

GUJARAT TECHNOLOGICAL UNIVERSITY**PDDC - SEMESTER-III • EXAMINATION – SUMMER 2013****Subject Code: X 31901****Date: 09-05-2013****Subject Name: Fluid Mechanics****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.

- Q.1** (a) State Pascal's law and prove it. **07**
(b) Give classification of fluid flow. **07**

- Q.2** (a) Define following terms : **07**
(i) Manometer (ii) Specific Gravity
(iii) Specific Volume (iv) Density
(v) Metacentre (vi) Buoyancy
(vii) Viscosity

- (b) Classify Manometers. Explain U – tube manometer with neat sketch. **07**

OR

- (b) State methods of dimensional analysis and describe any one method for dimensional analysis. **07**

- Q.3** (a) Derive Continuity Equation in 3 – dimension rectangular co-ordinate system. **07**

- (b) A 30 cm diameter pipe, conveying water, branches into two pipes of diameters 20 cm and 15 cm respectively. If the average velocity in 30 cm diameter pipe is 2.5 m/s, determine discharge in this pipe. Also find velocity in 15 cm diameter pipe if the average velocity in 20 cm diameter pipe is 2 m/s. **07**

OR

- Q.3** (a) Determine the total pressure and position of centre of pressure on a rectangular plate with 2 m wide and 3 m deep which is placed vertically in water in such a way that upper edge is horizontal and 2.5 m below the water surface. **07**

- (b) Discuss the conditions of equilibrium of floating and submerged bodies **07**

- Q.4** (a) Velocity components of a fluid flow are given as **07**
 $u = (6xy^2 + t)$, $v = (3yz + t^2 + 5)$, $w = (z + 3ty)$, where x, y, z are given in meters and time t in seconds. Determine velocity vector at point P (4, 1, 2) at time t = 4 seconds. Also determine the magnitude of velocity and acceleration of the flow for given location and time.

- (b) The right limb of a simple U – tube manometer containing mercury is open to the atmosphere while the left limb is connected to a pipe in which a fluid of specific gravity 0.9 is flowing. The centre of pipe is 12 cm below the level of mercury in the right limb. Find the pressure of fluid in the pipe if the difference of mercury level in two limbs is 20 cm. **07**

OR

- Q.4 (a)** Derive expression for discharge through horizontal venturimeter. **07**
(b) State and prove Bernoulli's equation. **07**

- Q.5 (a)** Distinguish between (i) Steady and unsteady flow
(ii) Uniform and non uniform flow
(iii) Compressible and incompressible flow
(b) The efficiency of fan η depends upon diameter of rotor D , discharge of fluid Q , density of fluid ρ , dynamic viscosity of fluid μ and angular velocity of rotor ω . Find expression for η in terms of dimensionless parameters. **07**

OR

- Q.5 (a)** Derive an expression for the velocity distribution for viscous flow through a circular pipe. **07**
(b) Derive the Hagen-Poiseuille equation. State the assumption made. **07**
