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Roll No. Total No. of Pages: 02

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B.Tech.(IE) (2008 Batch) / (ME) (Sem.-4) FLUID MECHANICS-I

Subject Code: ME-206 Paper ID: [A0810]

Time: 3 Hrs. Max. Marks: 60

INSTRUCTION TO CANDIDATES:

- SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
- 2. SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.
- 3. SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.

SECTION-A

1. Write briefly:

- a) Define the term continuum as applied to the mechanism of flow.
- b) Explain the term dynamic viscosity and kinematic viscosity.
- c) Explain using the concept of fluid mechanics, why petrol evaporates more readily then water at ordinary temperature.
- d) Classify different types of fluid. Distinguish between the Newtonian and Non-Newtonian fluid.
- e) What are flow nets? What is its utility?
- f) Prove that streamlines and equipotential lines are orthogonal.
- g) What are the conditions of a floating body and a submerged body?
- h) What would be the effect on time period of oscillation with the increase in Meta centric height?
- i) What do you understand by stagnation pressure and dynamic pressure?
- j) What is Vena-contracta?

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SECTION-B

- 2. How will you apply momentum equation for determining the force exerted by a flowing fluid on a pipe bend?
- 3. What is venturi-meter? Where do we use it? Write the principle and construction of venturi-meter and derive an expression for flow through venturi-meter.
- 4. Establish the Bernoulli's theorem from the Euler's equation of motion through stream line tube. Mention the assumptions made.
- 5. What are the various methods of dimensional analysis to obtain a functional relationship between various parameters affecting a physical phenomenon? Describe with an illustration.
- 6. Prove that for a steady laminar flow between two fixed parallel plates, the velocity distribution across the section is parabolic and that the average velocity is $2/3^{rd}$ of the maximum velocity.

SECTION-C

7. Sketch the stream lines represented by :

a)
$$\Psi = x^2 + y^2$$

b)
$$\Psi = x^2 - y^2$$

8. An aircraft propeller of diameter d rotating at a speed N and advancing with speed v in air of density ρ and viscosity μ develops a thrust V. Using Buckingham Pi-theorem, show that the thrust developed can be related through :

$$\pi_1 = \phi (\pi_2, \pi_3)$$

Where,
$$\pi_1 = T/\rho V^2 d^2$$
, $\pi_2 = \rho V d/\mu$ and $\pi_3 = dN/V$

If the effect of Reynolds number is relatively small, establish the value of corresponding speed for testing propellers.

9. A 30 cm diameter pipe carries water under a head of 20 meters with a velocity of 3.5m/s. if the axis of the pipe turns through 45°; find the magnitude and direction of the resultant force on the bend.

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