CBCS Scheme

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15MR46

Fourth Semester B.E. Degree Examination, June/July 2017
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 following properties of fluid
   i) Density
   ii) Specific volume
   iii) Specific gravity
   iv) Viscosity. **(04 Marks)**

b. State and prove Pascal's law and hydrostatic law. **(08 Marks)**

c. Find out the minimum size of glass tube that can be used to measure water level if the capillary rise in the tube is to be restricted to 2mm. consider surface interface with air as 0.0736 N/m. **(04 Marks)**

OR

2 a. Determine the total pressure on a circular plate of diameter 1.5m which placed vertically in water in such a way that the centre of the plate is 3m below the free surface of water. Find the position of centre of pressure also. **(08 Marks)**

b. Explain pressure measurement method by manometer for flow through pipes. **(04 Marks)**

c. Explain:
   i) Vapour pressure and cavitation
   ii) Viscosity of fluids. **(04 Marks)**

Module-2

3 a. A block of wood of specific gravity 0.8 floats in water. Determine the meta centric height of the block if its size is 3m×2m×1m. State whether stable or unstable. **(08 Marks)**

b. Derive the continuity equation in Cartesian coordinates with respect to steady flow and incompressible with definition express the continuity equation for steady flow and incompressible flow. **(08 Marks)**

OR

4 a. Derive the 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. **(04 Marks)**

b. A pipe of diameter 400mm carries water at velocity of 25m/s. The pressures at point A and B are 294:3 kN/m^2 and 225.63 kN/m^2 respectively while the datum head at A and B are 28m and 30m. Find the loss of head between A and B. **(12 Marks)**

Module-3

5 a. Derive the expression for rate of flow through venturimeter. **(08 Marks)**

b. A submarine moves horizontally in sea and has its axis 15m below the surface of water. A pitot-tube properly placed just in front of the sub-marine and along its axis is connected to the two limbs of a U-tube containing mercury. The difference of mercury level is found to be 170mm. Find the speed of the submarine in km/hr knowing that specific gravity of mercury is 13.6 and that of sea water is 1.026 with respect of fresh water. **(05 Marks)**

c. Differentiate V-notch and Rectangular notch related to discharge measurement. **(03 Marks)**

OR

6 a. The efficiency η of a fan depends on density ρ, dynamic viscosity μ of the fluid, angular velocity w, diameter D of rotor and the discharge Q, express η in terms of dimensionless parameter. **(08 Marks)**

b. Define and explain :
   i) Reynold's number
   ii) Euler's number
   iii) Mach number
   iv) Froude number. **(08 Marks)**

Module-4

7 a. Derive Darcy-Weisbach expression for head loss due to friction in a pipe flow. **(08 Marks)**

b. A pipe line 300mm in diameter and 3200m long is used to pump up 50kg/sec of an oi whose density is 950 kg/m^3 and whose density kinematic viscosity is 2.1×10^{-4}m^2/sec. Th centre of the pipe line at the upper end is 40m above than that at the lower end. Th discharge at the upper end is atmospheric. Find the pressure at lower end. Draw the HGI and TGL. **(08 Marks)**

OR

8 a. Derive Hagen-Poseuille equation for a laminar flow in a circular tube. **(10 Marks)**

b. Water at 15°C flows through between two parallel plates at a distance of 1.6mm apar Determine :
   i) The maximum velocity
   ii) Pressure drop/unit length
   iii) Shear stress at the plates is average velocity is 0.2 m/sec force viscosity of water a 15°C as 0.01 poise. **(06 Marks)**

Module-5

9 a. State the Bernoulli's theorem for compressible flow derives an expression for Bernoulli' equation when the process is isothermal. **(08 Marks)**

b. Derive an expression for drag and lift with usual notation. **(08Marks)**

OR

10 a. A sub marine which may be supposed to approximate a cylinder 4m in diameter and 20r long travels submerged at 1.3 m/sec in sea water. Find the drag excreted on it, if the drag c efficient for Renolds number greater than 10^5 may be taken as 0.75. The density of sea wat is given as 10356 kg/m^3 and kinematic viscosity as 0.015 stokers. **(06 Marks)**

b. A projectile travels in air of pressure 10.1043 N/cm^2 at 10°C at a speed of 1500km/hr. Fin the mach number and the mach angle. Take K = 1.4 and R = 287J/kg K. **(06 Marks)**

c. Define the terms subsonic and supersonic flow. **(04 Mark**

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