Code: 13A01408

R13

B.Tech II Year II Semester (R13) Supplementary Examinations December/January 2015/2016

MECHANICS OF FLUIDS

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

(a) Define Compressibility and write their units.

(b) If 5 m^3 of a certain oil weighs 40 kN. Calculate the specific weight and mass density.

(c) What is meant by velocity potential?

(d) When 3000 liters of water flows per minute through a 0.3 m diameter pipe which later reduces to a 0.15 m diameter pipe. Calculate the velocities of the flow in the two pipes.

(e) Write Chezy's formula and Mannings formula.

(f) Explain about displacement thickness (δ^*) and momentum thickness (θ).

(g) Explain about drag force (F_D) and the lift force (F_L).

(h) State the "Pascal's Law".

(i) Explain about Atmospheric, Absolute, Gage and Vacuum pressure.

(j) Find the depth of a point below water surface in sea where pressure intensity is 1.0006 MN/m^2. Specific gravity of sea water = 1.025.

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

2 (a) Define surface tension. Find the expression for the pressure intensity inside a droplet and inside a soap bubble.

(b) A cylinder of 0.30 m diameter rotates concentrically inside a fixed cylinder of 0.31 m long. Determine the viscosity of the liquid which fills the space between the cylinders if a torque of 0.98 Nm is required to maintain an angular velocity of 2π rad/s.

OR

3 (a) Explain in detail about simple manometers

(b) A U-tube manometer is used to measure the pressure of oil of specific gravity 0.85 flowing in a pipe line. Its left end is connected to the pipe and the right limb is open to the atmosphere. The centre of the pipe is 100 mm below the level of mercury in the right limb. If the difference of mercury level in the two limbs is 160 mm, determine the absolute pressure of the oil in the pipe.

UNIT – II

4 (a) Explain about different types of fluid flow

(b) Derive the equation of stream function and velocity potential for a uniform stream of velocity V in a two-dimensional field, the velocity V being inclined to the axis at a positive angle α.

OR

5 (a) State and prove Bernoulli's equation.

(b) The water is flowing through a tapering pipe having diameter 300 mm and 150 mm at section 1 and 2 respectively. The discharge through the pipe is 40 lit/sec. The section 1 is 10 m above datum and section 2 is 6 m above datum. Find the intensity of pressure at section 2 if that at section 1 is 400 kN/m^2.

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UNIT – III

6 (a) Derive Hagen – Poiseuille equation and state the assumption made.

(b) Oil of Specific gravity 0.82 is pumped through a horizontal pipeline 150 mm in diameter and 3 km long at the rate of 0.015 m^3/sec. the pump has an efficiency of 68% and requires 7.5 kW to pump oil.
(i) What is the dynamic viscosity of the oil?
(ii) Is the flow laminar?

OR

7 (a) Describe an venturimeter and find an expression for measuring discharge of fluid through a pipe with this device.

(b) Water flows at the rate of 0.015 m^3/s through a 100 mm diameter orifice used in a 200 mm pipe. What is the difference in pressure head between the U/S section and the vena contracta section? (Take C_c = 0.60, C_v = 1.0).

UNIT – IV

8 (a) Define boundary layer. Obtain the expression for displacement thickness and momentum thickness.

(b) The velocity distribution in the boundary layer is given by: $\frac{u}{U} = 2\left(\frac{y}{\delta}\right) - \left(\frac{y}{\delta}\right)^2$, 'δ' being boundary layer thickness. Calculate the following: (i) Displacement thickness. (ii) Momentum thickness. (iii) Energy thickness.

OR

9 (a) Explain what is meant by separation of boundary layer. Describe with sketches the method of control separation.

(b) Obtain Von-Karman momentum integral equation.

UNIT – V

10 (a) Define and describe the expression of drag and lift

(b) Assuming the c/s area of a passenger car to be 2.7 m^2 with a drag coefficient of 0.6, estimate the energy requirement at a speed of 60 km/h. Assume the weight of car to be 30 kN and coefficient of friction 0.012. Assume p to be 1.208 kg/m^3.

OR

11 (a) What are various effects of compressibility of drag?

(b) Explain about lift on an airfoil.

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