CBCS SCHEME

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15AU42

Fourth Semester B.E. Degree Examination, July/August 2021
Fluid Mechanics

Time: 3 hrs. Max. Marks: 80

Note: 1. ***Answer any FIVE full questions.***
2. ***Draw neat sketches, wherever applicable.***
3. ***Assume suitable, missing data, if any and state it appropriately.***

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+8 = 50, will be treated as malpractice.

1 a. Distinguish between :
i. Specific mass and specific weight
ii. Dynamic viscosity and Kinematic Viscosity
iii. Capillary rise and Capillary fall **(08 Marks)**

b. An oil of viscosity 5 poise is used for lubrication between a shaft and sleeve. The diameter of the shaft is 0.5m and rotates at 200rpm. Calculate the power lost in oil for a sleeve length of 100mm. The thickness of oil film is 1.0mm. **(08 Marks)**

2 a. Derive Expression for difference of pressure between two points in a pipe or in two different pipes in an
i) U-tube differential manometer
ii) Inverted U-tube differential Manometer. **(08 Marks)**

b. A rectangular sluice gate is situated on the vertical wall of a lock. The vertical side of the sluice is 'd' meters in length and depth of centroid of the area is 'P' m below the water surface. Prove that the depth of pressure is equal to $P+\frac{d^2}{12P}$. **(08 Marks)**

3 a. Derive an expression for the meta-centric height of a floating body by analytical method. **(10 Marks)**

b. Find the density of a metallic body which floats at the interface of mercury of specific gravity 13.6 and water such that 40% of its volume is submerged in mercury and 60% in water. **(06 Marks)**

4 a. Explain velocity potential function. Derive and explain the properties of velocity potential function. **(10 Marks)**

b. Sketch the stream lines represented by $\psi = x^2 + y^2$. Also find out the velocity and its direction at point (1, 2) **(06 Marks)**

5 a. State Bernoullis theorem for steady flow or an incompressible fluid. Derive an expression for Bernoullis equation from first principle and state the assumption made for such a derivation. **(09 Marks)**

b. A pipe line carrying oil of specific gravity 0.87, changes in diameter from 200mm diameter at a position A to 500mm diameter at a position B which is 4 meters at a higher level, if the pressure at A and B are 9.81 N/cm^2 and 5.886 N/cm^2 respectively and the discharge is 200 litres/sec. Determine the loss of head and direction of flow. **(07 Marks)**

6 a. Sketch and explain the construction pitot tube. Derive an expression for determination of velocity at any point with the help of pitot tube. **(08 Marks)**

b. A 30cm × 15cm venturimeter is provided in a vertical pipeline carrying oil of specific gravity 0.9, the flow being upwards. The difference in elevation of the throat section of the venturimeter is 30cm. The differential u-tube mercury manometer shows a gauge deflection of 25cm. Calculate: i) The discharge of oil ii)The pressure difference between the entrance section and the throat section. Take the coefficient of meter as 0.98 and specific gravity of mercury as 13.6. **(08 Marks)**

7 a. Briefly explain :
   i) type of Forces acting in moving fluid
   ii) important dimensionless numbers
   iii) types of similarities which must exist between model and prototype. **(10 Marks)**

b. Determine the dimensions of the quantities given below :
   i) Dynamic viscosity
   ii) Kinematic viscosity
   iii) Discharge **(06 Marks)**

8 a. Derive an expression for loss of head due to sudden enlargement of a pipe. **(09 Marks)**

b. Determine the rate of flow of water through a pipe of diameter 20cm and length 50m when one end of the pipe is connected to a tank and other end of the pipe is open to the atmosphere. The pipe is horizontal and the height of water in the tank 4m above the centre of the pipe. Consider all minor losses and take f = 0.009 in the formulae $h_f = \frac{4f1V^2}{d \times 2g}$ **(07 Marks)**

9 a. Derive expression for velocity distribution ratio of maximum velocity to average velocity, for the flow of viscous fluid through a circular pipe. **(10 Marks)**

b. Determine the
   i) Pressure gradient
   ii) The shear stress at two horizontal parallel plates and
   iii) The discharge per meter width for the laminar flow of oil with a maximum velocity of 2.0m/s between two. Horizontal parallel fixed plates which are at 100mm apart. Given $\mu = 2.4525 N/m^2$. **(06 Marks)**

10 a. Derive expression for drag and lift. **(10 Marks)**

b. A circular Disc 3m in diameter is held normal to a 26.4m/s wind of density 0.0012 gm/cc. What is required to hold it at rest? Assume Coefficient of drag of disc = 1.1. **(06 Marks)**

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