

**R09**

Code No: C0305

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD  
M.TECH I - SEMESTER EXAMINATIONS, APRIL/MAY-2012  
PROCESS ENGINEERING PRINCIPLES  
(BIOTECHNOLOGY)**

**Time: 3hours**

**Max. Marks: 60**

**Answer any five questions  
All questions carry equal marks**

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- 1.a) Differentiate between unit operations & unit processes with example.
- b) Show by the method of dimensions that the resistance  $R$  to the motion of a sphere of diameter  $d$  moving with uniform velocity  $V$  through a fluid having density  $\rho$  and viscosity  $\mu$  may be expressed as  $R = \rho d^2 V^2 \phi\left(\frac{\mu}{\rho V d}\right)$ .
- 2.a) Discuss about Newtonian and non-Newtonian fluids with examples.
- b) An oil of specific gravity 0.85 is flowing through a pipe of 5 cm diameter at the rate of 3 litre/sec. Find the type of flow, if the viscosity for the oil is 3.8 Poise.
3. Calculate the rate of heat loss through a plane of homogeneous wall whose thickness is considerably smaller than its width and length. Assuming the wall to be made from steel ( $k= 40$  W/ m K), concrete ( $k= 1.2$  W/ m K), Diatomite brick ( $k= 0.12$  W/ m K). Wall thickness for all the materials is equal to 5cm. The inner and outer surfaces are at  $1000^{\circ}\text{C}$  and  $100^{\circ}\text{C}$  respectively.
- 4.a) Differentiate between natural and forced convection with examples.
- b) Derive the equation for combined heat transfer by conduction, convection and radiation.
- 5.a) What is LMTD? Discuss its limitations.
- b) Describe shell and tube heat exchanger with a neat figure.
- 6.a) Describe the mechanism of boiling with the help of  $q/A$  Vs  $\Delta T$  curve.
- b) Discuss about the methods of feeding in multiple effect evaporators.
7. Discuss the following:
  - a) Theories of mass transfer
  - b) Ideal stage.
8. Write brief note on the following
  - a) Thermal boundary layer
  - b) Nucleate boiling
  - c) Film boiling
  - d) Fick's law of diffusion.

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