

<b>R09</b>
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Code No: C0305

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**  
**M.Tech I - Semester Examinations, March/April-2011**  
**PROCESS ENGINEERING PRINCIPLES**  
**(BIOTECHNOLOGY)**

Time: 3hours

Max. Marks: 60

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

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- 1.a) Distinguish between unit operation and unit processes with examples.
- b) Describe what are the mass transfer applications in bio-processing. [6+6]
- 2.a) Describe dimensionally homogeneous and non-homogeneous expressions with examples.
- b) Write a generalized energy balance equation for a steady state process. [6+6]
- 3.a) What is Newton's law of viscosity?
- b) Describe a co-axial cylinder viscometer, and explain how it is used for collecting rheological data. [4+8]
- 4.a) Describe the boundary layer concept.
- b) Describe how U-tube manometer is used for measurement of flow rates of fluids through pipes. [4+8]
5. Write an overview of various pumps you use in bio-processing for pumping fluids. [12]
6. A flat furnace wall is constructed of a 11.4cm layer of Sil-o-cel brick, with a thermal conductivity of 0.138 w/mc backed by a 22.9 cm layer of common brick of thermal conductivity 1.38w/m.c. The temperature of inner face of the wall is 760°C and that of the outer face is 76°C.
  - a) What is the heat loss through the wall?
  - b) What is the temperature of the interface between the refractory brick and common brick? [12]
7. Describe different types of heat transfer equipment you use in bio-processing. What are the relative advantages and disadvantages of each? [12]
- 8.a) What is the analog between heat, mass and momentum transfer?
- b) Describe the "Penetration theory". What are its advantages and limitations? [6+6]

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