

Indian Maritime University
(A Central University, Govt of India)
End Semester Examinations – December 2022
Programme Name: B Tech (ME)
Semester: V
Subject Code: UG11T3504
Subject Name: Fluid Mechanics - II

Date: 16.12.2022	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 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

17. Find the power required to drive a centrifugal pump which delivers $0.04\text{m}^3/\text{s}$ 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

$$h_f = \frac{4fLV^2}{d \times 2g} \quad (10 \text{ Marks})$$

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 $V = \sqrt{2gH} \phi \left[\frac{D}{H}, \frac{\mu}{\rho V H} \right]$, 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)

