Register No.: ..... Name: .....

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

THIRD SEMESTER B.TECH DEGREE EXAMINATION (S), FEBRUARY 2023
MECHANICAL ENGINEERING

(2020 SCHEME)

Course Code : 20MET203

Course Name: Mechanics of Fluids

Max. Marks : 100 **Duration: 3 Hours**

PART A

(Answer all questions. Each question carries 3 marks)

1. State Newton's Law of viscosity.
2. Explain the term 'meta-centric height'
3. What is the Eulerian description of fluid motion?
4. Distinguish between Compressible flow and incompressible flow
5. List the assumptions used in Bernoulli's equation?
6. Define the following terms (i) Co-efficient of velocity (ii)Co-efficient of discharge.
7. What are (i) Hydraulic gradient line and (ii) Total energy line?
8. What do you understand by the terms Major and Minor energy losses in pipes?
9. State Buckingham's Pi theorem.
10. List the different methods for preventing the separation of boundary layer.

PART B

(Answer one full question from each module, each question carries 14 marks)

MODULE I

11. An oil of viscosity 5 poise is used for lubrication between a shaft and sleeve. The diameter of the shaft is 0.5 m and it rotates at 200 r.p.m. Calculate the power lost in oil for a sleeve length of 100 mm. The thickness of oil film is 1.0 mm. (14)

OR

12. A circular opening 3 m diameter in a vertical side of a tank is closed by a disk of 3 m diameter which can rotate about a horizontal diameter. The head of water above the horizontal diameter is 4m. Calculate (i) the force on the disc, (ii) the torque required to maintain the disc in equilibrium in the vertical position (14)

MODULE II

13. a) The velocity potential function for a two dimensional flow is $\Phi = x(2y - 1)$, at a point P (4 , 5). Determine (i) the velocity and (ii) the value of stream function (10)

b) Explain stream line streak line and path line. (4)

OR

14. Write short notes on the following. (14)
    (i) Rotational and Irrotational flow
    (ii) laminar and turbulent flow
    (iii) Steady and unsteady flow
    (iv) Uniform and non-uniform flow

MODULE III

15. a) Oil of specific gravity 0.9 flows through a horizontal Venturimeter of diameter at inlet and throat, 0.4m and 0.2m respectively. A U tube Mercury manometer shows a head of 0.63 m. Calculate the flow rate (Assume C_d = 0.98). (7)

b) Air enters a nozzle steadily at 2.5 kg/m^3 and 28 m/s and leaves at 0.81 kg/m^3 and 178 m/s. If the inlet area of the nozzle is 80 cm^2 , determine (a) the mass flow rate through the nozzle (b) the exit area of the nozzle. (7)

OR

16. Derive Euler's equation of fluid motion along a streamline. Hence, obtain the Bernoulli's equation stating the assumptions and applications. (14)

MODULE IV

17. a) An oil of specific gravity 0.7 is flowing through a pipe of diameter 300 mm at the rate of 500 litres /sec. Find the head lost and pumping power required to maintain the flow for a length of 1000 m take kinematic viscosity = 0.29 stokes (7)

b) Derive Darcy-Weibach equation for the loss of head due to friction (7)

OR

18. Derive Hagen poiseuille's Formula for head loss in pipes (14)

MODULE V

19. The velocity distribution in a boundary layer is given by $u/U = y/\delta$, where u is the velocity at a distance y from the plate and u =U, at y = δ being boundary layer thickness. Find (14)
    (i) Displacement thickness
    (ii) Momentum thickness
    (iii) Energy thickness

OR

20. a) The efficiency η of a fan depends on density ρ , dynamic viscosity of the fluid μ, angular velocity ω ,diameter of rotor D ,and the discharge Q. Express efficiency η in terms of dimensionless parameters. (12)

    b) What are repeating variables? (2)

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