QP Code:ME2T02-2 **(Pages: 3)**

Reg No : ..... Name : .....

MAR ATHANASIUS COLLEGE OF ENGINEERING, KOTHAMANGALAM

(Govt. Aided Autonomous Institution)

Third Semester B.Tech. Degree (SAY) Examination, February, 2026

Course Code: B24ME2T02

Course Name: MECHANICS OF FLUIDS

Max. Marks: 100 Duration:3 Hours

PART - A: 30 Marks (10 Qns x 3 Marks)

Answer all questions

1. A reservoir of Glycerin has a mass of 1200 kg and a volume of 0.952 m^3. Find the mass density, specific weight, and specific gravity.
2. Define metacentre and metacentric height.
3. What is the definition of a streamline? What do streamlines indicate?
4. Distinguish between circulation and vorticity.
5. What are the different forces acting in a fluid flow? Discuss their significance.
6. Explain the concept of vena-contracta.
7. Define Reynold's number, what is the significance of Reynold's number.
8. Define friction factor and explain how it varies with Reynolds number for laminar and turbulent flow.
9. State Buckingham's π theorem and explain its significance in dimensional analysis.
10. List any four characteristics of a boundary layer.

PART - B: 70 Marks (5 Qns x 14 Marks)

Answer any One full question from each module.

Module 1

11. a. An oil film of thickness 1.5 mm is used for lubrication between a square plate of size 0.9 m X 0.9 m and an inclined plane with angle of inclination 20 degree. The weight of the square plate is 40 Kg and it slides down the plane with a uniform velocity of 0.2 m/sec. Find the dynamic viscosity of oil. (10 Marks)

b. Explain the stability conditions of floating bodies. (4 Marks)

OR

12. a. Differentiate between i. Specific weight and Specific volume ii. Dynamic viscosity and Kinematic viscosity iii. Real fluid and Ideal fluid. (7 Marks)

b. A manometer is used to measure the pressure in a tank. The fluid used has a specific gravity of 0.80 and the manometer column height is 50 cm. If the local atmospheric pressure is 98 kPa, determine the absolute pressure within the tank. (7 Marks)

Module 2

13. a. Find the acceleration and vorticity components at a point (1,1,1) for the following flow field $u=2x^2+3y$, $v=-2xy+3y^2+3zy$, $w=-1.5z^2+2xz-9y^2z$. (10 Marks)

b. Write short notes on uniform flow, streak line, potential function, and flow net. (4 Marks)

OR

14. a. The fluid velocity components are given by $u = x-4y$ and $v = -y-4x$, in a 2D incompressible flow. Show that it's a case of possible fluid flow. (7 Marks)

b. A fluid flow is given by $V=8x^3\ i\ -10x^2y\ j$. Find the shear strain rate and state whether the flow is rotational or irrotational. (7 Marks)

Module 3

15. A submarine moves horizontally in sea. A pitot static tube placed just in front of the submarine is connected to two limbs of a U tube manometer containing mercury. The difference of mercury level is found to be 170 mm. Find the speed of the submarine knowing that the specific gravity of mercury is 13.6 and that of sea water is 1.026.

OR

16. a. State Bernoulli's equation for real fluids and explain the significance of each term involved. (4 Marks)

b. A pipeline carrying oil of specific gravity 0.87, changes in diameter from 200 mm diameter at a position A to 500 mm diameter at a position B which is 4 m higher than that at A. If the pressures at A and B are 1 kg/cm^2 and 0.6 kg/cm^2, respectively and the discharge is 200 litres/s, determine the loss of head and direction of flow. (10 Marks)

Module 4

17. A syphon of diameter 200 mm connects two reservoirs having a difference in elevation 15 m. The total length of the syphon is 600 m and the summit is 4 m above the water level in the upper reservoir. If the separation takes place at 2.8 m of water absolute, find the maximum length of syphon from the upper reservoir to the summit. Take f=0.004 and atmospheric pressure =10.3 m of water.

OR

18. a. Explain Moody's Chart. Establish relation between friction factor is independent of the Reynolds number. (7 Marks)

b. Discuss the Chezy's equation for uniform flow in open channels. How does the Chezy coefficient depend on channel roughness and hydraulic radius? (7 Marks)

Module 5

19. a) Explain the phenomenon of boundary layer separation in fluid flow over a surface. Discuss the factors that lead to separation. (6 Marks)

b) Describe the various methods used to control or delay boundary layer separation, with examples. (8 Marks)

OR

20. The pressure drop Δp, for steady, incompressible viscous flow through a straight horizontal pipe depends on the pipe length l, the average velocity V, the fluid viscosity μ, the pipe diameter D, the fluid density ρ, and the average "roughness" height e. Determine a set of dimensionless groups that can be used to correlate data.

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