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367452(37)

B. E. (Fourth Semester) Examination, 2020

(New Scheme)

(Mechatronics Branch)

FLUID MECHANICS

Time Allowed : Three hours

Maximum Marks : 80

Minimum Pass Marks : 28

Note : *Part (a) from each question is compulsory. Attempt any* ***two*** *parts from parts (b), (c) and (d) of each part carries 7 marks.*

Unit-I

1. (a) Define surface tension. 2

(b) Define and derive the equation of Pascal's law. 7

(c) A plate 0·05 mm distant from a fixed plate moves at 1.2 m/s and requires a force of 2.2 N/m^2 to maintain the speed. find the viscosity of the fluid between the plates. 7

(d) A Urinate plate 1.5 m diameter is submerged in water, with its greatest and least depths below the surface being 2 m and 0.75 m respectively. 7

Determine :

(i) Total pressure an one face of the plate, and

(ii) The position of the centre of pressure.

Unit-II

2. (a) What is a streak line? 2

(b) Explain : 7

(i) Steady and unsteady flow, and

(ii) One dimensional, two dimensional and three dimensional flows.

(c) What is a flow net? Explain its characteristics and utilities. 7

(d) What is stream function? What are its properties. 7

Unit-III

3. (a) State Bernoulli's equation. 2

(b) Water flows in a circular pipe. At one section the diameter is 0.3 m, the static pressure is 260 kPa gauge, the velocity is 3 m/s and the elevation is 10 m above the ground level. The elevation at a section downstream is 0 m and the pipe diameter is 0·15 m. Find out the gauge pressure at the downstream section. Frictional effects may be neglected. Assume density of water to be 999 kg/m^3. 7

(c) Derive Bernoull's equation by using Euler's equation. 7

(d) Explain the construction of a venturimeter and derive an expression for actual discharge of the fluid. 7

Unit-IV

4. (a) Define Hydraulic Gradient line. 2

(b) Explain Reynold's experiment to show the type of fluid flow. 7

(c) In a pipe of 300 mm diameter and 800 m length an oil of specific gravity 0·8 is flowing at the rate of 0·45 m^3/s. 7

Find :

(i) Head loss due to friction and

(ii) Power required to maintain the flow

Take Kinematic viscosity of oil as $0·3 \times 10^{-4}$ m^2/s.

(d) What are the different reasons for the major and the minor energy loss in a pipe? What is water hammer? 7

Unit-V

5. (a) Define Dimensional Homogeneity. 2

(b) What do you mean by dimensionless number? Explain any three. 7

(c) Write short notes on: 7

(i) Euler's Model Law and

(ii) Weber's Model Law

(d) Show by the use of Buckingham's π theorem that the velocity through a circular orifice is given by : 7

$$V = \sqrt{2gH}\,\phi\left[\frac{D}{H},\ \frac{\mu}{\rho VH}\right]$$

where H = Head causing flow

μ = Coefficient of viscosity

g = acceleration due to gravity

D = Diameter of the orifice

ρ = mass density

V = Velocity of flow