

Code: 9A23603

R09

B.Tech III Year II Semester (R09) Supplementary Examinations December/January 2015/2016

TRANSPORT PHENOMENA IN BIOPROCESS

(Biotechnology)

Time: 3 hours

Max. Marks: 70

Answer any FIVE questions
All questions carry equal marks

- 1 (a) Explain the driving force and mechanism of momentum transport with biological applications.
(b) Describe and estimate the Newton's law of viscosity.
- 2 A Newtonian fluid is flowing in laminar motion over an inclined flat plate give a labeled schematic of the problem. Write assumptions required for formulation mathematical model of the problem. Estimate the shear stress distribution, velocity distribution, maximum velocity, average velocity; drag on the plate and expression for Reynolds number.
- 3 (a) Estimate the operating line equation for equation of motion.
(b) Demonstrate dimensionless and explain various dimensionless numbers with significance.
- 4 Microcarrier beads $120\ \mu\text{m}$ in diameter are used to culture recombinant CHO cells for production of growth hormone. It is proposed to use a 6 cm turbine impeller to mix the culture in a 3.5 liter stirred tank. Air and Carbon Dioxide are supplied by flow through the reactor headspace. The microcarriers suspension has a density of approximately $1010\ \text{kg/m}^3$ and a viscosity of $1.3 \times 10^{-3}\ \text{Pa.S}$. Estimate the maximum allowable stirrer speed which avoids turbulent shear damage of the cells.
- 5 Explain the following terms:
 - (a) Fourier's law.
 - (b) Thermal conductivity.
 - (c) Radiation.
- 6 Explain and estimate the operating line equation for heat conduction with a electrical heat source with bioprocess applications.
- 7 Estimate the working line equation for diffusion through a stagnant gas film.
- 8 (a) Describe medium properties.
(b) Estimate the mass transfer coefficient $K_L a$ by using dynamic method.
