

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE SEM-IV Examination-Nov/Dec-2011

Subject code: 140403

Date: 30/11/2011

Subject Name: Principles of Process Engineering - I

Time: 02.30 pm -5.00 pm

Total marks: 70

Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1 (a)** What types of transport processes occurs in the process engineering? Explain heat transport in detail with its modes, mechanism and examples. **07**
- (b)** Explain Fourier's law of conduction for steady state and unsteady state. Derive equation of heat transfer rate for steady state heat conduction through composite plane wall with neat sketch. **07**
- Q.2 (a)** Define radiation. Also explain in detail wave theory and quantum theory to explain phenomenon of radiation. **07**
- (b)** With neat sketch, explain emission of radiation, wavelength of radiation, emissive power and emissivity in detail. **07**
- OR**
- (b)** Explain the concept of black body and its characteristics in brief. Also, state the laws of black body radiation and explain each in detail. **07**
- Q.3 (a)** Stating the assumptions and limitations, derive Bernoulli's equation. **07**
- (b)** Starting from the definition of kinetic energy correction factor prove that $\alpha = 2$ for laminar flow of fluid in a circular pipe. **07**
- OR**
- Q.3 (a)** Derive equation of continuity and state the assumptions made while deriving the equation. **07**
- (b)** Prove that velocity profile for laminar flow of fluid in circular pipe is parabolic in nature and also derive the relation between local velocity, average velocity and maximum velocity. **07**
- Q.4 (a)** State the methods of dimensional analysis and Explain Rayleigh's method of dimensional analysis with a suitable example. **07**
- (b)** Explain friction factor and show that $f = 16/N_{Re}$ for laminar flow. **07**
- OR**
- Q.4 (a)** Give the detailed classification of pumps. Explain working principle of centrifugal pump. **07**
- (b)** Explain the construction and working of Shell and Tube heat exchanger with neat sketch indicating all the internals involved. **07**
- Q.5 (a)** Give the characteristic curves of centrifugal pump and explain each one of them. **07**
- (b)** Explain cavitation in pipes and its effect on efficiency of pump. **07**
- OR**
- Q.5 (a)** Show schematically 1-2 pass and 2-4 pass shell and tube heat exchanger. **07**
- (b)** State different metering devices. Explain rotameter in detail with neat sketch. **07**
