**Indian Maritime University**

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

**End Semester Examinations – June 2023**

**Programme Name: B Tech (ME)**

**Semester: III**

**Subject Code: UG11T4303**

**Subject Name: FLUID MECHANICS**

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|---|---|
| Date: 15.06.2023 | Max Marks: 70 |
| Duration: 03 Hrs | Pass Marks: 35 |

General Instructions

(i) All Sections (A, B & C) are to be attempted.
(ii) Numbers to the right carries the full marks of question
(iii) Non programmable calculators are allowed
(iv) Draw neat sketches wherever necessary

## Section A

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

1. A fluid in which shear stress is more than yield and shear stress is proportional to shear strain is known as
a) Ideal fluid
b) Newtonian fluid
c) Non-Newtonian fluid
d) Ideal plastic

2. Centre of pressure is defined as
a) Point of application of the negative and positive pressure on the surface
b) Point of application of the total pressure on the surface
c) Point of application of friction resistance on the surface
d) Point of application of drag resistance on the surface

3. In the inverted U-Tube manometer, the fluid used is---------- Compared to the fluid flowing in the main pipeline

4. If the Reynolds number is less than 2000 the flow in the pipe is
a) A turbulent flow
b) A laminar flow
c) Either of the above
d) None of the above

5) The Bernoulli's equations refers to the conservation of
a) Mass
b) Force
c) Momentum
d) Energy

6. The property by virtue of which liquid opposes relative motion between its different layers is called
a) Surface tension
b) Cohesion
c) Viscosity
d) Capillarity

7. Mechanical efficiency of a centrifugal pump is the ratio of
a) Energy available at the impeller to the energy supplied to the pump by the prime mover
b) Actual work-done by the pump to the energy supplied to the pump by the prime mover
c) Energy supplied to the pump to the energy available at the impeller
d) Manometric head to the energy supplied by the impeller per kN of water

8. For compressible fluid, continuity equation is given by

(a) $\frac{p_1}{p_2} = \frac{A_1}{A_2} = \frac{V_1}{V_2}$
(b) $\rho_1 A_1 V_1 = \rho_2 A_2 V_2$
(c) $\rho_2 A_2 V_1 = \rho_1 A_1 V_2$
(d) $A_1 V_1 = A_2 V_2$

9. -------- valves are fitted to settling and service tanks within the machinery spaces, boiler room and the emergency generator space so that in the event of an emergency such as a fire, they may be safely closed from a remote location to prevent the fuel in the tank from feeding the fire.

10. For full flow which type of valve are used?

a) Gate valve b) globe valve c) butterfly valve d) relief valve

## Section B

**Five Questions of 02 Marks each. All Questions compulsory.**

11. Define Newtonian fluid and Non Newtonian fluid?

12. Name the major and minor losses in pipes

13. What is co-efficient of contraction?

14. Write a difference between vortex casing and volute casing of centrifugal pump

15. Discuss the features of the globe valve

## Section C

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

16. Define the equation of continuity. Derive the continuity equation in differential form. (3M+7M)

17. A rectangular plate 4 m× 6 m is vertically immersed in water such that 6 m side is parallel to free surface. Calculate, the total pressure force and center of pressure if the top of rectangular plate is: a) touching the free liquid surface, b) 3 m below the surface of water. (4M +6M)

18. 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.

19. The diameter of the piston of a hydraulic jack is 6 times greater than the diameter of the plunger which is 200 mm. They are both at same height and made of same material. The piston weighs 100 N and supports a mass of 50 kg. The jack is filled with oil of density 900 kg/m3. Calculate the force required at the plunger to support the piston and mass if carries at a level 10 cm above that of plunger

20. Water flows through a pipe AB, 1.2m diameter at 3m/s and then passes through a pipe BC, 1.5m diameter. At C, the pipe branches, branch CD is 0.8 m in diameter and carries one-third of the flow in AB. The flow velocity in branch CE is 2.5m/s. Find the volume rate of flow in the AB, the velocity in BC, the velocity in CD and the diameter of CE.

21. Find the force exerted by the jet of liquid/water on moving curved symmetrical plate in the direction of jet (draw suitable diagram of arrangement)

22. The external and internal diameter of the impeller of the centrifugal pump is 0.6 m and 0.3 m respectively and the width of the impeller at outlet is 60 mm. The speed of the pump is 1440 rpm and it is required to work against the head of 105 m. The velocity of flow through the impeller is maintained at 4 m/s. The exit vane angle is 35 deg. Determine the vane angle at inlet, work done by the impeller on water per sec and the Manometric efficiency of the pump.