Indian Maritime University

(A Central University, Govt of India)

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

Semester: V

Subject Code: UG11T3504

Subject Name: FLUID MECHANICS II

Date: 17.09.2024	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 centrifugal pump works on the Principle of
   (a) Angular momentum principle
   (b) Linear momentum principle
   (c) Both of the options
   (d) None of the options
2. Ideal indicator diagram of the reciprocating pump includes
   (a) Losses because of friction
   (b) Losses because of acceleration
   (c) Losses because of acceleration and friction
   (d) None of the above
3. Pelton wheel is the _____ flow turbine
   (a) Axial flow turbine
   (b) Mixed flow turbine
   (c) Tangential flow turbine
   (d) Radial flow turbine

4. In model testing of Ship, the forces present in dynamic similarity are

(a) Inertia forces

(b) Gravity forces

(c) Viscous forces

(d) All of the above

5. The head against which a centrifugal pump has to work_____

(a) Static head

(b) Delivery head

(c) Suction head

(d) Manometric head

6. Which of the following are the parts of the reciprocating pump

(a) Cylinder

(b) Piston

(c) Connecting rod

(d) All the above

7. Kaplan turbine is mainly used when

(a) Flow rate is high

(b) Head is high

(c) Both head and flow rate is high

(d) None of the above

8. Geometric similarity describes

(a) The ratio of all corresponding velocities in the model and prototype are equal

(b) The ratio of all corresponding pressures in the model and prototype are equal

(c) The ratio of all corresponding forces in the model and prototype are equal

(d) The ratio of all corresponding linear dimension in the model and prototype are equal

9. The ratio of the total rate of flow through the turbine to the rate of flow of water through a single jet is explained as

(a) Number of buckets

(b) Number of nozzles

(c) Number of jets

(d) None

10. Froude's Number is the

(a) Square root of the ratio of inertia force of a flowing fluid to the gravity force

(b) Ratio of inertial forces to viscous forces occurring in a fluid flow.

(c) Square root of the ratio of inertia force of a flowing fluid to the pressure force

(d) Square root of the ratio of inertia force of a flowing fluid to the surface tension force

Section B

Five Questions of 02 Marks each

11. Define Cavitation and Specific speed of a Centrifugal pump
12. Define Slip and Coefficient of Discharge of a Reciprocating pump
13. Write down the advantages and disadvantages of a Francis turbine over Impulse turbine
14. Discuss in short about "dimensional homogeneity"
15. Illustrate the classification of centrifugal pump?

Section C

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

16. The internal and external diameter of the impeller of a centrifugal pump are 300 mm and 600 mm respectively. The pump is running at 1000rpm. The vane angles of the impeller at inlet and outlet are 20° and 30° respectively.

The water enters the impeller radially and velocity of flow is constant. Determine the work done by impeller per unit weight of water. Sketch the velocity triangle

17. A ship 300m long moves in seawater, whose density is 1030 kg/m^3, A 1:100 model of this ship is to be tested in a wind tunnel. The velocity of air in the wind tunnel around the model is 30 m/s and the resistance of the model is 60N. Determine the velocity of ship in seawater and also the resistance of the ship in seawater. The density of air is given as 1.24 kg/m^3. Take the kinematic viscosity of seawater and air as 0.012 strokes and 0.018 strokes respectively.

18. a) Draw neat sketches of the indicator diagram for the reciprocating pump when,

    i) Effect of only acceleration on suction and delivery side and

    ii) Effect of only friction on suction and delivery side is considered

    b) What is an air vessel? Write functions of the air vessel in reciprocating pump (05 marks + 05 marks)

19. Find the power required to drive a centrifugal pump which delivers 0.04m^3/s of water to a height of 20m through a 15 cm diameter pipe and 100m long. The overall efficiency pump is 70% and co-efficient of friction f = 0.15 in the formula $h_f = \frac{4f\,l\,V^2}{d \times 2g}$

20. A Pelton wheel has a mean bucket speed of 10 metres per second with a jet of water flowing at the rate of 700 litres/s under a head of 30 metres. The buckets deflect the jet through an angle of 160°. Calculate the power given by water to the runner and the hydraulic efficiency of the turbine. Assume co-efficient of velocity as 0.98.

21. Using Buckingham's π- theorem, show that the velocity through a circular orifice is given by $V = \sqrt{2gH}\,\phi\left[\frac{D}{H}, \frac{\mu}{\rho VH}\right]$, where H is the head causing flow,

D is the diameter of the orifice, μ is co-efficient of viscosity, ρ is the mass density and g is the acceleration due to gravity.

22. A reaction turbine works at 450 rpm. under a head of 120 m. Its diameter at inlet is 1.2 m and the flow area is 0.4 m^2. The angles made by absolute and relative velocities at inlet are 20° and 60° respectively with the tangential velocity. Determine:

a) The volume flow rate,
b) The power developed, and
c) The hydraulic efficiency

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