CBCS SCHEME

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15AU42

Fourth Semester B.E. Degree Examination, June/July 2024
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. 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)**

OR

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)**

Module-2

3 a. Discuss conditions for equilibrium of submerged and floating bodies in fluid. **(04 Marks)**

b. Derive equation for meta centric height of floating body by experimental method. **(04 Marks)**

c. A wooden cylinder of specific gravity 0.6 and circular in cross section is required to float in oil of sp.gr. 0.90. Find L/D ratio for the cylinder to float with its longitudinal axis vertical in oil where L is height of cylinder and D is its diameter. **(08 Marks)**

OR

4 a. Define following:
i) Steady and unsteady flow
ii) Uniform and non uniform flow
iii) Compressible and incompressible flow. **(06 Marks)**

b. In two dimensional incompressible flow, the velocity components are given by $u = x - 4y$ and $v = -y - 4x$. Show that velocity potential exists and determine its form. Find also the stream function. **(10 Marks)**

Module-3

5 a. Derive Euler's equation of motion along a stream line. Also derive Bernoulli's equation from Euler's equation of motion and list the assumptions made for deriving Bernoulli's equation. **(10 Marks)**

b. Water is flowing through a pipe having diameter 300 mm and 200 mm at the bottom and upper end respectively. The intensity of pressure at the bottom end is 24.525 N/cm^2 and the pressure at the upper end is 9.81 N/cm^2. Determine the difference in datum head if the rate of flow through pipe is 40 lit/s. **(06 Marks)**

OR

6 a. Derive an expression for the actual discharge through Venturimeter. **(10 Marks)**

b. An orifice meter with orifice diameter 10 cm is inserted in a pipe of 20 cm diameter. The pressure gauges fitted upstream and downstream of the orifice meter gives readings of 19.62 N/cm^2 and 9.81 N/cm^2 respectively. Co-efficient of discharge for the meter is given as 0.6. Find the discharge of water through pipe. **(06 Marks)**

Module-4

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)**

OR

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)**

Module-5

9 a. Derive an expression for shear stress distribution and velocity distribution for laminar flow through circular pipe. **(08 Marks)**

b. Water at 15°C flows between two large parallel plates at a distance of 1.6 mm apart. determine (i) the maximum velocity (ii) the pressure drop per unit length and (iii) the stress at the walls of the plates if the average velocity is 0.2 m/s. The viscosity of water at 15°C is given as 0.01 poise. **(08 Marks)**

OR

10 a. Define the following and write their equations :

i) Drag ii) Lift iii) Displacement thickness iv) Momentum thickness **(08 Marks)**

b. Explain Mach Angle and Mach Cone. **(04 Marks)**

c. A projectile is traveling in air having pressure and temperature as 8.829 N/cm^2 and -2°C. If the Mach angle is 40°. Find the velocity of the projectile.
Take K = 1.4 and R = 287 J/kg°K. **(04 Marks)**

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