Code: R5102306

R05

B. Tech I Year (R05) Supplementary Examinations, May 2012

PROCESS ENGINEERING PRINCIPLES

(Biotechnology)

Time: 3 hours Max Marks: 80

Answer any FIVE questions
All questions carry equal marks
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1. (a) Define unit operations and unit processes, giving examples from field of biotechnology.
   (b) Give any four applications of heat transfer in bioprocessing.

2. (a) Convert the heat transfer coefficient of value 100 Btu/hr.ft^2.ºF into W/m^2.ºC
   (b) What are standard conditions? State ideal gas law and give the range of its applicability.
   (c) Calculate the volume in cubic meters, occupied by a 40 kg of CO_2 at standard conditions.

3. (a) Derive barometric equation.
   (b) Water at 20ºC is pumped at a constant rate of 9m^3/h from a large reservoir resting on the floor to the open top of an experimental absorption tower. The point of discharge is 5m above the floor, and friction losses in the 50 mm pipe from the reservoir to the tower amount to 2.5 J/kg. At what height in the reservoir must the water level be kept if the pump can deliver only 0.1 kW?

4. (a) Draw the shear stress versus velocity gradient diagram for Newtonian and non-Newtonian fluids.
   (b) Discuss different types of non Newtonian fluids with examples in bioprocessing.
   (c) Write about the construction and working principle of plate and cone viscometer with the help of a schematic diagram.

5. (a) What are skin and form frictions? Explain them with the help of neat schematic diagrams.
   (b) Discuss the equations for finding pressure drop due to skin and form frictions.
   (c) Water is flowing at 32ºC through a long horizontal plastic pipe 75 mm in inside diameter, at a velocity of 2 m/s. Calculate the pressure drop in N/m^2 per 100 m of pipe.

6. (a) Explain the concept of fluidization. Obtain the equation for minimum fluidization velocity .
   (b) Particles of sphalerite (specific gravity 4.00) are settling under the force of gravity in carbon tetrachloride at 20ºC (specific gravity 1.594). The diameter of the sphalerite particles is 0.10 mm. The volume fraction of sphalerite in CCl_4 is 0.20. What is the settling velocity of the sphalerite? Viscosity of CCl_4 at 20ºC is 1.03 cP.

7. (a) Describe the construction and working of venturi meter with the help of a schematic diagram.
   (b) A horizontal venturimeter having a throat diameter of 25 mm is set in 75 mm inner diameter pipeline. Water at 24 ºC is flowing through the line. A manometer containing mercury under water measures the pressure differential over the instrument. When the manometer reading is 476 mm, what is the flow rate in m^3/hr? If 10 % of the differential is permanently lost, what is the power consumption of the meter?

8. (a) Write note on single cell protein (SCP).
   (b) Discuss the advantages and limitations of genetically modified crops and foods.

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