

GUJARAT TECHNOLOGICAL UNIVERSITY**BE- IVth SEMESTER-EXAMINATION – MAY/JUNE- 2012****Subject code: 140403****Date: 29/05/2012****Subject Name: Principles of Process Engineering-I****Time: 10:30 am – 01:00 pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Notations used have their conventional meanings.

- Q.1** (a) Differentiate between Natural and forced convection with examples of each. **04**
 (b) Derive equation of heat transfer rate in case of heat conduction through hollow sphere using Fourier's law. **04**
 (c) What is thermal radiation? Explain the mechanism of radiation using different theories. **06**

- Q.2** (a) State and explain in detail Planck's law, Stefan-Boltzmann law, Wien's displacement law and Kirchhoff's law for black body radiation. **07**
 (b) Derive equation of overall heat transfer coefficient U for the case of simultaneous conduction and convection heat transport in case of a plane wall. **07**

OR

- (b) What do you mean by critical thickness of insulation? Derive the expression for critical radius in case of cylindrical pipes. **07**

- Q.3** (a) Derive an equation to measure pressure difference between two points when a fluid is filled inside a vertical column. Write the equation in SI units and FPS units. **07**
 (b) Derive an equation of continuity, stating the assumption made. **07**

OR

- Q.3** (a) Explain Newton's law of viscosity. Also, Give detailed classification of fluids based on this law. **07**
 (b) List out various pressure measuring devices. Explain U-tube manometer in detail with neat sketch. **07**

- Q.4** (a) Define and give physical significance of Reynolds no., Prandlt no., Nusselt no., Peclet no. and Grashoff no. **10**
 (b) Explain cavitation and priming of a pump. **04**

OR

- Q.4** Classify different types of pumps used in chemical industries. Explain construction and working of centrifugal pumps with neat diagram. Also derive an expression to determine specific speed of centrifugal pump. **14**

- Q.5** (a) Discuss construction and working of shell and tube heat exchanger with neat sketch. **07**
 (b) Convert 1 std. atm. pressure into head of water and of mercury using their densities. Density of Hg is 13.5 gm/cc. **03**
 (c) Explain dropwise and filmwise condensation. **04**

OR

- Q.5** (a) Explain drag force and drag coefficient in case of flow past immersed bodies. **04**
 (b) State various methods of dimensional analysis. Explain any one in detail. **06**
 (c) Explain the concept of LMTD for heat exchangers in brief. **04**
