A **Reg. No. :** | | | | | | | | | | |

Question Paper Code: 93704

B.E./B.Tech. DEGREE EXAMINATION, NOV 2022

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)

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

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

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

2. Reynolds Number for laminar flow is CO1- R

   (a) Re > 4000 (b) Re = 2000 to 4000 (c) Re < 2000 (d) None of the above

3. The coefficient of viscosity may be determined CO2- R

   (a) Capillary tube method (b) Orifice tube viscometer

   (c) Rotating cylinder method (d) All of these

4. A monometer is used to measure CO2- R

   (a) Low pressure (b) Moderate pressure

   (c) High pressure (d) Atomospheric pressure

5. Dynamic viscosity (μ) has the dimensions as CO3- R

   (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 CO3- R

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

(c) force per uint volume (d) 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 per second against a head of 15 metres at 725 r.p.m is CO5- R

(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 – 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. CO1-App (16)

Or

(b) Calculate the capillary effect in millimeters in a glass tube of 4mm diameter, when immersed in (i) Water (ii) Mercury. The temperature of the liquid is 20°C and the values of surface tension of water and mercury at 20°C in contact with air are 0.073575N/m and 0.51N/m respectively. The angle of contact of water is 0^0 and for mercury is 130°. Take the density of water at 20°C as equal to 998kg/m^3. CO1-App (16)

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-Ana (16)

Or

(b) Derive DARCY – WEISBACH Equation. 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)	Design a Pelton Wheel for a head of 60m when running at 200rpm. The Pelton Wheel develops 95.6475kW shaft power. The velocity of the buckets = 0.45 times the velocity of the jet, overall efficiency = 0.85 and co-efficient of the velocity equals to 0.98.	CO4-App	(16)
		Or		
	(b)	An inward flow reaction turbine has external and internal diameters as 1.0 m & 0.6m 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: 1. Guide blade angle, 2. Speed of the turbine, 3. Vane angle of the runner at inlet, 4. Volume flow rate of turbine, 5. Power developed	CO4-App	(16)
20	(a)	Explain the working principle of Single acting & Double acting Reciprocating pump with a neat sketch.	CO5-U	(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)