

A

Reg. No. :

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Question Paper Code: U3707

B.E./B.Tech. DEGREE EXAMINATION, MAY 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)

- 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.
- Reynolds Number for laminar flow is CO1- U
(a) $Re > 4000$ (b) $Re = 2000$ to 4000 (c) $Re < 2000$ (d) None of the these
- The coefficient of viscosity may be determined by CO1- U
(a) capillary tube method (b) orifice tube viscometer
(c) rotating cylinder method (d) all of these
- At the center line of a pipe flowing under pressure where the velocity gradient is zero, the shear stress will be CO1- U
(a) minimum (b) maximum (c) zero (d) any value
- Poise is the unit of CO1- U
(a) mass density (b) kinematic viscosity (c) viscosity (d) velocity gradient
- Which of the following is a dimensionless equation? CO1- U
(a) Reynold's equation (b) Euler's equation (c) Weber's equation (d) all of the above
- 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. In a Kaplan turbine runner the number of blades are generally between CO1- U
 (a) 2 to 4 (b) 4 to 8 (c) 8 to 16 (d) 16 to 24
9. Which of the following pump is preferred for flood control and irrigation CO1- U
 applications?
 (a) centrifugal pump (b) axial flow pump
 (c) mixed flow pump (d) reciprocating pump
10. Reciprocating pumps are classified according to CO1- U
 (a) Drag force (b) Number of cylinders (c) Shock waves (d) Flow speed

PART – B (5 x 2= 10 Marks)

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= 80 Marks)

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 $y = 9\text{cm}$. assume dynamic viscosity as 8 poise. CO2- App (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- App (16)
17. (a) Derive DARCY – WEISBACH Equation. CO2- App (16)
 Or
- (b) The rate of flow of water through a horizontal pipe is 0.25 m³/s. 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 CO2- App (16)

18. (a) Using Buckingham's π – Theorem, show that the velocity through the circular orifice is given by: CO4- App (16)

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

H = Head causing flow, D = Diameter of orifice, μ = Dynamic Viscosity, ρ = Density and g = acceleration due to gravity.

Or

- (b) The efficiency (η) of a fan depend on density (ρ), dynamic viscosity (μ) of the fluid, angular velocity (ω), diameter (D) of the rotor and discharge (Q). Express η in terms of dimensionless parameters using Buckingham's π – theorem. CO4- App (16)
19. (a) A Pelton wheel is to be designed for the following specifications: Shaft power = 11772 kW, Head = 380 m, Speed = 750 rpm, 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. CO3- App (16)

Or

- (b) An inward flow reaction turbine has external and internal diameters as 1.0 m & 0.6 m respectively. The hydraulic efficiency of the turbine is 90%. When the head on the turbine is 36m. The velocity of flow at outlet is 2.5 m/s. and discharge at outlet is radial. If the vane angle at outlet is 15° and width of the wheel is 100mm at inlet and outlet. Determine: (i) Guide blade angle, (ii) Speed of the turbine, (iii) Vane angle of the runner at inlet, (iv) Volume flow rate of turbine and (v) Power developed. CO3- App (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)

