Total No. of Questions—**8**] [Total No. of Printed Pages—**3**

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# [5559]-114

## S.E. (Mech./Autom.) (Second Semester) EXAMINATION, 2019

## FLUID MECHANICS

## (2015 PATTERN)

**Time : 2 Hours** **Maximum Marks : 50**

***N.B.*** :— (*i*) Neat diagrams must be drawn wherever ncessary.

(*ii*) Figures to the right indicate full marks.

(*iii*) Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

(*iv*) Assume suitable data, if necessary.

Q1) a) Derive an expression for total pressure and center of pressure for inclined plane submerged in liquid and hence derive the expression for center of pressure for vertical plane. [6]

b) The stream function for flow is given as $\psi = 6x-4y+7xy+9$. Is the flow is rotational? Also find its velocity potential function. [6]

OR

Q2) a) Discuss various type of flows with examples [6]

b) A vertical gap 1.2 cm wide of infinite extent contains a fluid of viscosity 10 Poise and specific gravity 0.9. A metallic plate 1 m * 1 m * 0.2 cm is to be lifted up with a constant velocity of 0.2m/s, through the gap. If the plate is in the middle of the gap, find the vertical force required. The weight of the plate is 50 N [6]

Q3) a) A 300 mm x 150 mm venturimeter is provided in a vertical pipeline carrying oil of specific gravity 0.9, flow being upward. The difference in

P.T.O.

elevation of the throat section and entrance section of the venturimeter is 300 mm. The differential U-tube mercury manometer shows a gauge deflection of 250 mm. Calculate:
i)The discharge of oil, and
ii)The pressure difference between the entrance section and the throat section. Take Cd=0.98 and specific gravity of mercury as 13.6. [7]

b) Derive an expression of velocity and shear stress distribution for laminar flow between fixed parallel plates. [6]

OR

Q4) a) Define HGL and TEL. Draw a neat diagram of venturimeter and show HGL and TEL for it. [6]

b) A 0.2 m diameter pipe carries liquid in laminar region. A Pitot tube placed in the flow at a radial distance of 6 cm from the axis of the pipe indicates velocity of 0.5 m/s.
Calculate: The maximum velocity, mean velocity and discharge in the pipe. [7]

Q5) a) A pipe of diameter 25cm and length 2000m connects two reservoirs, having difference of water level 25m .Determine the discharge through the pipe. If an additional pipe of diameter 25cm and length 1000m is attached to the last 1000m length of existing pipe find the increase in discharge. Neglecting minor losses. Take coefficient of friction = 0.015 [6]

b) Explain the concept of series of pipe, parallel pipe and equivalent pipe with figure [6]

OR

Q6) a) Derive on the basis of dimensionless analysis suitable parameters to present thrust developed by a propeller .Assume that the thrust T depends upon angular velocity ω, speed of advance V, diameter D, viscosity μ, density ρ and speed of sound C. [8]

(b) Explain: [4]
1) Reynolds Number
2) Froude Number

Q7) a) A jet plane which weighs 19.62KN has a wing area of $25m^2$ .it is flying at a speed of 200km per hour . When the engine develops 588600 W, 70% of this power is used to overcome the drag resistance of the wing. Calculate the coefficient of drag and lift for the wing .if density of air is 0.00125gm/cc. [7]

(b) Explain: 1) terminal velocity 2) skin friction drag 3) pressure drag [6]

OR

Q8) a) Explain the concept of separation of boundary layer. What are the methods of preventing the separation of boundary layer [6]

(b) Find the displacement thickness, momentum thickness and energy thickness for velocity distribution in the boundary layer by $\left\{\frac{u}{U} = \frac{y}{\delta}\right\}$, where u is the velocity at a distance y from the plate and u=U at y=δ , where δ= boundary layer thickness. Also calculate the value of $\delta^*/\Theta$. [7]