

**Indian Maritime University**  
**(A Central University, Govt of India)**  
**March/April 2024 Supplementary Examinations**  
**Programme Name: B. Tech (Marine Engineering)**  
**Semester: III**  
**Subject Code: UG11T4303**  
**Subject Name: FLUID MECHANICS**

---

Date: 10-04-2024

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 section.

**Section A**

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

1. The fundamental S.I. unit of pressure is  $N/m^2$ ; this is also known as
  - (a) Poise
  - (b) Pascal
  - (c) Stoke
  - (d) None of the above
2. When a steady jet impinges on a fixed inclined surface
  - (a) the flow is divided into parts proportional to the angle of inclination of the surface
  - (b) the flow is divided into parts proportional to the angle of inclination of the surface
  - (c) the momentum component is unchanged parallel to the surface
  - (d) none of the above
3. Application of Bernoulli's equation to which of the following measuring devices is correct?

- (a) Venturimeter
  - (b) Orificemeter
  - (c) Pitot tube
  - (d) All of the above
4. The ratio of power outlet of the pump to the power input to the pump is known as
- (a) Overall efficiency
  - (b) Mechanical efficiency
  - (c) Mechanical efficiency
  - (d) None of the above
5. Differential manometers are used for measuring
- (a) velocity at a point in a fluid
  - (b) pressure at a single point in a fluid
  - (c) difference of pressure between two points
  - (d) none of the above
6. For the laminar flow through a pipe, the shear stress over the cross-section
- (a) varies inversely as the distance from the centre of the pipe
  - (b) varies directly as the distance from the surface of the pipe
  - (c) varies directly as the distance from the centre of the pipe
  - (d) remains constant over the cross-section
7. When two pipes with same diameters are connected in series, the total rate of flow
- (a) is equal to the sum of the rate of flow in each pipe
  - (b) is equal to the reciprocal of the sum of rate of flow in each pipe
  - (c) is equal to the sum of reciprocal of rate of flow in each pipe
  - (d) is the same as flowing through each pipe
8. The force exerted by a jet of water on a stationary vertical plate in the direction of jet is given by
- (a)  $F_x = \rho AV^2 \sin^2 \theta$

- (b)  $F_x = \rho AV^2$
- (c)  $F_x = \rho AV^2 [1 + \cos\theta]$
- (d)  $F_x = \rho AV^2 [1 + \sin\theta]$

9. Which of these are usually **not preferred** for frequent operation?
- (a) Ball valve
  - (b) Plug valve
  - (c) Gate valve
  - (d) Butterfly valve
10. In fluid mechanics, the continuity equation is a mathematical statement embodying the principle of
- (a) Conservation of momentum
  - (b) Conservation of energy
  - (c) Conservation of mass
  - (d) None of the above

### **Section B**

Five Questions of 02 Marks each

- 11. Define Reynolds Number and state the conditions for laminar and turbulent flow based on Reynolds' number
- 12. Define i) Coefficient of discharge ii) Coefficient of Contraction
- 13. Define mass density and specific gravity?
- 14. Define the three major energy components in a moving liquid in terms of its head
- 15. Explain Net Positive Suction Head (NPSH) for a Centrifugal Pump

### Section C

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

16. State Bernoulli's theorem for steady flow of an incompressible fluid. Derive an expression for Bernoulli's equation from first principle and list the assumptions made for such a derivation.
17. a) Define absolute pressure, gauge pressure, vacuum pressure and pressure at a point in a fluid?
- b) A hydraulic press has a ram of 20 cm diameter and a plunger of 3 cm diameter. It is used for lifting a weight of 30 kN. Find the force required at the plunger.
18. a) Derive an expression for Force exerted by a Jet on a flat vertical plate moving in the direction of Jet.
- b) A jet of water of diameter 10 cm strikes a flat plate normally with a velocity of 15 m/s. The plate is moving with a velocity of 6 m/s in the direction of the jet and away from the jet. Find: (i) the force exerted by the jet on the plate, (ii) Work done by the jet on the plate per second.
19. In a 100 mm diameter horizontal pipe a Venturimeter of 0.5 contraction ratio has been fixed. The head of water on the meter when there is no flow is 3 m (gauge). Find the rate of flow.  
(Take atmospheric pressure head = 10.3 m of water)
20. A centrifugal pump having outer diameter equal to two times the inner diameter and running at 1000 rpm works against a total head of 40 m. The velocity of flow through the impeller is constant and equal to 2.5 m/s. The vanes are set back at an angle of  $40^\circ$  at outlet. If the outer diameter of the impeller is 500 mm and width at outlet is 50 mm, determine:
- (i) Vane angle at inlet,
  - (ii) Work done by impeller on water per second, and
  - (iii) Manometric efficiency

21. (a) Define rate of flow through pipe and explain continuity equation with diagram of fluid flow through pipe?  
(b) Diameters of a pipe at the sections 1 and 2 are 10cm and 15cm respectively. Find the discharge through the pipe if the velocity of water flowing through the pipe at section 1 is m/s. Determine also the velocity at section 2.
22. In a 100 mm diameter horizontal pipe a venturimeter of 0.5 contraction ratio has been fixed. The head of water on the meter when there is no flow is 3 m( gauge) . Find the rate of flow Take atmospheric pressure head = 10.3 m of water.

