Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV • EXAMINATION – WINTER 2013

Subject Code: 140403 Date: 26-12-2013

Subject Name: Principles of Process Engineering-I

Time: 02.30 pm - 05.00 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)** Explain in detail three modes of heat transfer with examples of each. **07**

(b) What is thermal radiation? Explain the mechanism of radiation using different theories. **07**

Q.2 **(a)** Explain Fourier's law for heat conduction in detail. Also apply it for the case of plane wall and composite wall with neat sketches. **07**

(b) State and explain in detail Planck's law, Stefan-Boltzmann law, Wien's displacement law and Kirchhoff's law for black body radiation. **07**

OR

(b) A steel pipe 25 mm i.d. and 33 mm o.d. and insulated with rockwool carries steam at 178^0C. If the surrounding air temperature is 21^0C, calculate the rate of heat loss from one meter length of pipe. The thickness of insulation is 38 mm. Thermal conductivity of steel and rockwool are 10.74 and 0.0418 cal/sec-m-^{0}C respectively. The inside and outside heat transfer coefficients are 1356.17 & 2.7133 cal/sec-m^2-^{0}C respectively. Contact resistance between the pipe and insulation may be neglected. **07**

Q.3 **(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.3 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.4 **(a)** Derive an equation to find local velocity (u) as a function of radius (r) in a circular pipe. **07**

(b) Classify pressure measuring devices in detail and discuss any one with neat sketch. **07**

OR

Q.4 **(a)** Describe with neat diagram Shell & Tube heat exchanger with all its components involved. **07**

(b) Stating the assumptions and limitations, derive corrected form of Bernoulli's equation. **07**

Q.5 **(a)** State the methods of dimensional analysis and explain Rayleigh's method of dimensional analysis with suitable example. **07**

(b) Explain fluidization, fundamentals and its industrial applications. **07**

OR

Q.5 **(a)** State different metering devices. Explain venturimeter or orificemeter in detail with neat sketch. **07**

(b) Explain dropwise and filmwise condensation in detail. **07**

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