column; what is the maximum concentration of cells that can be maintained in the reactor?

(b) Animal cells are growing in a $5 \text{ m}^3 \text{ C S T R}$ with blood serum as feed. Feed substrate conc., $S_0 = 20 \text{ kg/m}^3$. Animal cell culture have the following characteristics : $\mu_{\text{max}} = 0.45 \text{ hr}^{-1}$, $K_s = 0.8 \text{ kg/m}^3$, $Y_{x/s} = 0.8$. What feed flow rate is required to achieve 90 % conversion of the substrate?

(c) What are the different kinds of spheroids? How can you use spheroids in medical biotechnology?

4 + 4 + (1 + 3) = 12

Group – D

6. (a) What is superovulation? How it is induced?

(b) Write the names different biopharmaceutical produced from transgenic animals.

(c) Describe the three major types of method of introduction of exogenous DNA into animal cells with labeled diagram.

(1 + 2) + 3 + 6 = 12

7. (a) Describe the steps of IVF with labeled diagram.

- (b) What are chimera? Define gene targeting and gene trapping.
- (c) Describe four types of Inhibitory "Anti-Gene" expression strategies as therapeutic agents.

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

Group - E

8. (a) What is organ culture and its objective? How does it differ from organotypic culture?
- (b) What are the limitation of using adult stem cell?
- (c) What is regenerative medicine? How stem cells can be used as a source of neurons for transplantation in Parkinsonism's disease?

$$(1 + 3) + 3 + (1 + 4) = 12$$

9. (a) Describe generation of human induced pluripotent stem cells for use in cell therapy.
- (b) Describe the application of stem cells for the treatment of haemophilia and diabetes mellitus.
- (c) Describe the process of cell fusion by (i) virus mediated method and (ii) electrofusion method in hybridoma technology, with label diagram.

$$3 + 3 + (3 + 3) = 12$$