CBCS SCHEME

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15AU42

Fourth Semester B.E. Degree Examination, June/July 2019
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 the following fluid properties :
i) Density ii) weight density iii) Specific volume
iv) Specific gravity v) Dynamic Viscosity vi) Surface Tension. **(06 Marks)**

b. Explain the phenomenon of capillarity obtain an expression for capillary rise of liquid. **(05 Marks)**

c. A 15cm diameter vertical cylinder rotates concentrically inside another cylinder of diameter 15.10cm. Both cylinders are 25cm high. The space between cylinders is filled with a liquid whose viscosity is unknown. If a torque of 12.0 N-m is required to rotate the inner cylinder at 100 rpm. Determine the viscosity of the fluid. **(05 Marks)**

OR

2 a. Differentiate between : i) Absolute and Gauge pressure ii) Simple and Differential manometers iii) Piezometer and pressure gauges. **(06 Marks)**

b. A differential Manometer is connected at the two points A and B of two pipes as shown in Fig Q2(b). The pipe A contains a liquid of sp.gr = 1.5 while pipe B contains a liquid of sp.gr = 0.9. The pressure at A and B are 1 Kg f/cm^2 and 1.8Kgf/cm^2 respectively. Find the difference in Mercury level in the differential Manometer. **(10 Marks)**

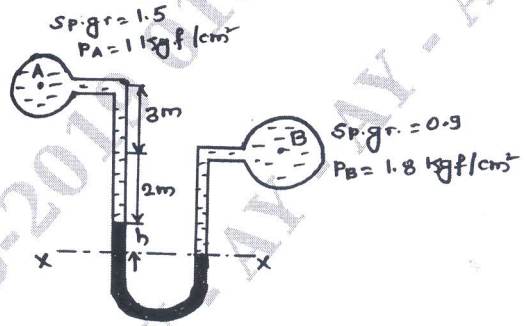

Fig Q2(b)

Module-2

3 a. Define the terms :
i) Buoyancy ii) Centre of buoyancy iii) Metacenre iv) Meta centric height. **(04 Marks)**

b. What are the conditions of equilibrium of a floating body and a submerged body? **(04 Marks)**

c. A solid cylinder of diameter 4m has a height of 4m, Find the meta centric height of the cylinder if specific gravity of the material of cylinder is 0.6 and it is floating in water with its axis vertical. State whether the equilibrium is stable or unstable. **(08 Marks)**

OR

4 a. Define the equation of continuity, obtain the expression for continuity equation for a 3-Deminsional flow. **(08 Marks)**

b. For a two dimensional potential flow the velocity potential is given by $\phi = x(2y - 1)$. Determine the velocity at a point P(4, 5). Also determine the value of stream function at appoint P. **(08 Marks)**

Module-3

5 a. State Bernoulli's theorem for steady flow of an incompressible fluid. Derive an expression for Bernoulli's equation from first principle and state the assumptions made in it. **(08 Marks)**

b. The Water is flowing through a taper pipe of length 100m having diameters of 600mm at the upper end and 300mm at the lower end. At the rate of 50 litres/s. The pipe has a slope of 1 in 30. Find the pressure at the lower end if the pressure higher level is 19.62 N/cm^2. **(08 Marks)**

OR

6 a. What is an orifce – meter? Derive an expression for the discharge through an orifice meter. **(08 Marks)**

b. Water flows through a triangular right angled weir first and then over a rectangular weir of 1m width. The discharge co-efficient of a triangular and rectangular weir are 0.6 and 0.7 respectively. If the depth of water over the triangular weir is 360mm, find the depth of water over the rectangular weir. **(08 Marks)**

Module-4

7 a. What are the different law on which models are designed for dynamic similarity? Where they are used? **(06 Marks)**

b. The pressure difference ΔP in a pipe of diameter D and length L due to turbulent flow depends on the velocity V, viscosity μ, density ρ and roughness k. using Buckingham's π theorem, obtain an expression for Δp. **(10 Marks)**

OR

8 a. Define and explain the terms: i) Hydraulic gradient line ii) Total Energy line. **(04 Marks)**

b. Show that the loss of head due to sudden expansion in pipe is a function of velocity head. **(08 Marks)**

c. An oil of specific gravity 0.9 and viscosity 0.06 poise is flowing through a pipe of diameter 200mm at the rate of 60 litres/s. Find the head loss due to the friction for a 500m length of pipe. Find the power required to mention this flow. **(04 Marks)**

Module-5

9 a. Derive on expression for the velocity distribution for viscous flow through a pipe. Also sketch the velocity distribution and shear stress distribution across a section of the pipe. **(08 Marks)**

b. Differentiate between : i) Stream lines body and bluff body
ii) Friction Drag and pressure drag **(04 Marks)**

c. Determine : i) The pressure gradient ii) The shear stress at the two horizontal parallel plates for the laminar flow of oil with maximum velocity of 2 m/s between two horizontal parallel fixed plates which are 100mm apart. Given y = 2.4525 N-s/m^2. **(04 Marks)**

OR

10 a. Define Mach number. What is the significance of Mach number in compressible flows? **(04 Marks)**

b. Find the displacement thickness, momentum thinkness and energy thickness for the velocity distribution in boundary layer given by $\frac{u}{U} = 2\left(\frac{y}{\delta}\right) - \left(\frac{y}{\delta}\right)^2$. **(10 Marks)**

c. Define the terms : Drag and Lift. **(02 Marks)**

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