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Question Paper Code: 31135

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2017

Third Semester

Civil Engineering

01UCE305 – FLUID MECHANICS

(Regulation 2013)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions.

PART A - (10 x 2 = 20 Marks)

1. Define surface tension.
2. What is Newton's law of viscosity?
3. State Pascal's law.
4. Write the continuity equation.
5. Differentiate between uniform flow and non-uniform flow.
6. Define path line.
7. Mention any four discharge measuring devices.
8. Write the instruments used for measurement of discharge.
9. What is dimensional homogeneity?
10. Write the uses of dimension analysis.

PART - B (5 x 16 = 80 Marks)

11. (a) Calculate the dynamic viscosity of oil, which is used for lubrication between a square plate of size 0.8*m*x0.8*m* and an inclined plane with an angle of inclination 30^0. The weight of the square plate is 300*N* and it slides down on an inclined plane at a velocity of 0.3*m/s*. The thickness of the oil film is 1.5*mm.* (16)

Or

(b) (i) A 18 cm diameter vertical cylinder rotates concentrically inside another cylinder of diameter 18.12 cm. Both the cylinders are 30 cm height. The space between the cylinders is filled with a liquid whose viscosity is unknown. If a torque of 20 Nm is required to rotate the inner cylinder at 120 rpm, determine the viscosity of the fluid. (10)

(ii) A cylinder contains a liquid of volume 0.0135 m^3 at a pressure of 750 N/m^2. When compressed to reach a volume of 0.0134 m^3 the pressure is increased to 1400 N/m^2. Determine the bulk modulus of elasticity of the fluid. (6)

12. (a) (i) A solid cylinder 2 m in diameter and 2 m high is floating in water with its axis vertical. If the specific gravity of the material of cylinder is 0.65 find its metacentric height. Also state whether the equilibrium is stable or unstable. (10)

(ii) The right limb of a U tube manometer containing mercury is open to the atmosphere while the left limb is connected to a pipe in which a fluid of specific gravity 0.9 is flowing. The centre of the pipe is 25 cm below the level of mercury in the right limb. Find the pressure in the pipe, if the difference of mercury level in the two limbs is 45 cm. (6)

Or

(b) A uniform body of size 3*m* long 2*m* wide 1*m* deep floats in water. What is the weight of the body if the depth of the immersion is 0.8*m*? Determine the meta-centric height also. (16)

13. (a) (i) Derive the continuity equation for three dimensional flows in Cartesian coordinates. (10)

(ii) Distinguish between

(a) Rotational flow and irrotational flow and (3)

(b) Path line and streak line. (3)

Or

(b) In a two dimensional incompressible flow the fluid velocity components are given by $u = x - 4y$ and v $= -y - 4x$; Where u and v are x and y components of velocity of flow. Show that the flow satisfies the continuity equation and obtain the expression for stream function. If the flow is potential, obtain also the expression for the velocity potential. (16)

14. (a) Derive the discharge equation for venturimeter. (16)

Or

(b) (i) A pipe line carrying oil of specific gravity 0.87, changes in diameter from 200 mm at a position A to 500 mm diameter to a position B which is 4 m at a higher level. If the pressures at A and B are 100 kN/m^2 and 60 kN/m^2 respectively. If the discharge is 0.20 m^3/s, determine the loss of head and direction of flow. (10)

(ii) A jet of water, 75 mm in diameter, issues with a velocity of 30 m/s and impinges on a stationary flat plate. Find the force exerted by the jet on the plate. (6)

15. (a) The thrust force, F generated by a propeller is found to depend on the following parameters: diameter D, forward velocity u, density ρ, viscosity μ and rotational speed N. Determine the dimensionless parameters to correlate the phenomenon. (16)

Or

(b) (i) An oil of specific gravity 0.92 and viscosity 0.03 poise is to be transported at the rate of 2.5 m^3/s through a 1.20 m diameter pipe. Tests were conducted on a 12 cm diameter pipe using water at 20°C. If the viscosity of water at 20°C is 0.01 poise, find the velocity flow in the model and rate of flow in the model. (10)

(ii) Classify the hydraulic models. Discuss the merits and demerits of each model. (6)

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