Exam.Code:0940
Sub. Code: 6715

2053
B.E. (Mechanical Engineering)
Fourth Semester
MEC-405: Fluid Mechanics

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

NOTE: Attempt five questions in all, including Unit-I (Question Nos. (1-5) which are compulsory and selecting two questions each from Unit II - III.

x-x-x

UNIT - I

1. State and explain Newton's law of viscosity.
2. What is meant by intensity of pressure? How it varies with the depth of the fluid.
3. Distinguish between (a) Steady flow and unsteady flow (b) Uniform and non-uniform flow.
4. Define an orifice and a mouthpiece. What is the difference between the two?
5. What do you understand by Boundary layer and illustrate with reference to flow over a flat plate.

(5x2)

UNIT - II

6. a) 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 ir- rotational.

   b) State and prove Pascal's law. (6, 4)

7. a) A solid cylinder of diameter **4 m** has a height of **4 m**. Find the meta-centric height of the cylinder if the specific gravity of the material of cylinder is **0.6** and it is floating in water with its axis vertical. State whether the equilibrium is stable or unstable.

   b) What are the conditions of equilibrium of a floating body and submerged body. (6,4)

8. The velocity through a circular orifice depends on head causing flow **H**, diameter of the orifice **D**, Viscosity coefficient **μ**, mass density **ρ** and gravity acceleration **g**. Obtain an expression of velocity **V** using Buckingham's **π** theorem. Also, state Buckingham's **π** theorem

(10)

P.T.O.

UNIT - III

9. (a) The velocity distribution in the boundary layer is given by:

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

Where "**u**" is the velocity at a distance "**y**" from the plate and "**u = U**" at "**y = δ**" and **δ** is the nominal boundary layer thickness. Calculate the (i) Displacement Thickness (ii) Momentum Thickness (iii) Shape Factor and (iv) Energy thickness.

b) Differentiate between Minor and Major Losses. (6, 4)

10. a) Write a short note on Prandtl Mixing Length Concept

b) An oil of viscosity **0.12 Ns/m^2** and specific gravity **0.85** is pumped at the rate of **0.03 m^3/s** through a pipe having **0.20 m** diameter and **400 m** length. Compute the pressure drop, average shear stress at the wall of the pipe and power required to maintain the flow, assuming pipe is horizontal. (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) What is meant by the term Sonic or Acoustic Velocity? Derive the following expression for the velocity of sound wave (**C**) in a compressible fluid where, **K** and **ρ** are the bulk modulus and density of fluid respectively.

$$C = \sqrt{\frac{K}{\rho}}$$

(5, 5)

x-x-x