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SEAT No. :

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S.E. (Automobile & Mechanical Engineering)

FLUID MECHANICS

(2019 Pattern) (Semester - IV) (202049)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7or Q8.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right side indicate full marks.***
4) ***Use of electronic pocket calculator is allowed.***
5) ***Assume Suitable data if necessary.***

Q1) a) Explain Eulerian method of Flow Description. **[4]**

b) Show that the streamlines and equipotential lines form a net of mutually perpendicular lines. **[6]**

c) Velocity of a fluid flow medium is given by,

$V = (10x^2y)i + (15xy)j + (25t + 3xy)k$

Find acceleration of medium at (1, 2, –1) *m* and $t = 0.5$ sec. **[7]**

OR

Q2) a) Explain Circulation and Vorticity. **[4]**

b) State weather the flow of liquid given by $u = 5x$ & $v = -5y$ is **[6]**

a) Continuous

b) Rotational

c) The velocity components in flow are given by, $u = 6y$ and $v = -6x$. **[7]**

Find:

i) Whether the flow is possible?

ii) Stream function ψ.

P.T.O.

Q3) a) Explain HGL and TEL. **[4]**

b) Derive expression for discharge through venturimeter. **[6]**

c) A Laminar flow is taking place in a pipe of diameter 200 mm. The maximum velocity is 1.5 m/s. Determine the mean velocity and radius at which this occurs. Also calculate the velocity at 40mm from the wall the pipe. **[8]**

OR

Q4) a) Explain following terms. **[4]**

i) Potential head,

ii) Velocity head

b) Derive expression for velocity distribution for flow in fixed parallel plates. **[6]**

c) A vertical pipe conveying oil of relative density 0.8, two pressure gauges has been installed at A and B where diameters are 160 mm and 80 mm respectively. Point A is 2m above point B. The pressure gauge readings have been shown that the pressure at B is greater than at A by 0.981 N/cm^2. Neglecting losses find the flow rate through the pipe. **[8]**

Q5) a) Explain factors affecting the growth of Boundary layer. **[4]**

b) Explain Streamlined Body and Bluff Body. **[6]**

c) A pipe line of 600 mm diameter is 1.5 km long, to increase the discharge, another pipeline of same diameter is introduced parallel to the first in the second half of the length. If f = 0.04 and head at the inlet is 300 mm, determine increase in discharge. Neglect minor losses in pipelines and f are a Darcy friction factor. **[8]**

OR

Q6) a) A solid sphere of 400 mm diameter is completely immersed in the flow of sea water. Velocity of flow is 1.2 m/s and specific gravity of sea water is 1.02 5. Determine the drag force on a sphere. Assume C_D = 0.6. **[4]**

b) Show that corresponding to the maximum power transmission through pipe, the power transmission efficiency is 66.67%. **[6]**

c) The velocity distribution in the boundary layer is, **[8]**

$$\frac{u}{U} = \frac{3}{2}\left(\frac{y}{\delta}\right) - \frac{1}{2}\left(\frac{y}{\delta}\right)2$$

Where δ = Thickness of boundary layer.

Determine:

i) Ratio of (δ*/δ)

ii) ratio of (θ/δ)

Q7) a) Explain dimensional homogeneity. **[4]**

b) Explain Mach Model Law and Give its applications. **[4]**

c) Using Buckingham π theorem, show that the velocity through a circular orifice is given by: **[9]**

$$V = \sqrt{2gH}\,\Phi\left(\frac{D}{H}, \frac{\mu}{\rho VH}\right)$$

Where H = Head, ρ = Mass Density, g = Acceleration due to gravity, D = Diameter of orifice, μ = Coefficient of Viscosity.

OR

Q8) a) How are the repeating variables selected for dimensional analysis? **[4]**

b) Explain Geometric Similarity. **[4]**

c) The Efficiency η of a fan depends on density p, the dynamic viscosity μ of the fluid, the angular velocity ω, diameter D of the rotor and discharge Q. Obtain expression of η in terms of dimensional parameter. **[9]**