Indian Maritime University

(A Central Universitay, Govt of India)

Sep/Oct'25 SE

Programme Name: B Tech (ME)

Semester: V

Subject Code: UG11T3504

Subject Name: FLUID MECHANICS-II

Date: 15.09.2025 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 head against which a centrifugal pump has to work_____.

a) Static head b) Delivery head

c) Suction head d) Manometric head

2. To produce a high head and to discharge a large quantity of liquid are the important function of the centrifugal pump

a) Single stage b) Double stage
c) Triple stage d) Multi stage

3. The valves of a reciprocating cylinder are _____, which allows the fluid in the direction of motion.

a) one way valve b) two-way valve
c) shutoff valve d) reducing valve

4. The difference between the theoretical discharge and the actual discharge is known as _____.

a) Slip b) Positive Slip
c) Negative Slip d) Zero Slip

5. The graph between the pressure head and the stroke length of the piston for one completer cycle is known as

a) Velocity diagram b) Acceleration diagram

c) Indicator diagram d) none

6. The head loss due to friction in the pipes is reduced due to the fitting of _____.

a) Air vessel in suction pipe b) Air vessel in delivery pipe
c) Air vessel in suction pipe and delivery pipe d) No Air vessel

7. The hydraulic efficiency of the turbine is the ratio of

a) Power supplied at inlet / Power delivered to runner b) Power delivered to runner / Power supplied at inlet c) Output / Input d) Water Power / Runner Power

8. 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

9. The method of dimensional analysis are given as

a) Rayleigh's method b) Buckingham's π- theorem
c) both a) and b) d) None

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

a) Inertia forces b) Gravity forces
c) Viscous forces d) all the three

Section B

Five Questions of 02 Marks each

11. Define Static head and Manometric head.
12. Define Cavitation and Specific speed of a Centrifugal pump
13. Define Slip and Coefficient of Discharge of a Reciprocating pump.
14. Write down the advantages and disadvantages of a Francis turbine and Impulse turbine
15. Discuss the three types of similarities between the model and the prototype

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 (7+3 = 10 Marks)

17. 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 $h_f = \frac{4flV^2}{d \times 2g}$ (10 Marks)

18. The cylinder bore diameter of single acting reciprocating pump is 150mm and its stroke is 300mm. The pump runs at 50 r.p.m. and lifts water through a height of 25m. The delivery pipe is 22m long and 100mm in diameter. Find the i) theoretical discharge and the theoretical power required to run the pump. If the actual discharge is 4.2 litres/s, ii) find the percentage slip. Also determine the iii) acceleration head at the beginning and iv) middle of the delivery stroke. (2+2+3+3 = 10 Marks)

19. 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. (5+5= 10 Marks)

20. An inward flow reaction turbine with an overall efficiency of 75% is required to produce 148.25 kW power. It is working under a head of 7.62 m. The peripheral velocity = 0.26 $\sqrt{2gH}$ and the radial velocity of flow at inlet is 0.96 $\sqrt{2gH}$. The wheel runs at 150 r.p.m. and the hydraulic losses in the turbine are 22% of the available energy. Assuming radial discharge, determine:

(i) The guide blade angle,
(ii) The wheel vane angle at inlet,
(iii) Diameter of the wheel at inlet, and
(iv) Width of the wheel at inlet. (2+2+3+3=10 Marks)

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. (10 Marks)

22. A ship 300m long moves in sea- water, whose density is 1030 kg/m^3, A 1:100 model of this ship is to be tested in a wind tunnel around the model is 30m/s and the resistance of the model is 60N. Determine the velocity of ship in sea- water and also the resistance of the ship in sea – water. The density of air is given as 1.24 kg/m^3. Take the kinematic viscosity of sea – water and air as 0.012 strokes and 0.018 strokes respectively. (10 Marks)