QP Code:ME2T07-1 **(Pages: 3)**

Reg No : ..... Name : .....

MAR ATHANASIUS COLLEGE OF ENGINEERING, KOTHAMANGALAM

(Govt. Aided Autonomous Institution)

Fourth Semester B.Tech. Degree Examination, May, 2026

Course Code: B24ME2T07

Course Name: FLUID MACHINES

Max. Marks: 100 Duration:3 Hours

PART - A: 30 Marks (10 Qns x 3 Marks)

Answer all questions

1. Define "Gross Head" and "Net Head" of a turbine.
2. A jet of water having a diameter of 5 cm issuing from a nozzle with a velocity of 20 m/s impinges on a series of vanes. The vanes are so arranged that each vane appears successively before that jet in the same position and always moves with a velocity of 5m/s. Find the force exerted on the plate, the work done by the jet and the efficiency of the jet.
3. What is the purpose of the Scroll Casing in a Kaplan turbine.
4. Define Cavitation. In which type of turbine does it occur?
5. Define suction head, delivery head and static head.
6. When should pumps be connected in Series and Parallel.
7. Define "slip" in a reciprocating pump. Under what specific conditions does negative slip occur?
8. Explain the working principle of a Gear Pump.
9. Define a Compressor. How does it differ from a fan or a blower?
10. List three industrial applications of compressors.

PART - B: 70 Marks (5 Qns x 14 Marks)

Answer any One full question from each module.

Module 1

11. A jet of water having a velocity of 15 m/s strikes a curved vane which is moving with a velocity of 5m/s. The vane is symmetrical and is so shaped that the jet is deflected through 120º. Find the angle of the jet at inlet of the vane so that there is no shock. What is the (i) absolute velocity of the jet at

outlet in magnitude and direction and (ii) work done per unit weight of water. Assume the vane to be smooth.

OR

12. Explain the construction and working of Pelton Turbine and derive an expression for work done.

Module 2

13. (a) A Pelton wheel prototype is designed to generate 15 MW of power under a net head of 400 m. A 1:5 scale model of this turbine is to be tested in a laboratory where the maximum available head is 40 m. Assuming the model and prototype have the same overall efficiency, determine:
(i) The Speed Ratio required to maintain similarity.
(ii) The Power developed by the model under these conditions. (7 marks)
(b) A turbine is tested at a head of 1 m. Explain how the results of this test are scaled up to a project with a 100 m head by using the concept of unit quantities. (7 marks)

OR

14. (a) Derive the expression for Unit power and Unit Discharge. (7 marks)
(b) Starting from the fundamental discharge and power equations, derive the formula for specific speed of a turbine. (7 marks)

Module 3

15. (a) The internal and external diameters of impellers of a centrifugal pump are 200 mm and 400 mm respectively. The pump is running at 1200 rpm. The vane angles at inlet and outlet are 20º and 30º respectively. Water enters the impeller radially and velocity of flow is constant. Determine work done by the impeller per unit weight of water. (7 marks)
(b) Describe the main parts of a centrifugal pump with a neat, labeled sketch. Explain its working principle. (7 marks)

OR

16. (a) Derive an equation and explain the concept of maximum suction lift for a pump. (7 marks)
(b) A centrifugal pump rotating at 1000rpm delivers 160 litre/s of water against a head of 30 m. The pump is installed at a place where the atmospheric pressure is $1x10^5$ Pa (abs) and vapor pressure of water is 3 kPa (abs). The head loss in suction pipe is equivalent to 0.2 m of water. Calculate minimum NPSH and maximum height at which the pump can be placed from free surface of water in the sump to ensure smooth functioning. Assume the critical value of cavitation (σc) to be 0.101. (7 marks)

Module 4

17. (a) A single acting reciprocating pump, running at 50 rpm, delivers 0.01 m^3/s of water. The diameter of the piston is 200mm and stroke length is 400 mm. Determine: (i)The theoretical discharge of the

pump (ii) Co efficient of discharge, and (iii) Slip and the percentage slip of the pump. (10 marks)

(b) How does a double-acting pump provide a more uniform discharge compared to a single-acting pump. (4 marks)

OR

18. (a) Explain and derive the effect of acceleration of piston on velocity and pressure in the suction and delivery pipes of a reciprocating pump and show the effect of acceleration head on the indicator diagram. (10 marks)

(b) Explain the function of suction and delivery valves in a reciprocating pump. Why are they non-return valves? (4 marks)

Module 5

19. A double acting air compressor works with an indicated power of 37 kW. Air is drawn at 1 bar and 300K and compressed according to the law $PV^{1.2}$ = constant at 7 bar. The compressor runs at 200 rpm with average piston speed of 2.5 m/s. Neglect clearance. Find the diameter and stroke length of the cylinder.

OR

20. (a) Explain the phenomena of surging and choking. Discuss the stable operating range. (7 marks) (b) Describe the construction and working of an axial flow compressor with a sketch showing the arrangement of rotor and stator blades. (7 marks)

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