TE-sem-V - old - Mech.

FM

1/12/15

QP Code : 1695

Duration 3 hrs **Total marks assigned to the paper 100**

1. Q.No.1 is compulsory.
2. Answer any 4 of the remaining questions
3. Assume suitable data, if necessary

Q.No.1 Answer any 4 20

1. A two-dimensional flow field is given by $u = 2y^2$; $v = 5x$. Find the acceleration at point A (-2, -3)

2. Convert -12560 N/sq m into metres of oil column (absolute), if the specific gravity of oil is 0.8 and the atmospheric pressure is equivalent to 10.18 m of water column.

3. Oil having a dynamic viscosity of 0.048 kg/m.s flows through a 20 mm tube . The maximum velocity is 0.3 m/s. What would be the head drop for flow in 250 metres of length of the tube. The specific gravity of oil is 0.85

4. Derive an expression for capillary rise of water in a glass tube of diameter 'd'.

5. What is CFD? What are the benefits of a CFD simulation? Where is it used ?

Q.No.2

10

1. Two reservoirs are connected by three cast iron pipes in series. The pipe data is as follows

Pipe No	Length in m	Diameter in mm	Friction factor f
1	300	200	0.02
2	360	300	0.022
3	1200	450	.025

If the discharge through the pipes is 0.1 cubic metres/sec, calculate the difference in elevation between the water levels in the 2 reservoirs. Consider entry and exit losses.

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2. A vertical square plate of area 6m x 6m is submerged in water with the upper edge 3m below the water surface. Locate a horizontal line on the surface of the square such that (a) the force on the upper portion equals the force on the lower portion and (b) the moment of the force about the line due to the upper portion equals the moment due to the lower portion

Q.No.3

10

1. 600 litres/s of water flows through a 50 cm diameter pipeline that contains a horizontal 90 degree bend. The pressure at the entrance of the bend is 150 kPa. Determine the force components parallel and normal to the approach velocity required to hold the bend in place.

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2. The velocity distribution in a laminar boundary layer is given by $u/U= 3(y/\delta) -2(y/\delta)^2$. Determine the displacement thickness, momentum thickness and energy thickness in terms of δ.

Q.No.4

10

1. A flow has a velocity potential function is given by $\varphi = x^3 - 3xy^2$. Verify whether it represents a valid flow field. If it does then determine the stream function and calculate the velocity and pressure at (-1, -3) given that the pressure at (4,-1) is 14.5 KPa and the fluid is water.

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2. State and explain the Prandtl's mixing length hypothesis for turbulence and derive an expression for turbulent stresses. Using this expression derive the universal velocity profile for turbulent flow in a pipe

Q.No.5

10

1. Draw a sketch of an orificemeter and derive an expression for the discharge through the orificemeter. Explain the terms C_v, C_c and C_d.

6

2. State Newton's law of viscosity. A Newtonian fluid is in the clearance between a shaft and a concentric sleeve. When a force of 600 N is applied to the sleeve parallel to the shaft, the sleeve attains a speed of 1 m/s. If a 1500 N force is applied what speed will the sleeve attain. The temperature of the sleeve remains constant.

4

3. Define bulk modulus of elasticity

Q.No.6

10

1. A doublet at the origin is combined with a uniform rectilinear flow of 12 m/s along the positive X axis to give flow past a cylinder of diameter of 4.0 m. Calculate the strength of the doublet. A clockwise vortex of strength 150 m^2s is superimposed on this flow at the centre of the cylinder. Calculate the location of the stagnation points. What is the pressure on the cylinder surface at $\theta = 90^0$ if the pressure far upstream is negligible.

5

2. A point A in a pipeline carrying water the diameter is 1 m, the pressure is 98 kPa and the velocity is 1 m/s. At point B, 2 m higher than A, the diameter is 0.5 m and the pressure is 20 kPa. Determine the direction of flow.

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3. Determine the density, specific volume and volume of an object that weighs 3 N in water and 4 N in oil of sp. gravity 0.83.

Q.No.7

Write short notes (any 4)

1. Boundary layer separation
2. Induced drag
3. Stability of floating bodies
4. Minor losses in pipes
5. Surface tension as a fluid property

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