GUJARAT TECHNOLOGICAL UNIVERSITY
B.E. Sem-IV Examination June- 2010

Subject code: 140403
Subject Name: Principles of Process Engineering -I

Date: 19 / 06 / 2010   **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.**

Q.1 **(a)** Answer the followings   **07**
1. Define:Absolute viscosity
2. Define:Potential flow
3. Newton's law of viscosity relates _____ and _____.
4. 1 Pa-s = _____ cP
5. Give the unit of dynamic viscosity.
6. Give the dimension of acceleration.
7. Which pump can be used for handling slurries?

(b) Answer the followings   **07**
1. Define:Thermal conductivity
2. Define:Heat flux
3. State different laws of Heat Transfer.
4. Give full form of LMTD.
6. Give the unit of thermal conductivity.
7. What is Nusset number?

Q.2 **(a)** Derive Bernoulli's equation stating the assumptions and limitations involved **07**
in it.
(b) Water flows through a pipe AB of 1.2m diameter at 3m/s and then passes **07**
through a pipe BC of 1.5m diameter. At C, the pipe branches. Branch CD is
0.8m diameter and carries one third of the flow in AB. The flow velocity in
branch CE is 2.5m/s. Find the volumetric flow rate of the flow in pipe AB,
velocity in pipe BC and CD. Also find the diameter of pipe CE.
OR
(b) Explain Fluidization stating different regimes of Fluidization.   **07**

Q.3 **(a)** Explain Buckingham –π theorem of dimensional analysis giving an example. **07**
(b) Explain boundary layer formation and separation.   **07**
OR
Q.3 **(a)** Explain with a neat sketch principle, working and construction of centrifugal **07**
pump. Also explain why the feed enters tangentially inside the centrifugal
pump.
(b) State different types of flow measuring devices. Explain buoyancy force with **07**
application in area meter.
Q.4 **(a)** Derive an expression for overall heat transfer co-efficient from individual **07**
film coefficients.
(b) Explain the concept of critical thickness of insulation in detail.   **07**
OR

| Q.4 | (a) | Derive $\alpha + \rho + \tau = 1$ for radiation. | 07 |
| | (b) | Explain the energy balance in heat exchanger. | 07 |

| Q.5 | (a) | Explain the significance of fouling factor and scaling in heat exchanger. | 07 |
| | (b) | State different laws of radiation and explain any one in detail. | 07 |

OR

| Q.5 | (a) | Determine the rate of heat flow through a boiler wall made of 20mm thick steel (k = 58 W/mK). The outer surface of the boiler wall is covered with asbestos insulation (k = 0.116 W/mK), 5mm thick. The temperature of outer surface and that of fluid inside are 50° C and 300° C respectively. The inner film resistance is 0.0023K/W. | 07 |
| | (b) | Draw a neat schematic diagram of 1-2 pass and 2-4 pass heat exchanger for counter current flow. | 07 |

****