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

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

THIRD SEMESTER B.TECH DEGREE EXAMINATION (R,S), DECEMBER 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 stability conditions of floating bodies
3. Write short notes on steady and unsteady flow
4. Define the terms: (i) Streamline (ii) Path line (iii) Streak line
5. Distinguish between co-efficient of discharge and coefficient of velocity
6. State Bernoulli's theorem and list its applications
7. Define hydraulic gradient line and total energy line
8. What is hydraulic mean depth?
9. What do you understand by repeating variable in Buckingham-∏ theorem?
10. Distinguish between displacement thickness and momentum thickness

PART B

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

MODULE I

11. A rectangular gate is 2m wide and 4 m high is located in a vertical plane in water and other side is air. Find total pressure and depth of centre of pressure from the free surface if (i) top edge of the gate is coincide with free surface and (ii) top edge is at a depth of 4 m from the free surface (14)

OR

12. a) Two large plane surfaces are 24mm apart. The space in between filled with glycerin. What forces is required to move a very thin plate having surface area 0.2 m^2 between the two plane surfaces with velocity of 1 m/s when (i) thin plate is in the middle of two (ii) thin plate is at 8 mm from one surface. Take μ = 0.5 Ns/m^2 (9)

    b) Find out the pressure within the droplet of water of 0.05 mm in diameter if the surrounding air pressure is 1.01325 bar. Take surface tension at the water droplet surface = 0.08 N/m (5)

MODULE II

13. Velocity for a two-dimensional flow is given by the following expression. (14)

$V = (3+2xy+4t^2)i + (xy^2+3t)j$

Find the velocity and acceleration at point (1, 2) after 2 seconds.

OR

14. A two-dimensional steady state flow is given by the following stream function: (14)

$\Psi = 2\ xy.$

Determine the velocity at a point P (1, 4) in the field. Also find out the value of velocity potential function passing through the point P

MODULE III

15. A venturi meter having inlet and throat diameters 30 cm and 15 cm is fitted in a horizontal diesel pipe line (sp.gr = 0.92) to measure the discharge through the pipe. The venturi is connected to a mercury manometer. It was found that the discharge is 8 liters/sec. find the reading of mercury manometer head in cm. Take C_d= 0.96 (14)

OR

16. a) The flow of water through a pipe is measured with the help of orifice meter. The pipeline and orifice diameters are 20cm and 10cm respectively. The pressure gauge fitted up stream and down stream read 195 kPa and 105 kPa respectively. Find out the discharge of the water. Take C_d= 0.64 (7)

    b) With the help of neat sketches briefly explain about different types of notches (7)

MODULE IV

17. a) With suitable assumptions derive an equation for velocity distribution and shear stress distribution for a viscous flow through a circular pipe (7)

    b) A pipeline carrying oil of specific gravity 0.87 changes in diameter from 200 mm at a position A to 500 mm at another position B which is 4 meters at a higher level. If the pressures at A and B are 1 bar and 0.6 bar respectively and the discharge is 0.2 m^3/s, determine the loss of head and direction of flow. (7)

OR

18. With suitable assumptions derive the Darcy equation for head loss due to friction in a circular pipe (14)

MODULE V

19. a) With a neat sketch explain the different regions of the boundary layer over a long thin flat plate (6)

b) The pressure difference Δp in a pipe of diameter D and length L due to a turbulent flow depends on the velocity V, viscosity μ, density ρ and roughness k. Using Buckingham's pi theorem, obtain an expression for Δp (8)

OR

20. A 2.5 m ship model was tested in fresh water (ρ = 1000kg/m^3) and measurements indicated that there was a resistance of 45N when the model was moved at 2m/s. Work out the velocity of 40m prototype. Also calculate the force required to drive the prototype at this speed through sea water (ρ=1-25 kg/m^3) (14)

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