CBCS SCHEME

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18MR46

Fourth Semester B.E. Degree Examination, June/July 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 properties of fluid with a suitable sketches:
(i) Newtonian and Non-Newtonian fluids
(ii) Viscosity
(iii) Compressibility and Capillarity **(10 Marks)**

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

OR

2 a. With neat sketch explain the working of a U-tube differential manometer. **(10 Marks)**

b. Derive an expression for the depth of centre of pressure from the free surface of liquid of a vertical plane surface submerged in the liquid. **(10 Marks)**

Module-2

3 a. Classify the type of fluid flow. **(10 Marks)**

b. Derive an expression for metacentric height for a floating body and state the condition for stability and floating body. **(10 Marks)**

OR

4 a. Derive Bernoulli's equation and state the assumptions made. **(10 Marks)**

b. A pipe of diameter 400mm carries water at a velocity of 25 m/s. The pressures at the points A and B are given as 29.43 N/cm^2 and 22.563 N/cm^2 respectively, while the datum head at A and B are 28m and 30m, find the loss of head between A and B. **(10 Marks)**

Module-3

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

b. Derive an expression for flow trough V-notch. **(10 Marks)**

OR

6 a. Explain following dimensionless number:
(i) Mach's number (M) (ii) Reynold's number (iii) Euler's number **(10 Marks)**

b. Define Reynold's numbers. Write its physical significance. **(10 Marks)**

Module-4

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

b. Show that the average velocity is equal to the half of the maximum velocity in a laminar flow through pipe. **(10 Marks)**

OR

8 a. Determine :
i) Pressure gradient
ii) Shear stress at the two horizontal plates
iii) Discharge per meter width for laminar flow of oil with a maximum velocity of 2 m/sec between two plates which are 150 mm apart. Given $\mu = 2.5$ Pa.sec. **(10 Marks)**

b. The rate of flow of water through a horizontal pipe is 0.85 m^3/s. The diameter of the pipe which is 200mm is suddenly enlarge to 400mm. The pressure intensity is smaller pipe is 11.772 N/cm^2. Determine
i) Loss of head due to sudden enlargement
ii) Pressure density in large pipe
iii) Power lost due to enlargement **(10 Marks)**

Module-5

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

b. Explain the following :
(i) Momentum thickness (ii) Energy thickness **(10 Marks)**

OR

10 a. Derive an expression for the velocity of sound in terms of bulk modulus (K). **(10 Marks)**

b. Differentiate between :
(i) Steam body and bluff body
(ii) Pressure drag and friction drag. **(10 Marks)**

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