

Indian Maritime University
(A Central University, Govt of India)
Supplementary Examinations – March/April 2025
Programme Name: B Tech [ME]
Semester: 3
Subject Code: UG11T4303
Subject Name: FLUID MECHANICS

Date: 24.03.2025

Max Marks: 70

Duration: 03 Hrs

Pass Marks: 35

General Instructions

- (i) All Sections (A, B & C) are to be attempted.
- (ii) Options, if any, are specified in respective sections.

Section A

Ten MCQs/Fill in the Blanks of 01 Mark each – Choose the correct answer as applicable.

1. The viscous force _____ the relative motion between the adjacent layers of a fluid in motion
 - a. opposes
 - b. never affects
 - c. facilitates
 - d. None of the above
2. What is the condition related to the minimum speed for starting a centrifugal pump?
 - a. The pump will start delivering water as soon as the impeller begins rotating at any speed.
 - b. The pump must reach a minimum speed where the pressure rise equals or exceeds the manometric head (H_m) to start delivering water.
 - c. The impeller must reach maximum speed to start the pump.
 - d. The pump starts delivering water only after a specified period of operation, regardless of speed.
3. Which of the following best describes vacuum pressure?
 - a. Pressure that is higher than atmospheric pressure.
 - b. The absolute pressure in a system measured from zero pressure.
 - c. Pressure that is lower than atmospheric pressure.
 - d. Pressure measured in relation to a perfect vacuum.
4. What does Pascal's Law state?
 - a. Pressure applied to a confined fluid is transmitted undiminished in all directions.

- b. The pressure in a fluid decreases with depth.
 - c. Fluids exert pressure only in the direction of applied force.
 - d. Pressure in a fluid is inversely proportional to its density.
5. Which of the following is the correct equation for volumetric flow rate (Q)?
- a. $Q=A \times v$
 - b. $Q=m \times v$
 - c. $Q=Pv$
 - d. $Q=\rho \times v$

where, A is the cross-sectional area, v is the velocity of the fluid, m is the mass flow rate, P is the pressure and ρ is the fluid density.

6. Which of the following factors contribute to the total head in a fluid flow system?
- a. Velocity head, elevation head and pressure head.
 - b. Pressure head, temperature head and friction head.
 - c. Velocity head, density head and pressure head.
 - d. Elevation head, pressure head and friction head only.
7. How does pressure vary with depth in a fluid at rest?
- a. Pressure decreases with increasing depth.
 - b. Pressure increases linearly with depth.
 - c. Pressure remains constant regardless of depth.
 - d. Pressure increases exponentially with depth.
8. Which of the following represents a major head loss in a fluid flow system?
- a. Losses associated with bends
 - b. Losses associated with fittings
 - c. Losses due to sudden expansion of pipe
 - d. Losses due to friction
9. What is the primary purpose of priming a centrifugal pump?
- a. To increase the fluid velocity in the pump.
 - b. To adjust the pressure of the fluid entering the pump.
 - c. To lubricate the moving parts of the pump.
 - d. To remove air from the pump and suction line to ensure proper flow.
10. Which valve is used to ensure that fluid flows only in one direction?
- a. Gate valve
 - b. Ball valve
 - c. Check valve
 - d. Globe valve

Section B

Five Questions of 02 Marks each

- 11. Differentiate between ideal and real fluids
- 12. Explain the working principle of a Bourdon tube pressure gauge
- 13. Write a brief note on Sounding Pipes and Air release pipes

14. Define Reynolds number and classify fluid flow based on Reynolds number
 15. Explain about Cavitation in Centrifugal Pumps

Section C

Seven Questions of 10 Marks each of which any 05 questions to be answered.

16. A horizontal pipeline 40 m long is connected to a water tank at one end and discharges freely into the atmosphere at the other end. For the first 25m of its length from the tank, the pipe is 150 mm in diameter and its diameter is suddenly enlarged to 300 mm. The height of the water level in the tank is 8 m above the centre of the pipe. Considering all losses of head which occur, determine the rate of flow. Take $f = 0.01$ for both sections of the pipe.

17. Derive Bernoulli's equation. State the assumptions for the derivation.

18. (a) Explain the construction and working of a typical Relief Valve (05 marks)
 (b) Explain the construction and working of a Quick Closing Valve (05 marks)

19. (a) Explain the construction and working of a U-tube manometer with suitable diagram (05 marks)
 (b) Explain in detail the effect of Temperature on Viscosity for liquids and gases (05 marks)

20. A jet of water of diameter 7.5 cm strikes a curved plate at its centre with a velocity of 20 m/s. The curved plate is moving with a velocity of 8 m/s in the direction of the jet. The jet is deflected through an angle of 165° . Assuming the plate smooth find:

- i) Force exerted on the plate in the direction of the jet
- ii) Power of the jet, and
- iii) Efficiency of the jet

21. (a) Deduce the equation $F = 9.81 \times \text{head} \times \text{density} \times \text{Area}$ to give the forces on the surface of a rectangular tank (05 marks)

(b) State and derive the Continuity equation (05 marks)

22. Explain the Manometric and Volumetric efficiency, and Mechanical and Overall efficiency of a centrifugal pump.

