CBCS SCHEME

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18AU42

Fourth Semester B.E. Degree Examination, June/July 2024
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. Draw neat sketch and explain about surface tension and capillarity. Also obtain expression for capillary rise. **(06 Marks)**

b. Calculate the dynamic viscosity of an oil, which is used for lubrication between a square plate of size 0.8 × 0.8m and an inclined plane with angle of inclination 30° as shown in Fig Q1(b). The weight of the square plate is 300N and it slides down the inclined plane with a uniform velocity of 0.3m/s. Thickness of oil film is 1.5mm.

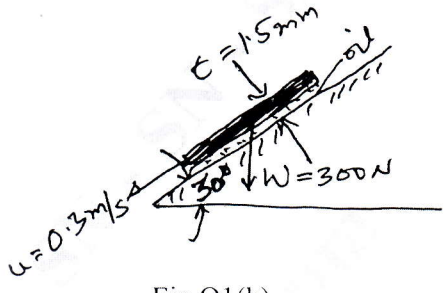

Fig Q1(b) **(08 Marks)**

c. Define Pascal's law and State an example for use of it. **(06 Marks)**

OR

2 a. Explain with a diagram Absolute, gauge atmospheric and vacuum pressure. **(06 Marks)**

b. A simple U tube manometer containing mercury is connects to a pipe in which a fluid of sp.gr 0.8 and having vacuum pressure is flowing. The other end of the manometer is open to atmosphere. Find the vacuum pressure in the pipe if difference of mercury level in the two limbs is 40cm and the height of fluid in the last from the center of pipe is 15cm below. **(08 Marks)**

c. Obtain the relation for Hydrostatic forces for a cured surface submerged in liquid. **(06 Marks)**

Module-2

3 a. A rectangular pontoon is 5m long, 3m wide and 1.20m high the depth of immersion of pontoon is 0.80m in sea water. If the center of gravity of pontoon is 0.6m above the bottom of the pontoon, determine the metacentric height the density sea water = 1025Kg/m^3. **(08 Marks)**

b. Define velocity potential and stream function. Prove that equipotential line and constant stream function line are mutually perpendicular. **(06 Marks)**

c A pipe of 450mm diameter branches into two pipes of diameters 300mm and 200mm. The average velocity in 450mm pipe is 3m/s. Find :

i) Discharge in a 450mm diameter pipe

ii) Velocity in 200mm diameter pipe of average velocity in 300mm pipe is 2.5m/s. **(06 Marks)**

OR

4 a. Derive continuity equation in 3 Dimensions by explaining the basic principles. **(10 Marks)**

b. Explain different types of fluid flow. **(10 Marks)**

Module-3

5 a. Derive "Euler's equation of motion and write Bernoulli's equation. **(10 Marks)**

b. A horizontal venturimeter with inlet diameter 20cm and throat diameter 10cm is used to measure the flow of water. Pressure at the inlet is 17.658N/cm^2 and the vacuum pressure at the throat is 30cm of mercury. Find the discharge through venturimeter of $C_d = 0.98$. **(10 Marks)**

OR

6 a. With neat sketch, explain the working of pitot tube. **(08 Marks)**

b. Find the expression for flow over the rectangular notch interms of head over the crest. **(08 Marks)**

c. Find the discharge over a Triangular notch of angle of 60° when the head over the notch is 0.3m. Assume $C_d = 0.6$. **(04 Marks)**

Module-4

7 a. Derive on the basis of dimensional analysis for the thrust developed by a propeller. Assume thrust P depends on angular velocity W, Speed V, diameter D dynamic viscosity μ, density ρ elasticity of fluid medium which can be denoted by speed of sound 'C'. **(10 Marks)**

b. Explain different types of dimensional similarities between prototype and a model. **(10 Marks)**

OR

8 a. Derive Darcy equation for Loss of head in a pipe. **(10 Marks)**

b. What are meant by total energy line and hydraulic gradient line? Explain. **(06 Marks)**

c. At a sudden enlargement of water main from 240mm to 480mm diameter, the hydraulic gradient rises by 10mm. Estimate the rate of flow. **(04 Marks)**

Module-5

9 a. Derive Hagen Poiseuille equation. **(10 Marks)**

b. Define :

i) Displacement thickness ii) Momentum thickness iii) Energy thickness appropriate equation. **(10 Marks)**

OR

10 a. Explain the propagation of sound wave (pressure wave) in a compressible fluid. **(10 Marks)**

b. An air craft is flying at 1100Km/hr through the stagnant air having pressure of 7N/cm^2 and temperature -5°C. Find the Mach number of the air craft. Also calculate the pressure, temperature and density of air at the stagnation point on the nose of the aircraft take R = 287.145/Kg K, K = 1.4. **(10 Marks)**

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