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Question Paper Code: 93704

B.E./B.Tech. DEGREE EXAMINATION, NOV 2023

Third Semester

Mechanical Engineering

19UME304– FLUID MECHANICS AND MACHINERY

(Regulation 2019)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

- In one dimensional flow, the flow CO1- R
 - Is steady and uniform
 - takes place in straight line
 - takes place in curve
 - takes place in one direction
- Reynolds Number for laminar flow is CO1- R
 - $Re > 4000$
 - $Re = 2000$ to 4000
 - $Re < 2000$
 - None of the above
- The coefficient of viscosity may be determined CO2- R
 - Capillary tube method
 - Orifice tube viscometer
 - Rotating cylinder method
 - All of these
- A monometer is used to measure CO2- R
 - Low pressure
 - Moderate pressure
 - High pressure
 - Atmospheric pressure
- Dynamic viscosity (μ) has the dimensions as CO3- R
 - MLT^{-2}
 - $ML^{-1}T^{-1}$
 - $ML^{-1}T^{-2}$
 - $M^{-1}L^{-1}T^{-1}$
- Surface tension has the units of CO3- R
 - force per unit area
 - force per unit length
 - force per unit volume
 - none of the above

7. _____ is the electric power obtained from the energy of the water. CO4- R
 (a) Roto dynamic power (b) Thermal power
 (c) Nuclear power (d) Hydroelectric power
8. The speed ratio in case of francis turbine varies from CO4- R
 (a) 0.15 to 0.3 (b) 0.4 to 0.5 (c) 0.6 to 0.9 (d) 1 to 1.5
9. Slip of a reciprocating pump is defined as the CO5- R
 (a) Ratio of actual discharge to the theoretical discharge
 (b) Sum of actual discharge and the theoretical discharge
 (c) Difference of theoretical discharge and the actual discharge=
 (d) Product of theoretical discharge and the actual discharge
- 10 The specific speed of a centrifugal pump, delivering 750 litres of water CO5- R
 per second against a head of 15 metres at 725 r.p.m is
 (a) 24.8 r.p.m (b) 48.2 r.p.m (c) 82.4 r.p.m (d) 248 r.p.m

PART – B (5 x 2= 10 Marks)

- 11 Define specific weight with its units. CO1- U
- 12 State Bernoulli's equation and its assumptions CO2- U
- 13 Define dimensional homogeneity CO3- U
- 14 Define Turbine CO4- U
- 15 Write the classification of Pumps. CO5- R

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. CO1-App (16)

Or

- (b) Calculate the dynamic viscosity of oil, which is used for CO1-App (16)
 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

- 17 (a) The water is flowing through a pipe having diameters 20cm and 15cm at sections 1 and 2 respectively. The rate of flow through pipe is 40 liters/sec. The section-1 is 6m above the datum and section-2 is 3m above the datum. If the pressure at section-1 is 29.43 N/cm², find the intensity of pressure at section-2. CO2-App (16)

Or

- (b) Derive Bernoulli's Equation from Euler's Equation with a neat sketch. CO2-App (16)

- 18 (a) 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 CO3-App (16)

Or

- (b) The resisting force (R) of a supersonic plane during flight can be considered as dependent upon the length of aircraft (l), velocity (V), dynamic viscosity of air (μ), air density (ρ) and bulk modulus of air (K). Express the functional relationship between these variables and the resisting force using Buckingham's π – Theorem. CO3-App (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. CO4-App (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. CO4-App (16)

- 20 (a) Derive and Explain the working principle of Single stage Centrifugal Pump with neat sketch CO5-App (16)

Or

- (b) A centrifugal pump having outer diameter equal to two times the inner diameter and running at 1000 rpm. Work against a total head of 40m. The velocity of flow through the impeller is constant and equal to 2.5 m/s. the vanes are set back at an angle of 40° at outlet. If the outer diameter of the impeller is 500mm and width at outlet is 50mm. Determine (i) vane angle at inlet, (ii) work done by impeller on water per second, (iii) manometric efficiency. CO5-App (16)