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Question Paper Code: U3705

B.E./B.Tech. DEGREE EXAMINATION, NOV 2024

Third Semester

Mechanical Engineering

21UME307 - FLUID MECHANICS AND HYDRAULIC MACHINERY

(Regulations 2021)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. Which of the following is an example of laminar flow? CO1-U
(a) Underground flow (b) Flow past tiny bodies
(c) Flow of oil in measuring instruments (d) All of these.
2. Reynolds Number for laminar flow is CO1-U
(a) $Re > 4000$ (b) $Re = 2000$ to 4000
(c) $Re < 2000$ (d) None of the these
3. A monometer is used to measure CO1-U
(a) Low pressure (b) Moderate pressure
(c) High pressure (d) Atmospheric pressure
4. Piezometer is used to measure CO1-U
(a) Pressure in pipe, channels etc. (b) Atmospheric pressure
(c) Very low pressures (d) Difference of pressure between two points
5. Dynamic viscosity (μ) has the dimensions as CO1-U
(a) MLT^{-2} (b) $ML^{-1}T^{-1}$ (c) $ML^{-1}T^{-2}$ (d) $M^{-1}L^{-1}T^{-1}$
6. Square root of the ratio of inertia force to elastic force is called as CO1-U
(a) Mach's Number (b) Cauchy's Number
(c) Both a. and b (d) None of these
7. The speed ratio in case of francis turbine varies from CO1-U

- (a) 0.15 to 0.3 (b) 0.4 to 0.5 (c) 0.6 to 0.9 (d) 1 to 1.5
8. The value of specific speed of Kaplan turbine is _____ that of the Pelton turbine. CO1-U
 (a) lower than (b) higher than
 (c) same as (d) unpredictable
9. Reciprocating pumps are classified according to _____ CO1-U
 (a) Drag force (b) Number of cylinders
 (c) Shock waves (d) Flow speed
10. _____ pump is also called as velocity pump. CO1-U
 (a) Reciprocating pump (b) Reciprocating pump
 (c) Centrifugal pump (d) Screw pump

PART – B (5 x 2= 10Marks)

11. State Newton's law of viscosity. CO1-U
12. Name some minor losses CO1-U
13. Explain the similarities between models and prototype CO1-U
14. Classify the different types of turbines. CO1-U
15. Distinguish Single acting and Double acting reciprocating pump CO1-U

PART – C (5 x 16= 80Marks)

16. (a) Velocity distribution for flow over a flat plate is given by $u = (3/2)y - y^3/2$, where u is the point velocity in m/s at a distance y meter above the plate. Determine the shear stress at $y = 9$ cm. assume dynamic viscosity as 8 poise. CO2 -AP (16)
 Or
 (b) Calculate the dynamic viscosity of oil, which is used for lubrication between a square plate of size 0.8m X 0.8m and an inclined plane with angle of inclination 30°. The weight of the square plate is 300N and it slides down the inclined plane with a uniform velocity of 0.3m/s. The thickness of the oil film is 1.5mm CO2 -AP (16)
17. (a) Derive DARCY – WEISBACH Equation. CO6- AP (16)
 Or
 (b) The rate of flow of water through a horizontal pipe is 0.25 m³/s. CO6- AP (16)
 The diameter of the pipe which is 200 mm is suddenly enlarged to 400 mm. The pressure intensity in the smaller pipe is 11.772 N/cm². Determine: (i) Loss of head due to sudden enlargement (ii)

Pressure intensity in the large pipe (iii) Power lost due to Enlargement

18. (a) The frictional torque T of a disc of diameter (D) rotating at a speed (N) in a fluid of viscosity (μ) and density (ρ) in a turbulent flow is given by

$$T = D^5 N^2 \rho \phi \left[\frac{\mu}{D^2 N \rho} \right]$$

Or

- (b) The pressure difference ΔP in a pipe of diameter (D) and length (L) due to viscous flow depends on the velocity (V), viscosity (μ) and density (ρ). Using Buckingham's π – Theorem obtain an expression for ΔP . CO4- AP (16)
19. (a) A Pelton Wheel has a mean bucket speed of 10m/s with a jet of water flowing at the rate of 700lit/s under a head of 30m. The buckets deflect the jet through an angle of 160° . Calculate the power delivered to the runner and the hydraulic efficiency of the turbine. Assume co-efficient of velocity at 0.98. CO7- AP (16)

Or

- (b) A Pelton Wheel is to be designed for the following specifications: Shaft power = 11772KW, Head = 380m, Speed = 750rpm, Overall Efficiency = 86%, Jet diameter is not to exceed one-sixth of the wheel diameter. Determine (i) The wheel Diameter (ii) The number of jets required (iii) Diameter of the jet. CO7- AP (16)
20. (a) Explain the working principle of single acting & double acting reciprocating pump with a neat sketch. CO1- U (16)
- Or
- (b) Explain the working principle of Single stage centrifugal Pump with a neat sketch. CO1- U (16)

