**Indian Maritime University**

**(A Central University, Govt of India)**

**Supplementary Examinations – September/October 2024**
**Programme Name: B. Tech (Marine Engineering)**

**Semester: III**

**Subject Code: UG11T4303**

**Subject Name: FLUID MECHANICS**

| | |
|---|---|
| Date: 24.09.2024 | 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 Bernoullis equation to which of following measuring device 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. The dimension of coefficient of viscosity is

(a) $M^1L^{-1}T^{-1}$

(b) $M^{-1}L^{-1}T^{-1}$

(c) $M^1L^{-1}T^1$

(d) $M^{-1}L^1T^{-1}$

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) $F_x = \rho AV^2 [1+\text{Sin}\theta]$

9. Which of these are usually **not preferred** for frequent operation?

(a) Ball valve

(b) Plug valve

(c) Gate valve

(d) Butterfly valve

10. When a fluid is in motion, the pressure at a point is the same in all directions. Then the fluid is

(a) Real fluid

(b) Newtonian fluid

(c) Ideal fluid

(d) Non-Newtonian fluid

## 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. The inlet and outlet velocity of the pipe are 5 m/s and 10 m/s respectively. The inlet cross sectional area of the pipe is 10 m^2. Find the outlet cross section area. The pipe fluid flow obeys continuity flow principle

13. What is the purpose and application of quick closing valve?

14. Define the three major energy components in a moving liquid in terms of its head

15. The shear stress at a point in oil is 5 N/m2 and velocity gradient at this point is 2 s^-1. Determine dynamic viscosity of oil.

## 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. Describe fluid flow of lubricating oil system in Diesel Engine Propulsion Plant onboard marine vessels using suitable circuit diagram

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° 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) Explain in brief the main component parts of a centrifugal pump.

    (b) Explain the working of a single stage centrifugal pump with a neat sketch.

22. The 2660 km long Salaya-Mathura crude oil pipeline originates from Salaya near Vadinar in Jamnagar district on the coast of Gujarat to bring crude oil to a leading PSU's Refineries at Koyali in Gujarat, Mathura in Uttar Pradesh and Panipat in Haryana. If Crude oil of Kinematic Viscosity 0.4 stoke is flowing through such a pipe of diameter 300 mm at the rate of 300 litres per second, find the head lost due to friction for a length of 50 m of the pipe.