Exam.Code:0940
Sub. Code: 7051

1019
B.E. (Mechanical Engineering)
Fourth Semester
MEC-406: 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 Part.

x-x-x

I.(i)	Define the terms buoyancy and centre of buoyancy.	
(ii)	Differentiate between free vortex and forced vortex flow.	
(iii)	State Buckingham's- π theorem.	
(iv)	Why does boundary layer increase with distance from the upstream edge.	
(v)	What is the significance of Mach number in the compressible fluid flows.	(2x5)
	PART-A	
II. (i)	A wooden cylinder of specific gravity =0.6 and circular cross section is required to float in oil (specific gravity=0.9).Find the L/D ratio for the cylinder to float with its longitudinal axis vertical in oil where L is the height of the cylinder and D is its diameter.	(5)
(ii)	Determine the total pressure and centre of pressure on an isosceles triangular plate of base 4m and altitude 4m when it is vertically immersed in an oil of specific gravity=0.9.The base of the plate coincides with the free surface of oil.	(5)
III.(i)	Define two- dimensional stream function and velocity potential function. Check if the following stream function $\varphi=6x-4y+7xy+9$ represents an irrotational flow. Then find its velocity potential.	(5)
(ii)	Derive an expression for continuity equation for a three-dimensional flow.	(5)
IV.(i)	Derive the Euler's equation of motion.	(5)
(ii)	A hemispherical tank of diameter 4m contains water up to a height of 1.5 m. An orifice of diameter 50mm is provided at the bottom. Find the time required by water.(i) to fall from 1.5m to 1.0m (ii) for completely emptying the tank .Take $C_d=0.6$.	(5)
	PART-B	
V.(i)	For a laminar steady flow show that the pressure gradient in the direction of motion is equal to shear gradient normal to the direction of motion.	(5)
(ii)	An oil of viscosity 10 poise flows between two parallel fixed plates which are kept at a distance of 50mm apart. Find the rate of flow of oil between the plates if the drop of pressure in a length of 1.2m is $0.3N/cm^2$.The width of plates is 200mm.	(5)
VI.	For the velocity distribution in the boundary layer plate is given by the relation $u/U=\sin(\pi y/2\delta)$, where symbols have their usual meaning. Use momentum integral equation to find an expression for (i) boundary layer thickness (ii) wall shear stress(iii)skin friction coefficient(iv)drag force on one side of plate(v) drag coefficient in terms of Reynold's number.	(10)
VII(i)	Find the velocity of the bullet fired in the air if the Mach angle is 30° .Assume the temperature as 15°C. Take R=287.14 J/kg-K and γ= 1.4 for air.	(5)
(ii)	Derive an expression for the area velocity relationship for the compressible fluid.	(5)

x-x-x