UE 20907)

Exam.Code:0940
Sub. Code: 7098

2062
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. I which is compulsory and selecting two questions from each Unit.

x-x-x

I. Write briefly:-

a) What do you mean by the term viscosity. How is dynamic viscosity different than kinematic viscosity.
b) Define non-Newtonian fluid. Give two examples.
c) List the minor losses encountered in pipe systems.
d) Differentiate between a turbulent flow and a laminar flow.
e) How is shock wave produced in a compressible fluid.

(5x2)

UNIT - I

II. a) A solid cylinder 4m in diameter and 4m high is floating in water with its axis vertical. If the specific gravity of the material of cylinder is 0.6, find its metacentric height. State whether the equilibrium is stable or unstable. **(5)**

b) Determine the total pressure and centre of pressure on an isosceles triangular plate of base 4m and altitude 4m when it immersed vertically in oil of specific gravity 0.9. It is immersed in such a way that the base of plate coincides with the free oil surface. **(5)**

III. a) Given that : **(6)**
$u = -4ax(x^2-3y^2)$
$v = 4ay(3x^2-y^2)$
Examine whether these velocity components represent a physically possible two-dimensional flow; if so whether the flow is rotational or irrotational.

b) Discuss about the significance of terms 'circulation' and 'vorticity' in a fluid flow. **(4)**

IV. a) What is Similitude. How do you ensure complete similarity between a model and a prototype. **(4)**

b) The pressure difference Δp in a pipe of diameter 'D' and length 'l' due to turbulent flow depends on velocity 'V', viscosity 'μ', density 'ρ' and roughness 'k'. Using Buckingham's π-theorem, obtain the expression for Δp. **(6)**

P.T.O.

UNIT - II

V. A lubricating oil of viscosity 8poise and specific gravity 0.9 is pumped through a 50mm diameter pipe. If the pressure drop per metre length of pipe is $20kN/m^2$. determine : (i) the mass flow rate in kg/min (ii) the centre line velocity (iii) the Reynold number of flow (iv) Total frictional drag over 100m length of pipe(v)Velocity and shear stress at 10mm from the wall. **(10)**

VI. a) Define a boundary layer and explain the fundamental causes of its existence. **(5)**

b) A jet weighing 25kN and having wing area of $16.5m^2$ flies at 900km/h. When the engine delivers 6125kW, 65% of the power is used to overcome the drag resistance of the wing. Determine the coefficients of lift and drag. Take air density=$1.12kg/m^3$ **(5)**

VII. a) A supersonic nozzle is to be designed for air flow with Mach number 3 at the exit section which is 200mm in diameter. The pressure and temperature of air at the nozzle exit are to be $7.85kN/m^2$ and 200K respectively. Determine the reservoir pressure and temperature. Also find the nozzle throat area. Take γ=1.4. **(6)**

b) Derive an expression for the velocity of sound wave in a compressible fluid in terms of bulk modulus and density of the fluid. **(4)**

x-x-x