

**B. TECH. MECHANICAL
ENGINEERING (COMPUTER
INTEGRATED MANUFACTURING)**

Term-End Examination

June, 2019

BME-028 : FLUID MECHANICS

Time : 3 Hours

Maximum Marks : 70

Note : Attempt any seven questions. Use of scientific calculator is permitted.

1. (a) How is the U-tube manometer used for the measurement of fluid pressure ? Explain with a neat sketch. 5
- (b) A hydraulic press has a ram of 30 cm diameter and plunger of 5 cm diameter. Find the weight lifted by the hydraulic press when the force applied at the plunger is 400 N. 5
2. (a) Differentiate between forced vortex and free vortex flow. 5
- (b) An orifice meter with orifice diameter 15 cm is inverted in a pipe of 30 cm diameter. The pressure gauges upstream

and downstream of the orifice meter give readings of 14.715 N/cm^2 and 9.81 N/cm^2 respectively. Find the rate of water through the pipe in litres/sec. Take $\rho_d = 0.6$. 5

3. Derive Bernoulli's theorem for steady flow of an incompressible fluid. Derive an expression for Bernoulli's theorem from first principle and state the assumptions made for such a derivation. 10
4. (a) Discuss the relative merits and demerits of venturimeter with respect to orifice meter. 5
(b) A rectangular orifice, 2.0 m wide and 1.5 m deep is discharging water from a tank. If the water level in the tank is 3.0 m above the top edge of the orifice, find the discharge through the orifice. Take $\rho_d = 0.6$. 5
5. (a) Explain the term co-efficient of friction. On what factors does this co-efficient depend? 5
(b) Water is flowing through a rough pipe of diameter 40 cm and length 3000 m at the rate of $0.4 \text{ m}^3/\text{s}$. Find the force required to maintain this flow. Take the average height of roughness as $k = 0.3 \text{ mm}$. 5

6. (a) How will you determine the loss of head due to friction in pipes by using (i) Darcy's formula and (ii) Chezy's formula ? 5
- (b) Find the diameter of pipe of length 2500 m when the rate of flow of water through the pipe is $0.25 \text{ m}^3/\text{s}$ and head loss due to friction is 5 m. Take $C = 50$ in Chezy's formula. 5
7. (a) What are the methods of dimensional analysis ? Describe the Rayleigh's method for dimensional analysis. 5
- (b) A pipe of diameter 1.8 m is required to transport an oil specific gravity 0.8 and viscosity 0.04 poise at the rate of $4 \text{ m}^3/\text{s}$. Tests were conducted on a 20 cm diameter pipe using water at 20°C . Find the velocity and rate of flow in the model. Viscosity of water at $20^\circ\text{C} = 0.01$ poise. 5
8. (a) What are the different methods of preventing the separation of boundary layers ? 5
- (b) Find the frictional drag on one side of the plate 200 mm wide and 50 mm long placed longitudinally in a stream of crude oil (specific gravity is 0.925, kinematic viscosity is 0.9 stoke) flowing with undisturbed velocity of 5 m/s. Also find the thickness of boundary layers and shear stress at the trailing edge of the plate. 5

9. (a) How are drag and lift forces caused on a body immersed in a moving fluid ? 5
- (b) A flat plate $2 \text{ m} \times 2 \text{ m}$ moves at 40 km/hours in stationary air of density 1.25 kg/m^3 . If the coefficient of drag and lift are 0.2 and 0.8 respectively. Find (i) lift force (ii) the drag force (iii) resultant force (iv) the power required to keep the plate in motion. 5
10. (a) Differentiate between the following : 5
- (i) Uniform and non-uniform flow
- (ii) Laminar and turbulent flow
- (b) A 500 mm diameter pipe with friction factor of 0.02 has a pipe fitting with loss coefficient of 1.9 and 200 mm diameter pipe of 50 m length with friction factor of 0.022. Determine their equivalent length in terms of 300 mm diameter pipe. 5