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Question Paper Code: U3704

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

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)

1. In one dimensional flow, the flow   CO1- U

    (a) Is steady and uniform   (b) takes place in straight line

    (c) takes place in curve   (d) takes place in one direction

2. 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 the above.

3. 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 the above

4. Which property of the fluid accounts for the major losses in pipes?   CO1- U

    (a) Density   (b) Specific gravity   (c) Viscosity   (d) Compressibility

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. Surface tension has the units of   CO1- U

    (a) force per unit area   (b) force per unit length

    (c) force per unit volume   (d) none of the above

7. _____is the electric power obtained from the energy of the water.   CO1- U

    (a) Roto dynamic power   (b) Thermal power

    (c) Nuclear power   (d) 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) Reciprocating pump

    (c) Centrifugal pump   (d) None of these

PART – B (5 x 2= 10Marks)

11. Describe capillarity with its units.   CO1- U

12. Explain the difference between laminar and turbulent flow.   CO1- U

13. Mention Buckingham's π – Theorem.   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) Velocity distribution for flow over a flat plate is given by u =   CO2-App   (16)
         (3/2)y – y3/2, where u is the point velocity in m/s at a distance y
         meter above the plate. Determine the shear stress at y = 9cm.
         assume dynamic viscosity as 8 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) The water is flowing through a pipe having diameters 20cm and CO6-App   (16)
         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.

                                        Or

    (b) Derive Bernoulli's Equation from Euler's Equation with a neat sketcl CO6-App   (16)

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18. (a) The efficiency (η) of a fan depend on density (ρ), dynamic   CO4- App   (16)
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.

Or

(b) The resisting force (R) of a supersonic plane during flight can be   CO4- App   (16)
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.

19. (a) A Pelton Wheel is having a mean bucket diameter of 1m and is   CO7- App   (16)
running at 1000rpm. The net head on the Pelton Wheel is 700m. If
the side clearance angle is 15° and discharge through nozzle is
$0.1m^3$/s. Find (i) Power available at the nozzle (ii) Hydraulic
efficiency of the turbine.

Or

(b) A Kaplan Turbine working under a head of 20m develops   CO7- App   (16)
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.

20. (a) Explain the working principle of Single acting & Double acting   CO1- U   (16)
Reciprocating pump with a neat sketch.

Or

(b) Explain the working principle of Gear Pump and Vane Pump with   CO1- U   (16)
the neat sketch.

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