Exam.Code:0940
Sub. Code: 33859

2055
B.E. (Mechanical Engineering)
Fourth Semester
MEC-405: Fluid Mechanics

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

NOTE: Attempt five questions in all, including Question No.1 (Section-A) which are compulsory and selecting two questions each from Section B-C. All questions carry 10 marks.

x-x-x

Section – A (2 marks each)

1. i. Differentiate between Dynamic viscosity and Kinematic viscosity.
   ii. Define the terms "Drag" and "Lift"
   iii. What are the conditions for Couette flow.
   iv. What is meant by the terms "Normal Shock wave" and "Oblique shock wave".
   v. List down the three basic laws of Similitude. Also, define the term "Similitude".

Section – B (Do any two questions)

2. A square door with side dimensions **30 cm** is provided in the side wall of a tank which is filled with water of specific weight **9790 N/m^3**. What force must be applied at the lower end of the gate so as to hold the hinged door closed. The hinged end of the door lies at a depth of **3 m** from the free water surface.
   How this force would change if the water is subjected to a pressure of $0.5\,X\,10^5$ **N/m^2**. **(10)**

3. a) Prove that the Streamlines and Equipotential Lines form a net of mutually perpendicular lines.
   b) Which of the following functions represents a possible Ir-rotational Flow:
      (i) $\Psi = A\,(x^2 - y^2)$ **and where 'A' is constant**
      (ii) $\Psi = x^3 - 3xy^2$ **(4, 6)**

4. State Buckingham's π- theorem. The resistance ***"R"*** experienced by a partially submerged body depends upon the velocity ***"V"***, length of the body ***"L"***, viscosity of the fluid "μ", density of the fluid "ρ" and gravitational acceleration "g". Obtain a dimensionless expression for "**R**" using Buckingham Pi Theorem. **(10)**

P.T.O.

Section – C (Do any two questions)

5. a) Differentiate between Minor and Major Losses.

b) Water is to be supplied to the inhabitants of a college campus through a supply main. The following data is given:

Distance of the reservoir from the campus = **3 km**

Number of inhabitants = **4000**

Consumption of water per day of each inhabitant = **180 litres**

Loss of head due to friction = **18 m**

Co-efficient of friction for the pipe, $f = 0{\cdot}007$

If half of the daily supply is pumped in **8 hours**, determine the size of the supply main. **(4, 6)**

6. An oil with a mass density of **850 kg/m^3** and dynamic viscosity of **0.025 poise** flows through a **5 cm** diameter pipe of length **400 m** at the rate of **0.2 litre/sec.** Determine the following terms:

(i) Reynolds number of flow

(ii) Centre line velocity

(iii) Pressure gradient

(iv) Wall shear stress

(v) Power required to maintain the flow **(10)**

7. a) Explain the terms: Mach Number, Mach Cone, Mach line and Mach angle

b) Find out the Displacement Thickness, the Momentum Thickness, and the Energy Thickness for the velocity distribution in the boundary layer given by

$$\frac{u}{U} = \frac{y}{\delta};$$

where "**u**" is the velocity at a distance "**y**" from the plate and $u = U$ *at* $y = \delta$, where δ is the boundary layer thickness. Also calculate the ratio of displacement thickness to the momentum thickness. **(4, 6)**

x-x-x