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

Question Paper Code: R3704

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2025

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. 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 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. A monometer is used to measure CO1- U

   (a) Low pressure (b) Moderate pressure (c) High pressure (d) Atmospheric pressure

4. Piezometer is used to measure

   (a) Pressure in pipe, channels etc. (b) Atmospheric pressure

   (c) Very low pressures (d) Difference of pressure between two points

5. Which of the following is a dimensionless equation? CO1- U

   (a) Reynold's equation (b) Euler's equation

   (c) Weber's equation (d) All of the above

6. Force can be written as_____ CO1- U

   (a) [M][L][T]-2 (b) [M][L][T]2 (c) [M][L][T] (d) [M][L][T]3

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. The value of specific speed of Kaplan turbine is _____ that of the Pelton turbine. CO2- U

(a) lower than (b) higher than (c) same as (d) unpredictable

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 CO2- U

(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 pump is preferred for flood control and irrigation applications? CO2- U

(a) Centrifugal pump (b) Axial flow pump

(c) Mixed flow pump (d) Reciprocating pump

PART – B (5 x 2= 10 Marks)

11. Explain the difference between gauge pressure and absolute pressure. CO1- U

12. Explain the terms: (i) pipes in series (ii) pipes in parallel CO1- U

13. List methods used for dimensional analysis. CO1- U

14. Explain the difference between impulse turbine and Reaction turbine. CO1- U

15. Mention the main components 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 = (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. CO2-App (16)

Or

(b) Derive continuity equation in three dimensions. CO2-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/cm^2, find the intensity of pressure at section-2. CO2-App (16)

Or

(b) A Horizontal pipe line 40 meter long is connected to water tank at one end and Discharges freely into the atmosphere at the other end. For the first 25 meter of its length from the tank, the pipe is 150 mm diameter and its diameter is suddenly enlarged to 300 mm. The height of the water level in the tank is 8 meter above the center of the pipe. Considering all losses of head which occur, determine the rate of flow. Take f=0.01 at the both section of the pipe. CO2-App (16)

18. (a) The pressure difference ΔP in a pipe of diameter (D) and length (L) due to viscous flow depends on the velocity (V), viscosity (μ) and density (ρ). Using Buckingham's π – Theorem obtain an expression for ΔP. CO4-App (16)

Or

(b) Discuss the importance of dimensionless numbers and derive five dimensionless numbers which are most important in fluid flow problems. CO4-App (16)

19. (a) A Pelton Wheel is having a mean bucket diameter of 1m and is running at 1000 rpm. The net head on the Pelton Wheel is 700m. If the side clearance angle is 15° and discharge through nozzle is $0.1 m^3/s$. Find (i) Power available at the nozzle (ii) Hydraulic efficiency of the turbine. CO3- App (16)

Or

(b) Two Jets strike the buckets of a pelton wheel, which is having shaft power as 15450 kw. The diameter of each jet is given as 200 mm. If the net head on the turbine is 400m, find the overall efficiency of the turbine. Take C_v=1.0. CO3- App (16)

20. (a) A single acting reciprocating pump running at 50 rpm is delivers $0.01 m^3/s$ of water. The diameter of the piston is 200 mm and stroke length 400 mm. Determine (i) The theoretical discharge of the pump (ii) Coefficient of discharge and (iii) Slip and the percentage of slip. CO3- App (16)

Or

(b) A single acting reciprocating pump has a plunger diameter of 250 mm and stroke of 450 mm. It is driven with S.H.M at 60 rpm. The length and diameter of delivery pipe are 60 m and 100 mm respectively. Determine the power saved in overcoming friction in the delivery pipe by fitting and air vessel on the delivery side of the pump , Assume friction factor = 0.01. CO3- App (16)