

BE- IVth SEMESTER–EXAMINATION – MAY/JUNE- 2012 le: 140403 Date: 29/05/2012

Subject code: 140403

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 04 sphere using Fourier's law.
 - (c) What is thermal radiation? Explain the mechanism of radiation using different 06 theories.
- Q.2 (a) State and explain in detail Planck's law, Stefan-Boltzmann law, Wien's 07 displacement law and Kirchhoff's law for black body radiation.
 - (b) Derive equation of overall heat transfer coefficient U for the case of 07 simultaneous conduction and convection heat transport in case of a plane wall.

OR

- (b) What do you mean by critical thickness of insulation? Derive the expression for 07 critical radius in case of cylindrical pipes.
- Q.3 (a) Derive an equation to measure pressure difference between two points when a 07 fluid is filled inside a vertical column. Write the equation in SI units and FPS units.
 - (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 07 based on this law.
 - (b) List out various pressure measuring devices. Explain U-tube manometer in 07 detail with neat sketch.
- Q.4 (a) Define and give physical significance of Reynolds no., Prandlt no., Nusselt 10 no., Peclet no. and Grashoff no.
 - (**b**) Explain cavitation and priming of a pump.

OR

- Q.4 Classify different types of pumps used in chemical industries. Explain 14 construction and working of centrifugal pumps with neat diagram. Also derive an expression to determine specific speed of centrifugal pump.
- Q.5 (a) Discuss construction and working of shell and tube heat exchanger with neat 07 sketch.
 - (b) Convert 1 std. atm. pressure into head of water and of mercury using their 03 densities. Density of Hg is 13.5 gm/cc.

(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

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