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Question Paper Code: U3704

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

Third Semester

Mechanical Engineering

21UME304 – FLUID MECHANICS AND MACHINERY

(Regulations 2021)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

- In one dimensional flow, the flow CO1- U
 - Is steady and uniform
 - takes place in straight line
 - takes place in curve
 - takes place in one direction
- Which of the following is an example of laminar flow? CO1- U
 - Underground flow
 - Flow past tiny bodies
 - Flow of oil in measuring instruments
 - All of the above.
- The coefficient of viscosity may be determined by CO1- U
 - Capillary tube method
 - Orifice tube viscometer
 - Rotating cylinder method
 - All of the above
- Which property of the fluid accounts for the major losses in pipes? CO1- U
 - Density
 - Specific gravity
 - Viscosity
 - Compressibility
- Dynamic viscosity (μ) has the dimensions as CO1- U
 - MLT^{-2}
 - $ML^{-1}T^{-1}$
 - $ML^{-1}T^{-2}$
 - $M^{-1}L^{-1}T^{-1}$
- Surface tension has the units of CO1- U
 - force per unit area
 - force per unit length
 - force per unit volume
 - none of the above
- _____ is the electric power obtained from the energy of the water. CO1- U
 - Rotor dynamic power
 - Thermal power
 - Nuclear power
 - Hydro electric power

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. The specific speed of a centrifugal pump, delivering 750 litres of water per second CO1- U
 against a head of 15 metres at 725 r.p.m is
 (a) 24.8 r.p.m (b) 24.8 r.p.m (c) 82.4 r.p.m (d) 248 r.p.m
10. Which of the following is NOT a type of positive displacement pumps? CO1- U
 (a) Reciprocating pump (b) dummy pump
 (c) Centrifugal pump (d) None of these

PART – B (5 x 2= 10Marks)

11. Describe specific weight with its units. CO1- U
12. Explain the difference between laminar and turbulent flow. CO1- U
13. Explain the similarities between models and prototype? CO1- U
14. Explain the short notes on Draft tube? CO1- U
15. Explain the Slip of reciprocating pump. CO1- U

PART – C (5 x 16= 80 Marks)

16. (a) If the velocity profile of a fluid over a plate is parabolic with the CO2-App (16)
 vertex 20cm from the plate, where the velocity is 120cm/s.
 Calculate the velocity gradients and shear stresses at a distance of
 0, 10 and 20cm from the plate, if the viscosity of fluid is 8.5 poise.
 Or
- (b) Calculate the dynamic viscosity of oil, which is used for lubrication CO2-App (16)
 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) Derive DARCY – WEISBACH Equation. CO2-App (16)
 Or
- (b) The rate of flow of water through a horizontal pipe is 0.25 m³/s. CO6-App (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 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)
- 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. CO4- App (16)
19. (a) A Pelton Wheel is having a mean bucket diameter of 1m and is running at 1000rpm. The net head on the Pelton Wheel is 700m. If the side clearance angle is 15° and discharge through nozzle is $0.1\text{m}^3/\text{s}$. Find (i) Power available at the nozzle (ii) Hydraulic efficiency of the turbine. CO7- App (16)
- Or
- (b) A Kaplan Turbine working under a head of 20m develops 11772KW shaft power. The outer diameter of the runner is 3.5m and hub diameter 1.75m. The guide blade angle at the extreme edge of the runner is 35° . The hydraulic and overall efficiencies of the turbines are 88% and 84% respectively. If the velocity of whirl is zero at outlet, determine (i) Runner vane angles at inlet and outlet at the extreme edge of the runner (ii) Speed of the turbine. CO7- App (16)
20. (a) Explain the working principle of Gear Pump and Vane Pump with the neat sketch. CO1- U (16)
- Or
- (b) Explain the working principle of Single acting & Double acting Reciprocating pump with a neat sketch. CO1- U (16)

