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Code No: 153AX

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech II Year I Semester Examinations, February -2024

FLUID MECHANICS

(Civil Engineering)

Time: 3 Hours **Max. Marks: 75**

Note: i) Question paper consists of Part A, Part B.
ii) Part A is compulsory, which carries 25 marks. In Part A, answer all questions.
iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART – A

(25 Marks)

1.a)	Define Specific gravity of a fluid.	[2]
b)	What do you understand by Hydrostatic law?	[3]
c)	Define the term Buoyancy and Center of Buoyancy.	[2]
d)	Define weir.	[3]
e)	Define Velocity potential.	[2]
f)	What do you understand minor losses in pipes?	[3]
g)	Define the Equation of Continuity.	[2]
h)	Distinguish between External mouthpiece and internal mouth piece.	[3]
i)	Define Reynold's number.	[2]
j)	Define momentum thickness.	[3]

PART – B

(50 Marks)

2.a) Explain the phenomenon of capillarity. Obtain an expression for capillary rise of a liquid.

b) The velocity distribution for flow over a flat plate is given by $u = \frac{3}{2}y - y^{3/2}$ where u is the pint of velocity in meters per second at a distance y meter above the plate. Determine the shear stress at y = 9cm. Assume dynamic viscosity as 8 Ns/m^2. [5+5]

OR

3.a) Define and explain Newton's law of viscosity.

b) A simple manometer (U-tube) containing mercury is connected to a pipe in which an oil of sp. gr. Is flowing. The pressure in the pipe is vaccum. The other end of the manometer is open to the atmosphere. Find the vaccum, pressure in pipe, if the difference of mercury level in the two limbs is 20 cm and height of the oil I the left limb from the center of the pipe is 15 cm below. [5+5]

4.a) Distinguish between steady flow and unsteady flow.

b) For the velocity potential function, $\phi = x^2-y^2$, find the velocity components at the points (4,5). [5+5]

OR

5.a) State Bernoulli's theorem. Mention the assumptions made. How is it modified while applying in practice? List out its engineering applications.

b) A pipe line carrying oil of specific gravity 0.8, changes in diameter from 300 mm at a position A to 500 mm diameter to a position B which is 5m at a higher level. If the pressures at A and B are 19.62 N/cm^2 and 14.91 N/cm^2 respectively, and the discharge is 150 litres/sec. Determine the loss of head and direction of flow. [5+5]

6.a) Define an orifice meter. Prove that the discharge through an orifice meter is given by the relation.

$$Q = C_d \frac{a_0 a_1 \sqrt{2gh}}{\sqrt{a_1^2 - a_0^2}}$$

Where a_1 = area of the pipe in which orifice meter is fitted
A_0 = area of the orifice.

b) An orifice meter with orifice diameter 15 cm is inserted in a pipe of 30 cm diameter. The pressure gauges fitted upstream and downstream of the orifice meter give readings of 14.715 N/cm^2 and 9.81 N/cm^2 respectively. Find the rate of flow of water through the pipe in litres/sec. [5+5]

OR

7.a) How are the Weirs and notches classified?

b) Find the discharge through a trapezoidal notch which is 1.2 m wide at the top and 0.50 m at the bottom and 40 cm in height. The head of water on the notch is 30 cm. Assume C_d for rectangular portion as 0.62 while for triangular portion is 0.60. [5+5]

8.a) What do you understand about Major energy loss in pipes?

b) A horizontal pipe of diameter 400 mm is suddenly contracted to a diameter of 200 mm. The pressure intensities in the large and smaller pipe is given by 14.715 N/cm^2 and 12.753 N/cm^2 respectively. If C_c = 0.62, find the loss of head due to contraction. Also determine the rate of flow of water. [5+5]

OR

9.a) Obtain the expression for head loss in a sudden contraction in the pipe. List all the assumptions made in the derivation.

b) A pipe line of length 2100 m is used for transmitting 103 kW. The pressure at the inlet of the pipe is 392.4 N/cm^2. If the efficiency of transmission is 80%, find the diameter of the pipe. Take f = 0.005. [5+5]

10.a) Prove that the maximum velocity in a circular pipe for laminar flow is equal to two times the average velocity of the flow.

b) A fluid of viscosity 0.5 Ns/m^2 and specific gravity 1.20 is flowing through a circular pipe of diameter 100 mm. The maximum shear stress at the pipe wall is given by 147.15 N/m^2, find (i) the pressure gradient (ii) the average velocity and (iii) the Reynolds number of the flow. [5+5]

OR

11.a) What are the Boundary conditions that must satisfied by a given velocity profile in laminar Boundary layer separation?

b) What are the different methods of preventing the separation of boundary layers? [5+5]

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