Government College of Engineering, Aurangabad

(An Autonomous Institute of Government of Maharashtra)

S. E. Civil Examination

End Semester Examination November 2016

CE 244: FLUID MECHANICS-I

Time: Three Hours 21 NOV 2016 *Max. Marks: 60*

"Verify the Course Code and check whether you have got the correct question paper"

N.B:-

1. *All questions are compulsory*
2. *All questions carry equal marks*
3. *Assume suitable data if necessary and state it clearly*
4. *Use of non-programmable calculator is allowed*

Q1. Attempt any TWO

a) Explain the terms i) Dynamic viscosity, and ii) Kinematic viscosity. Give their dimensions.

b) An oil film of thickness 2.2 mm is used for lubrication between a square plate of size 0.9m x 0.9m and an inclined plane having an angle of inclination 20^0. The weight of the square is 410.0 N and it slides down the plane with a uniform velocity of 0.22 m/s. Find the dynamic viscosity of the oil.

c) The surface tension of water in contact with air at 20^0 C is given as 0.0718 N/m. The pressure inside a droplet of water is to be 0.015 N/cm^2 greater than the outside pressure, calculate the diameter of the droplet of water.

Q2. Attempt any TWO

a) Show that the distance between the meta-centre and centre of buoyancy is given by $BM = \frac{I}{\forall}$. Where I = Moment of inertia of the plan of the floating body at water surface about longitudinal axis. $\forall$ = Volume of the body submerged in liquid.

b) An inverted differential manometer containing an oil of sp. gr. 0.9 is connected to find the difference of pressure at two points A and B of a pipe containing water. If the manometer reading is 35 cm, and the level nearer to A being the lower one find the difference of pressures.

c) A circular plate 2.8 m diameter is immersed in water, its greatest and least depth below the free surface being 4 m and 2 m respectively. Find the total pressure on one face of the plate and the position of the centre of pressure.

Q3. Attempt any TWO

a) Define terms i) Vortex flow ii) Forced vortex flow, and iii) Free vortex flow

b) An incompressible fluid flows steadily through two pipes of diameter 0.3 m and 0.32 m which combine to discharge in a pipe of 0.4 m diameter. If the average velocities in the 0.3 m and 0.32 m diameter pipes are 1.8 m/s and 3.0 m/s respectively, then find the average velocity in the 0.4 m diameter pipe.

c) If for a two dimensional potential flow, the velocity potential is given by $\phi = 4x(4y-6)$, determine the velocity at the point (2,3). Determine also the value of stream function ψ at the point (2,3).

Q4. Attempt any TWO

a) Derive Euler's equation of motion along a stream line for an ideal fluid stating clearly the assumptions. Explain how this is integrated to get Bernoulli's equation along a stream line.

b) Explain the principle of venturimeter with a neat sketch. Derive the expression for the rate of flow of fluid through it.

c) A tank has two identical orifices in one of its vertical sides. The upper orifice is 6 m below the water surface and lower one 8m below the water surface. If the value of Cv for each orifice is 0.95, find the point of inter-section of the two jets.

Q5. Attempt any TWO

a) A viscous flow is taking place in a pipe of diameter 142 mm. The maximum velocity is 1.8 m/s. Find the mean velocity and the radius at which this occurs. Also calculate the velocity at 30 mm from the wall of the pipe.

b) Explain the terms: i) Friction drag ii) Pressure drag and profile drag

c) Define displacement thickness. Derive an expression for the displacement thickness

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