

Reg. No. :

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

**Question Paper Code: R3704**

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

Third Semester

Mechanical Engineering

R21UME304 – FLUID MECHANICS AND MACHINERY

(Regulations R2021)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. The pressure less than atmospheric pressure is known as CO1- U  
(a) Suction pressure (b) Vacuum pressure (c) Negative gauge pressure (d) All of these.
2. Reynolds Number for laminar flow is CO1- U  
(a)  $Re > 4000$  (b)  $Re = 2000$  to  $4000$  (c)  $Re < 2000$  (d) None of the these
3. Which of the following is a formula for the friction factor of circular pipes? CO1- U  
(a)  $Re/64$  (b)  $16/Re$  (c)  $64/Re$  (d)  $Re/16$
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 ( $\mu$ ) 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. Square root of the ratio of inertia force to elastic force is called as CO1- U  
(a) Mach's Number (b) Cauchy's Number (c) Both a. and b (d) None of these
7. For 450m head of water \_\_\_\_\_ shall be used CO1- U  
(a) Pelton wheel (b) Kaplan turbine (c) Francis turbine (d) None of these
8. A pressure of 25 m of head of water is equal to CO1- U  
(a)  $25 \text{ kN/m}^2$  (b)  $245 \text{ kN/m}^2$  (c)  $2500 \text{ kN/m}^2$  (d)  $2.5 \text{ kN/m}^2$

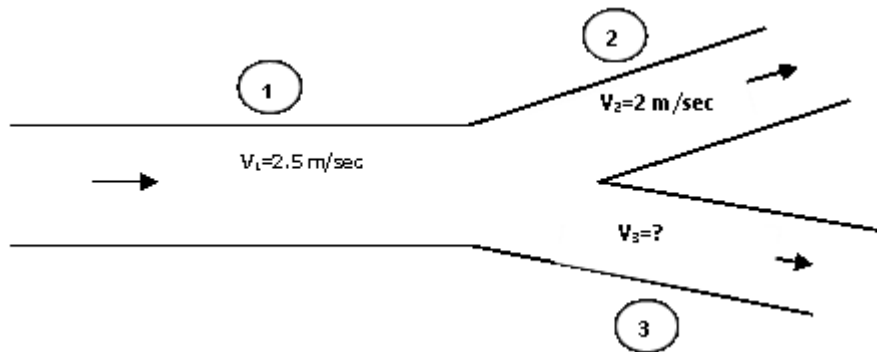
9. The specific speed of a centrifugal pump, delivering 750 litres of water per second against a head of 15 metres at 725 r.p.m is CO1- U
- (a) 24.8 r.p.m            (b) 22.8 r.p.m            (c) 82.4 r.p.m            (d) 248 r.p.m
10. The discharge of a centrifugal pump working under constant head \_\_\_\_\_ with the speed. CO1- U
- (a) Increases            (b) decreases            (c) equal            (d) None of these

PART – B (5 x 2= 10Marks)

11. State Newton’s law of viscosity. CO1- U
12. Name some minor losses CO1- U
13. Mention Buckingham’s  $\pi$  – Theorem. CO1- U
14. Explain the difference between impulse turbine and Reaction turbine. CO1- U
15. Explain the Slip of reciprocating pump. CO1- U

PART – C (5 x 16= 80 Marks)

16. (a) 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  $30^\circ$ . 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)
- Or
- (b) A 30 cm diameter pipe, conveying water, branches into two pipes of diameters 20cm and 15 cm respectively. If the average velocity in the 30cm diameter pipe is 2.5m/sec. Find the discharge in this pipe. Also find the velocity in 15 cm pipe if the average velocity in 20cm diameter pipe is 2 m/sec CO2- App (16)



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

Or

- (b) A pipe of diameter 400 mm carries water at velocity of 25 m/s. CO2- App (16)  
The pressures at the points A & B are given as 29.43 N/cm<sup>2</sup> and 22.56 N/cm<sup>2</sup> respectively, while the datum head at A and B are 28 m and 30 m. Find the loss of head between A and B.

18. (a) 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 ( $\mu$ ), air density ( $\rho$ ) and bulk modulus of air (K). Express the functional relationship between these variables and the resisting force using Buckingham's  $\pi$  – Theorem. CO4- App (16)

Or

- (b) The frictional torque T of a disc of diameter (D) rotating at a speed (N) in a fluid of viscosity ( $\mu$ ) and density ( $\rho$ ) in a turbulent flow is given by CO4- App (16)

$$T = D^5 N^2 \rho \phi \left[ \frac{\mu}{D^2 N \rho} \right]$$

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. CO3- App (16)

Or

- (b) Explain the working of Kaplan turbine with a neat sketch. CO3- App (16)

20. (a) Explain the working principle of Single stage Centrifugal Pump with neat sketch. CO1- U (16)

Or

- (b) Explain with neat sketches, the working of air vessel and single acting reciprocating pump. CO1- U (16)

