

Indian Maritime University
(A Central University, Govt of India)
End Semester Examinations – December 2022
Programme Name: B Tech (NAOE)
Semester: III
Subject Code: UG12T2302
Subject Name: Fluid Mechanics-I

Date: 13.12.2022

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 specific volume of a fluid is the reciprocal of
 - (a) Weight density
 - (b) Mass density
 - (c) Specific weight
 - (d) Specific gravity

2. Water flows between two plates separated by a distance, 'd'. The upper plate under a shear stress of ' τ ' moves with a velocity of 'V' m/s. What will be the velocity in m/s at the lower plate?
 - (a) $500 \tau d$
 - (b) $1000 \tau d$
 - (c) $2000 \tau d$
 - (d) 0

3. The friction factor, f for laminar flow in a circular pipe is
 - (a) $16/Re$
 - (b) $64/Re$
 - (c) $Re/16$
 - (d) $Re/64$

4. Chezy's equation is used to determine the velocity of flow in
 - (a) Pipes
 - (b) Open channels
 - (c) Both (a) and (b)

- (d) Neither (a) nor (b)
5. The impact of jets is evaluated considering
- (a) Conservation of momentum
 - (b) Conservation of mass
 - (c) Conservation of energy
 - (d) None of the above
6. The energy available at the inlet of an impulse turbine is
- (a) Pressure energy
 - (b) Kinetic energy
 - (c) Potential energy
 - (d) All the above
7. In a centrifugal pump the fluid enters the pump from
- (a) From all sides
 - (b) Through the top
 - (c) Through the bottom
 - (d) Through the centre
8. Slip of a reciprocating pump is the difference in theoretical and actual
- (a) power
 - (b) discharge
 - (c) energy
 - (d) velocity
9. Capacity of a hydraulic accumulator is nothing but
- (a) Force applied on the ram
 - (b) Volume swept by the ram
 - (c) Volume of the ram
 - (d) Work done by the ram
10. A hydraulic press works on the principle of
- (a) Bernoulli's equation
 - (b) Reynolds equation
 - (c) Hydrostatic law
 - (d) Pascal's law

Section B

Five Questions of 02 Marks each

- 11. Define Pascal's law with an example.
- 12. What is water hammer in pipes?
- 13. Explain the energy conversion in hydraulic turbines
- 14. Why are centrifugal pumps connected in series?
- 15. Describe the working principle of a hydraulic ram.

Section C

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

16. A circular plate 3.0 m diameter is immersed in water in such a way that its greatest and least depths below the free surface are 4 m and 1.5 m respectively. Determine the total pressure on side of the plate and also the location of the centre of pressure.
17. A ship 70 m in length and 10 m in breadth has a displacement of 19, 620 kN. A weight of 343. 35 kN is moved across the deck through a distance of 6 m, tilting the ship through 6 deg. The moment of inertia about the longitudinal axis of the ship is 75% of the area of the circumscribing rectangle. The centre of buoyancy is 2.25 m below the water-line. Find the metacentric height and the position of centre of gravity of the ship. Take density of sea water as 1030 kg/m^3 .
18. (a) What are the various similitudes between model and prototype.
(6 marks)
(b) Explain the significance of Buckingham-Pi theorem in dimensional analysis.
(4 marks)
19. The water in a jet-propelled boat is drawn through inlet orifices. The boat moves through sea-water with a speed of 30 km/hour. The absolute velocity of the jet discharged at the back of the ship is 20 m/s and the area of jet of water is 0.03 m^2 . Find the efficiency of propulsion if
(a) The inlet orifices are perpendicular to the direction of motion of the ship.
(5 marks)
(b) The inlet orifices are parallel to the direction of motion of the ship.
(5 marks)
20. With respect a hydraulic turbine
(a) Explain the function of a draft tube.
(5 marks)
(b) Draw the velocity triangles at the inlet and outlet of the Francis turbine and obtain an expression for work done by the turbine per second.
(5 marks)
21. (a) What do you understand by specific speed of a centrifugal pump?
(5 marks)
(b) Derive an expression for the slip of a reciprocating pump.
(5marks)
22. With a neat sketch explain the working of a hydraulic crane.