JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -2 EXAMINATION- 2024

B.Tech-IV Semester (CSE/IT/ECE/CE)

COURSE CODE(CREDITS): 18B11CE412(3)

COURSE NAME: Fluid Mechanics MAX. MARKS: 25

COURSE INSTRUCTORS: Ashish Kumar MAX. TIME: 1 Hour 30 Minutes

Note: (a)All questions are compulsory.

(b)Marks are indicated against each question in square brackets.

(c) The candidate is allowed to make Suitable numeric assumptions wherever required for solving problems

Q1. Answer the following in brief. [CO1]

(a) Differentiate between linear deformation and angular deformation of a fluid particle on motion. **[1]**

(b) Show that if velocity potential function exists, the flow should be irrotational. **[2]**

(c) Prove that equipotential line and stream line are mutually orthogonal. **[2]**

Q2. (a) Explain the continuity equation for the one dimensional flow through a pipe. [CO3] **[1]**

(b) A 30 cm diameter pipe carries oil of specific gravity 0.8 at a velocity of 2 m/s. At another section the diameter is 20 cm. Find the velocity and discharge at this section. [CO3] **[2]**

Q3. If for a two-dimensional flow, the velocity potential function is given by $\Phi=4x(3y-4)$, Determine the velocity at the point x (4,3). Determine also the value of stream function at the point x. [CO1] **[4]**

Q4. Water is flowing through a pipe having diameters 30 cm and 15 cm at the bottom and upper end respectively. The intensity of pressure at the bottom end is 29.5 N/cm^2 and the pressure at the upper end is 15.0 N/cm^2. Determine the difference in datum head if the rate of flow through pipe is 0.05 m^3/sec. [CO4]

Q5. (a) Differentiate between steady flow and unsteady flow. [CO3] **[4]**

(b) The velocity components in a two-dimensional flow field for an incompressible fluid are expressed as: **[1]**

$$u = \frac{y^3}{3} + 2x - 2x^3y^2 \quad , v = 2x^2y^3 - 2y - \frac{x^3}{3}$$

(i) Is the flow physically possible?

(ii) Find out the angular velocity? Is the flow an irrotational flow. [CO3]

Q6. A circular plate 3 m in diameter is submerged in water as shown in figure. Their greatest and least depths are below the surface being 2 m and 1 m respectively. Find the total pressure on the front face of the plate and the position of the centre of pressure. [CO2] **[4]**