

Roll No.

Total Pages : 04

BT-3/D19

33019

FLUID MECHANICS-I

CE-205E

Time : Three Hours]

[Maximum Marks : 100

Note : Attempt *Five* questions in all, selecting at least *one* question from each Unit.

Unit I

1. (a) Define and distinguish between the following :
 - (i) Real fluid and Ideal fluid
 - (ii) Cohesion and Adhesion
 - (iii) Specific volume and Specific gravity
 - (iv) Dynamic and Kinematic viscosity
 - (v) Newtonian and Non-Newtonian fluids 10
- (b) Find kinematic viscosity of an oil of density 918 kg/m^3 . The shear stress at a point in oil is 0.2452 N/m^2 and velocity gradient at that point is 0.2 per second. 10
2. (a) (i) Define Rotational and Irrotational flow. 5
(ii) Differentiate between Laminar and Turbulent flow. 5
- (b) The stream function for a two-dimensional flow is given by $\Psi = 2xy$. Calculate the velocity at a point P(2, 3). Also find out the velocity potential function ϕ . 10

- Unit II**
3. (a) Discuss the condition of equilibrium of floating and submerged bodies. 10
 - (b) Find the volume of water displaced and position of centre of buoyancy for a wooden block of width 3 m and of depth 2 m, when it floats horizontally in water. Then density of wooden block is 700 kg/m^3 and its length is 7 m. 10
 4. (a) Show that the metacentre, M of a floating body always lies above its centre of gravity G for stable equilibrium. 10
 - (b) A solid cylinder of diameter 3 m has a height of 2 m. Find the metacentre height of the cylinder when it is floating in water with its axes vertical. The specific gravity of the cylinder is 0.5. 10

Unit III

5. (a) Explain Bernoulli's theorem and its various limitations. 10
- (b) A 0.2 m diameter pipe carries water at a velocity of 14 m/s at a point A and B, pressure and elevations at two sections A and B along the pipe were observed as

250 kN/m² and 150 kN/m² and 20 cm and 25 m respectively. Assuming steady flow, calculate the loss of head between sections A and B. **10**

6. (a) A discharge of 100 L/s is to be measured by a triangular notch of vertex angle 45°. What would be the head over the vertex of notch? If the accuracy of reading the head is 1 mm? What error in discharge can be expected at this level? Assume $C_d = 0.60$. **10**
- (b) Explain the following:
- (i) Effect of end contraction in rectangular notches. **5**
 - (ii) Velocity of approach and its effect on discharge computation. **5**

Unit IV

- (a) Explain displacement thickness, momentum thickness and energy thickness of boundary layer. **10**
- (b) Explain, what is meant by separation of boundary layer. Describe with neat sketches the methods of control separation. **10**
8. (a) Explain the geometric kinematic and dynamic similarity with reference to physical modelling. **10**

- (b) In the model test of a spillway the discharge and velocity of flow over the model were 3.5 m³/s and 2.5 m/s respectively. Calculate the velocity and discharge over the prototype which is 30 times the model size. **10**