CBCS SCHEME

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18MR46

Fourth Semester B.E. Degree Examination, Jan./Feb. 2023
Fluid Mechanics

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Define the following :
i) Density ii) Specific volume iii) viscosity iv) Surface Tension v) Bulk modulus. **(10 Marks)**

b. The dynamic viscosity of an oil used for lubrication between a shaft and sleeve its 6 poise. The shaft is of diameter 0.4m and rotates at 190rpm. Calculate the power lost in the bearing for a sleeve length of 90mm. The thickness of the oil film is 1.5mm. **(10 Marks)**

OR

2 a. State and prove the Pascal's law. **(08 Marks)**

b. A pipe contains an oil of specific gravity 0.9. A differential manometer connected at the two points A and B shows a difference in mercury level as 15cm. Find the difference of pressure at the two points. **(04 Marks)**

c. A rectangular plane surface of 2m wide and 3m and is it lies in vertical plane in water determine the total pressure and position of the center of pressure on the plane surface, when the appear edge is horizontal and coincides with the water surface. **(08 Marks)**

Module-2

3 a. Explain stability of a floating body. With usual notations derive and expression for metacentric height for a floating body in liquid. **(10 Marks)**

b. A trapezoidal channel 2m wide at the bottom and 1m deep has side slopes 1:1 determine :
i) Total pressure force
ii) The point of application of center of pressure on the vertical gate chosing the channel when it is full of water. **(10 Marks)**

OR

4 a. Derive an expression for continuity equation for the three dimensional steady incompressible flow. **(10 Marks)**

b. Derive Bernoullis equation from fundamentals. List all the assumption made. **(10 Marks)**

Module-3

5 a. Derive an expression for rate of flow through venturimeter. **(12 Marks)**

b. The maximum flow through a rectangular flame 1m deep and 1.5m wide is $0.90m^3$/sec. If is proposed to install a full width sharp edged rectangular weir across the flume to measure the flow. Find the maximum height at which the crest of the weir must be placed in order water may not over flow the side of the flume. Neglect velocity of approach. Take $C_d = 0.9$. **(08 Marks)**

OR

6 a. Define the following ;
   i) Reynold's number
   ii) Froude's number
   iii) Euler's number
   iv) Mach number **(08 Marks)**

b. Derive on the basis of dimension analysis suitable parameters to present the thrust P developed by a propeller. Assume that the thrust P depends upon the angular velocity 'w' speed of advance V, diameter D, Dynamic viscosity μ, mass density ρ, elasticity of the fluid medium which can be denoted by the speed of sound in the medium 'C'. **(12 Marks)**

Module-4

7 a. Derive an expression for Darcy equation for loss of head due to friction in pipes. **(10 Marks)**

b. The rate of flow of water through a horizontal pipe is $0.025m^3/sec$. The diameter of the pipe 200mm is suddenly enlarged, to 400mm. The pressure intensity in the smaller pipe is $11.772N/cm^2$. Determine :
   i) Loss of head due to sudden enlargement
   ii) Pressure intensity in the large pipe
   iii) Power lost due to enlargement **(10 Marks)**

OR

8 a. Derive Hagen – Poiscuille equation for a laminar flow in a circular tube. **(12 Marks)**

b. An oil of viscosity 10 poise flows between two parallel plates which are kept at a distance of 50m apart. Find the rate of flow of oil between the plates if the drop of pressure in a length of 1.2m be $0.3N/cm^2$. The width of the plate is 200mm. **(08 Marks)**

Module-5

9 a. Define lift and Drag. Derive an expression for lift and Drag. **(12 Marks)**

b. A flat plate 1.5m × 1.5m moves at 50Kmph is stationary air of density $1.15Kg/m^3$. If the coefficient of drag and lift are 0.15 and 0.75 respectively. Determine :
   i) The drag force
   ii) The lifts force
   iii) The resultant force
   iv) Power required to keep the plate in motion. **(08 Marks)**

OR

10 a. Derive an expression for Bernoulli's equation for the compressible flow when the process is i) isothermal ii) adiabatic **(12 Marks)**

b. Find the velocity of bullet fired in standard air if the Mach angle is 30°, take R = 287.14 J/Kg K, K = 1.4 for air. Assume temperature is 15°C. **(08 Marks)**

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