

Seat No.: _____

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER- IV(NEW) – EXAMINATION – SUMMER 2019****Subject Code: 2140403****Date: 20/05/2019****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.

- Q.1** (a) State and explain Newton's Law of Viscosity. **03**
(b) Define: **04**
a) Ideal fluid b) Potential flow c) Compressible fluids d) Kinematic Viscosity
(c) Discuss different modes of Heat Transfer also state the governing laws. **07**
- Q.2** (a) Explain Fourier's law of heat conduction. **03**
(b) Explain advantages and disadvantages of single pass and multi pass heat exchangers. **04**
(c) Describe Reynolds experiment in brief. Water of density 1 gm/cc and viscosity 1cp is flowing in a pipe of 25mm ID at the rate of 1000 kg/min. Calculate the Reynolds number and find the type of flow. **07**

OR

- (c) Derive equation for heat transfer rate per unit length of cylinder for steady state simultaneous heat conduction and convection through cylindrical and plane wall. **07**
- Q.3** (a) Give the significance of following dimensionless numbers in case of convection heat transfer (i) Peclet number (ii) Nusselt number (iii) Reynolds's number **03**
(b) Derive the expression for critical radius in case of Sphere. **04**
(c) A furnace is constructed with 229 mm thick of fire brick, 115mm of insulation brick and again 229mm of building brick. The inside temperature is 1223K and the temperature at the outermost wall is 323K. Thermal Conductivities of fire brick, insulating brick and building brick are 6.05, 0.581, and 2.33 W/m.K. Find the heat loss per unit area and temperatures at the interfaces. **07**

OR

- Q.3** (a) Define thermal diffusivity. **03**
(b) Differentiate between Natural Convection and Forced Convection with suitable examples. **04**
(c) Derive the governing equation for unsteady state heat conduction with neat diagram. **07**
- Q.4** (a) Discuss the rheological classification of fluids and give one example each of all types. **07**
(b) Derive Continuity Equation for three dimensional flow of an incompressible fluid. **07**

OR

- Q.4** (a) Define velocity gradient. **03**
(b) Compare fixed tube heat exchanger with floating head heat exchanger. **04**
(c) Explain construction and working and derive expression for flow rate in following: Venturi Meter **07**

- Q.5** (a) Explain cavitation and priming in pumps. **03**
(b) Discuss classification of pumps. **04**
(c) Derive Bernoulli's equation stating the assumptions and limitations involved in it. **07**

OR

- Q.5** (a) Define Drag force and Drag Coefficient. **03**
(b) Explain mechanism of fluidization. **04**
(c) Explain Buckingham π theorem of dimensional analysis giving an example. **07**

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