Exam.Code:0940
Sub. Code: 7051

1108

B.E. (Mechanical Engineering)
Fourth Semester
MEC-406: Fluid Mechanics

Time allowed: 3 Hours **Max. Marks: 50**

NOTE: Attempt five questions in all, including Question No. I (Section-A) which is compulsory and selecting two questions each from Section B-C.

x-x-x

Section – A (2 marks each)

1. Can two streamline intersect with each other. Comment on the statement with valid reason.
2. What are the Hydraulic Gradient and Energy Gradient Lines?
3. Define a Weir and point out the difference between Notch and Weir.
4. State any two assumptions in deriving Bernoulli's equation and write Bernoulli's equation with friction?
5. What do you understand by Minor and Major Head losses

Section – B (Do any two questions)

6. a) A Fireman holds a water hose ending into a nozzle that issues a **25 mm** diameter jet of water. If the pressure of water in the **70 mm** diameter hose is **1000 kPa**, find the force experienced by the firemen.

   b) Explain the necessary conditions for complete similarity between a Model and a Prototype. (5, 5)

7. a) For a two-dimensional potential flow, the velocity potential is given by $\Phi = x(2y-1)$, determine the velocity at the point P (7, 8). Also find out the value of stream function Ψ at this point P.

   b) A circular plate of **2 m diameter** is submerged in water, with its greatest and least depth below the water surface being **2 m** and **1 m** respectively. Determine: (a) The total pressure on the face of the plate (b) The position of centre of pressure. (5, 5)

8. a) A horizontal Venturimeter with a **150 mm** diameter at inlet and **100 mm** at the throat is laid with its axis horizontal and is used to measure the flow of an oil of specific gravity **0.9**. Determine the deflection of the oil-mercury gauge, if the discharge of the oil is **60 liters/sec**. The coefficient of Venturimeter is **0.98**

   b) A solid cylinder of **2 m** diameter and **1 m** height is made of a material of specific gravity **0.7** and floats in water. Find its Metacentric height. (5, 5)

P.T.O.

Section – C (Do any two questions)

9. a) A fluid of viscosity **0.7 Ns/m^2** and specific gravity **1.3** is flowing through a circular pipe of diameter **100 mm**. The maximum shear stress at the pipe wall is given as **196.2 N/m^2**. Find (i) the pressure gradient (ii) the average velocity (iii) Reynolds number of flow.

   b) Determine the speed of sound in air at (a) **300 K** and (b) **1000 K**. Also determine the Mach number of an aircraft moving in air at a velocity of **240 m/s** for both cases. Use the values, **R =0.287 kJ/kg -K and γ = 1.4.** (6, 4)

10. a) Work out the Displacement Thickness, Momentum Thickness in terms of nominal boundary layer thickness δ and Energy Thickness, Shape factor for the following velocity distribution prescribed by the relation:

$$\frac{u}{U_o} = \left(\frac{u}{\delta}\right)^{1/7}$$

   where **"u"** is the velocity at a height **"y"** above the surface and **"U_0"** is the free stream velocity.

   b) What is a Rankine Half-Body and explain the flow past a Rankine Half- Body with the help of suitable labeled diagrams and corresponding equations. (5, 5)

11. a) A source of disturbance travels in air alternatively at Subsonic, Sonic and Supersonic velocities. Sketch and explain the propagation of disturbance in each of the above cases.

    b) Show that the discharge per unit width between two parallel plates distance **"b"** apart, when one plate is moving at velocity **"V"** while the other one is held stationery, for the condition of zero shear stress at the fixed plate is: **q=bV/3** (5,5)

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