B.Tech II Year I Semester (R15) Regular \& Supplementary Examinations November/December 2017

# FLUID MECHANICS <br> (Civil Engineering) 

Time: 3 hours
Max. Marks: 70

## PART - A

(Compulsory Question)
1 Answer the following: (10×02=20 Marks)
(a) State Pascal's law.
(b) What do you understand by total pressure and center of pressure?
(c) Explain the terms meta-centre and meta-centric height.
(d) Distinguish between convective acceleration and local acceleration.
(e) What are the various forces that are acting on a fluid motion?
(f) List out the engineering applications of Bernoulli's theorem.
(g) Distinguish between mouth piece running full and running free.
(h) Define velocity of approach. How does the velocity of approach affect the discharge over a weir?
(i) What is a siphon? When does it stop functioning?
(j) Distinguish between hydro dynamically smooth and rough boundaries.

## PART - B

(Answer all five units, $5 \times 10=50$ Marks)

## UNIT - I

2 (a) Define the terms vacuum pressure, viscosity, specific gravity, surface tension and capillarity.
(b) A circular plate 3 m diameter is immersed in water in such a way that its greatest and least depth below the free surface are 4 m and 1.5 m respectively. Determine the total pressure on one face of the plate and position of the centre of pressure.

## OR

3 (a) What is the difference between U-tube differential manometers and inverted U-tube differential manometers? Where are they used?
(b) Calculate the capillary rise in a glass tube of 2.5 mm diameter when immersed vertically in: (i) Water. (ii) Mercury. Take surface tension for mercury and water as $0.0725 \mathrm{~N} / \mathrm{m}$ and $0.52 \mathrm{~N} / \mathrm{m}$ respectively in contact with air. Specific gravity for mercury is given as 13.6 and angle of contact is $130^{\circ}$.

## UNIT - II

4 (a) What are the conditions of equilibrium of a floating body and a submerged body?
(b) A rectangular tank of length 6 m , width 2.5 m and height 2 m is completely filled with water when at rest. The tank is open at the top. The tank is subjected to a horizontal constant linear acceleration of $2.4 \mathrm{~m} / \mathrm{s}^{2}$ in the direction of its length. Find the volume of water spilled from the tank.

## OR

5 (a) Prove that velocity potential lines and stream lines are orthogonal to each other.
(b) A block of wood of specific gravity 0.7 floats in water. Determine the meta centric height of the block if its size is $2 \mathrm{~m} \times 1 \mathrm{~m} \times 0.8 \mathrm{~m}$.

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## UNIT - III

6 (a) What are the different forms of energy in a flowing fluid? Explain energy correction factor.
(b) A 300 mm diameter pipe carries water under a head of 20 m with a velocity of $3.5 \mathrm{~m} / \mathrm{s}$. If the axis of the pipe turns through $45^{\circ}$, find the magnitude and direction of the resultant force at the bend.

OR
7 (a) Describe with the help of sketch the construction, operation and use of Pitot-static tube.
(b) A $20 \mathrm{~cm} \times 10 \mathrm{~cm}$ venturimeter is inserted in a vertical pipe carrying oil of sp.gr. 0.8 . The flow of oil is in upward direction. The difference of levels between the throat and inlet section is 50 cm . The oil mercury differential manometer gives a reading of 30 cm of mercury. Find the discharge of oil. Neglect losses.

## UNIT - IV

8 (a) What is a convergent-divergent mouthpiece? Obtain an expression for the ratio of diameters at outlet and at vena-contracta.
(b) A rectangular weir of crest length 50 cm is used to measure the rate of flow of water in a rectangular channel of 80 cm and 70 cm deep. Determine the discharge in the channel if the water level is 80 mm above the crest of weir. Take velocity of approach into consideration and value of $C_{d}=0.62$.

OR
9 (a) What is a Cipolletti weir? Derive the expression for the discharge through this weir.
(b) Find the discharge through a rectangular orifice 2 m wide and 1.5 m deep fitted to a water tank. The water level in the tank is 3 m above the top edge of the orifice. Take $\mathrm{C}_{\mathrm{d}}=0.62$.

## UNIT - V

10 (a) Explain Prandtl's mixing length theory.
(b) A crude oil of viscosity 0.97 poise and relative density 0.9 is flowing through a horizontal circular pipe of diameter 100 mm and of length 10 m . Calculate the difference of pressure at the two ends of the pipe, if 100 kg of oil is collected in a tank in 30 sec .

## OR

11 (a) Obtain an expression for head loss due to sudden expansion in the pipe.
(b) A pipe of diameter 300 mm and length 3500 m is used for the transmission of power by water. The total head at the inlet of the pipe is 500 m . Find the maximum power available at the outlet of the pipe, if the value of $f=0.006$.

