Seat No.: Enrolment No. **GUJARAT TECHNOLOGICAL UNIVERSITY BE - SEMESTER-IV(New) • EXAMINATION - WINTER 2016** Subject Code:2140403 Date:23/11/2016 Subject Name: Principles of Process Engineering-I Time:02:30 PM to 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. 0.1 **Short Ouestions.** 14 1 What is SI unit of thermal conductivity? What is SI unit of heat transfer coefficient? 2 3 Define fluid. 4 What is the use of baffles and floating head in heat exchanger? 5 Define sensible heat and latent heat. Define drag force. 6 What is opaque body? 7 State use of pitot tube. 8 Name different methods of dimensional analysis. 9 10 Which pump can be used for handling slurries? Define friction factor. 11 Write the name of one area meter. 12 Write mathematical form of Bernoulli equation. 13 Give significance of Reynolds number. 14 (a) State and explain modes of heat transfer with examples. **Q.2** 03 (b) Explain the concept of critical thickness of insulation. 04 Derive the expression for heat transfer rate through cylinder from Fourier's law of 07 (c) heat of conduction. OR (c) Classify pressure measuring devices in detail and discuss any one with neat 07 diagram. **Q.3** (a) Explain a) Potential Flow b) Newtonian Fluid c) Stream line flow 03 Schematically show temperature profiles for counter flow and parallel flow **(b)** 04 condenser. Crude oil flows at the rate of 1000 kg/hr through the inside pipe of a double pipe 07 (c) heat exchanger and is heated from 30°C to 90°C. The heat is supplied by Kerosene initially at 200 °C flowing through the annular space. If the temperature difference (approach) is 10°C, determine the heat transfer area for co-current flow and the kerosene flow rate. Cp for Crude oil = 0.5 kcal/kg °C, Cp for Kerosene = 0.6kcal/kg °C,  $U_0 = 400$  kcal/hrm<sup>2</sup>°C OR Q.3 (a) State general laws of conduction, convection and radiation. 03 (b) Differentiate between laminar flow and turbulent flow 04 Explain principle, working and uses of centrifugal pump with neat diagram. (c) 07 Q.4 (a) Define: 1) Black body 2) Gray body 3) Emissivity 03

|     | (b)<br>(c) | Explain cavitation and priming in pump.<br>Derive an equation for log mean temperature difference (LMTD) for heat exchanger.  | 04<br>07 |
|-----|------------|---|----------|
|     |            | OR  |          |
| Q.4 | <b>(a)</b> | Give the classification of pumps.   | 03       |
|     | <b>(b)</b> | Differentiate between natural convection and forced convection with examples.   | 04       |
|     | (c)        | Derive the governing equation of venture meter with neat sketch.  | 07       |
| Q.5 | (a)        | Define and give physical significance of i) Prandtl Number ii) Nusselt Number iii) Grashoff Number  | 03       |
|     | <b>(b)</b> | State application of momentum transfer in biotechnology.  | 04       |
|     | (c)        | 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       |
| OR  |            |   |          |
| Q.5 | <b>(a)</b> | Give types of fluidization.   | 03       |
|     | <b>(b)</b> | Discuss classification of fluids.   | 04       |
|     | (c)        | State and explain different laws of radiation.  | 07       |

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