CBCS SCHEME

USN | | | | | | | | | |

18AE/AS35

Third Semester B.E. Degree Examination, Jan./Feb. 2021
Mechanics of Fluids

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Explain the terms:
(i) Specific weight
(ii) Specific gravity
(iii) Dynamic Viscosity
(iv) Kinematic viscosity **(08 Marks)**

b. Explain surface tension with sketch. Derive an expression for surface tension on liquid droplet. **(06 Marks)**

c. If the velocity distribution over a plate is given by $u = \frac{2}{3}y - y^2$ in which u is the velocity in metre per second at a distance 'y' metre above the plate, determine the shear stress at y = 0 and y = 0.15 m. Take dynamic viscosity of fluid as 8.63 poises. **(06 Marks)**

OR

2 a. Derive an expression for pressure variation in a fluid at rest. **(06 Marks)**

b. Derive curved surface submerged in liquid. **(08 Marks)**

c. A caisson for closing the entrance to a dry dock is of trapezoidal form 16 m wide at the top and 10 m wide at the bottom and 6 m deep. Find the total pressure and centre of pressure on the caisson if the water on the outside is just level with the top and dock is empty. **(06 Marks)**

Module-2

3 a. Explain methods of describing fluid motion. **(04 Marks)**

b. Explain different types of fluid flow. **(08 Marks)**

c. Derive continuity equation in three dimensions. **(08 Marks)**

OR

4 a. Explain velocity potential function and stream function. **(12 Marks)**

b. Explain types of fluid motion. **(08 Marks)**

Module-3

5 a. Derive Euler's equation of motion for ideal fluid. **(10 Marks)**

b. Derive an expression for rate of flow through venturimeter. **(10 Marks)**

OR

6 a. The resisting force R of a supersonic plane during flight can be considered as dependent upon the length of the aircraft 'ℓ', velocity 'v', air viscosity μ, air density ρ, and bulk modulus of air 'K'. Express the functional relationship between these variables and the resisting force. **(10 Marks)**

b. Define similitude. Explain types of similarities. **(10 Marks)**

Module-4

7 a. Derive an expression for drag force on a flat plate due to boundary layer. (12 Marks)

b. A man weighing 981 N descends to the ground from an aeroplane with the help of a parachute against the resistance of air. The shape of the parachute is hemispherical of 2 m diameter. Find the velocity of the parachute with which it comes down. Assume $C_d = 0.5$ and ρ for air = 0.00125 gm/cc and $\gamma = 0.015$ stoke. (08 Marks)

OR

8 a. Explain boundary layer concept. (05 Marks)

b. Derive an expression for displacement thickness, momentum thickness, and energy thickness for flow over a plate. (15 Marks)

Module-5

9 a. Explain propagation of pressure waves in a compressible medium. (10 Marks)

b. Derive an expression for velocity of sound wave in a fluid. (10 Marks)

OR

10 a. Derive Bernoulli's equation for isothermal process and adiabatic process of compressible flow. (10 Marks)

b. Prove that stagnation pressure for compressible flow is given as

$$P_s = P_1\left[1 + \frac{K-1}{2} M_1^2\right]^{\left(\frac{K}{K-1}\right)}$$ (10 Marks)

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