

# CBCS SCHEME

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15CV33

Third Semester B.E. Degree Examination, June/July 2023

## Fluid Mechanics

Time: 3 hrs.

Max. Marks: 80

*Note: Answer any FIVE full questions, choosing ONE full question from each module.*

### Module-1

- 1 a. Define mass density, specific weight and specific gravity. Also write their SI units. (04 Marks)
- b. A mass of liquid weighs 500 N when exposed to standard earth's gravity  $g = 9.806 \text{ m/s}^2$ 
  - (i) What is its mass? (06 Marks)
  - (ii) What will be its weight in a planet with acceleration due to gravity of  $18.0 \text{ m/s}^2$ ? (06 Marks)
- c. A liquid at  $20^\circ\text{C}$  has a relative density of 0.80 and a kinematic viscosity of 2.3 Centistoke. Determine its: (i) Unit weight (ii) Dynamic viscosity in Pa.S. (06 Marks)

OR

- 2 a. State and prove Pascal's law. (08 Marks)
- b. The tank in Fig.Q2(b) is closed at top and contains air at a pressure  $P_A$ . Calculate the value of  $P_A$  for the manometer readings shown.

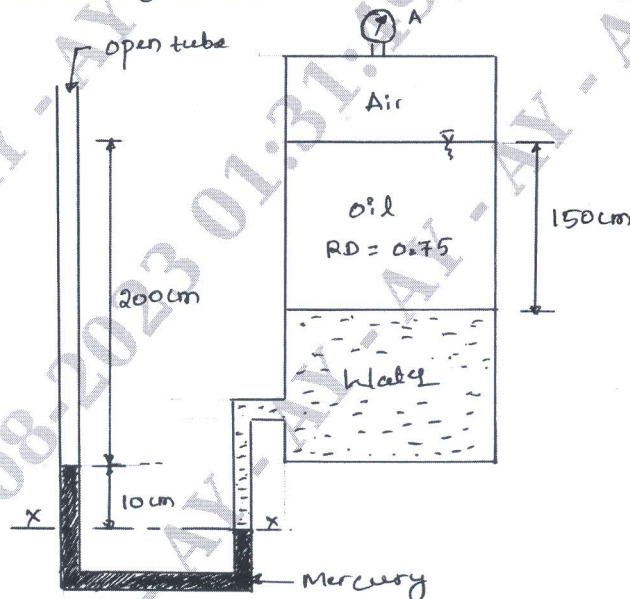


Fig.Q2(b)

(08 Marks)

### Module-2

- 3 a. Derive an expression for the force exerted on a submerged vertical plane surface by the static liquid and locate the position of centre of pressure. (08 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
2. Any revealing of identification, appeal to evaluator and /or equations written eg,  $42 \pm 8 = 50$ , will be treated as malpractice.

- b. A rectangular plate 2 mtr wide and 4 mtr deep is immersed in water in such a way that its plane makes an angle of  $25^\circ$  with the water surface as shown in Fig.Q3(b). Determine the total pressure on one side of the plate and the position of the centre of pressure.

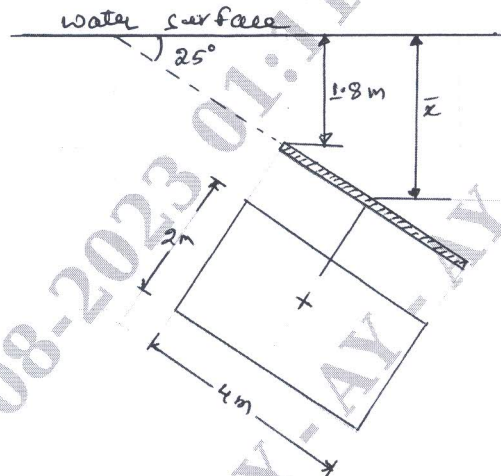


Fig.Q3(b)

(08 Marks)

OR

- 4 a. State the difference between:
- Uniform flow and non uniform flow
  - Steady and unsteady flow
  - Rotational and irrotational flow
  - One, Two, Three dimensional flow
- (08 Marks)
- b. A stream function is given by  $\psi = 5x - 6y$ . Calculate the velocity components and also magnitude and direction of the resultant velocity at any point. (08 Marks)

Module-3

- 5 a. Obtain an expression for Euler's equation of motion along stream line and deduce it to Bernoulli's equation. (08 Marks)
- b. A pipe 300 mtr long has a slope of 1 in 100 and tapers from 1 metre diameter at the higher end to 0.5 mtr at the lower end. The quantity of water flowing is 900 litres/sec. If the pressure at the higher end is 70 kPa, find the pressure at the lower end. (08 Marks)

OR

- 6 a. A venturimeter with a 150 mm diameter at inlet and 100 mm at throat is laid with its axis horizontal and is used for measuring the flow of oil specific gravity 0.9. The oil-mercury differential manometer shows a gauge difference of 200 mm. Assume coefficient of the venturimeter as 0.98. Calculate the discharge in litre per minute. (08 Marks)
- b. An orifice metre consisting of 100 mm diameter orifice in a 250 mm diameter pipe has coefficient equal to 0.65. The pipe delivers oil (sp. Gravity 0.8). The pressure difference on the two sides of the orifice plate is measured by a mercury oil differential manometer. If the differential gauge reads 80 mm of mercury calculate the rate of flow in litres/sec. (08 Marks)

Module-4

- 7 a. What is an orifice? Discuss its classification. (04 Marks)
- b. A jet of water issues from an orifice of diameter 20 mm under a head 1 mtr. What is the coefficient of discharge for the orifice, if actual discharge is 0.85 litres/second? (06 Marks)
- c. A pipe of 100 mm diameter is suddenly enlarged to 200 mm diameter. Find the loss of head, when the discharge is 60 litres/sec. (06 Marks)

OR

- 8 a. What is a notch? Derive an equation for the discharge over a rectangular notch. (08 Marks)  
b. The daily record of rainfall over a catchment area is 0.2 million cubic metres. It has been found that 80% of the rain water reaches the storage reservoir and then passes over a rectangular weir. What should be the length of the weir, if the water is not to rise more than 400 mm above the rest? Assume the value of  $c_d$  of the weir as 0.61. (08 Marks)

**Module-5**

- 9 a. Derive Darcy Weisbach equation for head loss due to friction in a pipe. (08 Marks)  
b. Find the diameter of a pipe of length 2000 mtr when the rate of flow of water through the pipe is 2000 litres/sec and the head lost due to friction is 4 mtr. Take the value of  $c = 50$  in Chezy's formulae. (08 Marks)

OR

- 10 a. Define the term compared pipe and equivalent pipe. Derive the expression for diameter of equivalent pipe. (08 Marks)  
b. A main pipe divides into two parallel pipes which again forms one pipe. The length and diameter for the first parallel pipe are 2000 m and 1.0 m respectively, while the length and diameter of 2<sup>nd</sup> parallel pipe are 2000 m and 0.8 m. Find the rate of flow in each parallel pipe, if total flow in the main is 3.0 m<sup>3</sup>/sec. The coefficient of friction for each parallel pipe is same and equal to 0.005. (08 Marks)

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