Exam.Code:0940
Sub. Code: 6715

2054
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 (a) Differentiate between Newtonian and Non-Newtonian Fluids

(b) Define Buoyant Force and centre of buoyancy.

(c) State Pascal's Law. What are its applications?

(d) What do you understand by Minor and Major Head losses

(e) What is meant by the terms: Sub-Sonic, Sonic, Supersonic and Hypersonic Flow.

Section – B (Do any two questions)

2. a) An isosceles triangular plate of base **4 m** and altitude **4 m** is immersed vertically in an oil of specific gravity **0.9**. The base of the plate coincides with the free surface of oil. Determine: (i) Total pressure on the plate; (ii) Centre of pressure.

(b) Discuss the Stability of Immersed and Floating Bodies in brief. (6,4)

3. (a) Show that the Streamlines and Equipotential Lines form a net of mutually perpendicular lines.

(b) Given that $u = -4ax(x^2 - 3y^2)$ and $v = 4ay(3x^2 - y^2)$

Examine whether these velocity components represent a physically possible two-dimensional flow; if so whether the flow is rotational or irrotational. (5,5)

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's π-theorem.

Section – C (Do any two questions)

5. (a) What do you mean by the term boundary layer and explain the fundamental causes of its existence using a well-labelled diagram. Also, explain the characteristics of the laminar and turbulent boundary layer.

b) What are the different methods of preventing or delaying the separation of the boundary layer. (6,4)

6. Two fixed parallel plates kept **8 cm** apart having a laminar flow of oil between them with a maximum velocity of **1.5 m/s**. Take the dynamic viscosity of oil to be **2 Ns/m²**. Compute the (i) discharge per metre width (ii) the shear stress at the plates (iii)

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pressure difference between two points **25 metres** apart (iv) velocity at **2 cm** from the plate (v) velocity gradient at the plates end.

7. Discuss with the help of diagrams the nature of propagation of Pressure waves or disturbances in a compressible flow when the flow is (i) Sub-sonic (ii) Sonic (iii) Super-Sonic. Also discuss the terms: Mach Cone, Mach Angle, Zone of Action and Zone of Silence.

x-x-x