BACHELOR OF ENGINEERING (CIVIL ENGINEERING)
FIRST YEAR FIRST SEMESTER EXAM 2024

Fluid Mechanics – II

Full Time: 3 Hours **Full Marks: 100**

Different parts of the same question should be answered together.
All symbols carry their usual meanings unless otherwise mentioned.
Assume any relevant data if necessary.

(Answer any **FIVE** questions)

1. a) What are the flow measurement devices used in closed conduit and open channel flow? 4
   b) Derive the expression for the discharge through a V- Notch. 6
   c) Water flowing through a horizontal Venturi meter of inlet and throat diameters are 24 cm and 12 cm respectively. The pressure at inlet is 12 N/cm^2 and 2 N/cm^2 at the throat. Determine coefficient of discharge and rate of flow if 4 % head loss occurs between the two sections. 10
2. a) What do you mean by viscous flow? Prove that velocity profile a flow of viscous fluid though a pipe shows a parabolic profile. 10
   b) An oil of viscosity 1 poise and density 800 kg/m^3 is flowing through a horizontal pipe of diameter 10 cm and of length 10 m. Determine the difference of pressure at the two ends of the pipe, if 200 kg of the oil is collected in a tank in 40 seconds. Also determine the shear stress at the pipe wall. 10
3. a) What are the different losses in pipe flow? 3
   b) Find an expression for the head loss due to sudden enlargement in the pipe flow. 10
   c) The rate of flow of water through a horizontal pipe of diameter 20cm which is suddenly enlarged to 40cm diameter. If the pressure in the smaller pipe is 12N/cm^2 and discharge is 0.5 m^3/s, calculate the head loss due to sudden enlargement and pressure in the large pipe. 7
4. a) How water turbines are classified? Explain the function of different major components of a hydroelectric power plant with a neat sketch. 10
   b) A Francis turbine of inlet diameter 100 cm works at 600 rpm under a head of 100 m. The angels made by the absolute and relative velocities at inlet are 20° and 50° respectively. Calculate the power developed and hydraulic efficiency with the flow area is 0.3m^2. (Assume whirl at outlet is zero). Draw the velocity triangle. 10

5. a) What do you mean by open channel flow? What are the differences between notch and weir? 6

   b) What do you mean by most economical cross section of channel? What is the condition for the rectangular channel for it? 6

   c) Determine the diameter of a circular pipe which is laid at a slope of 1 in 5000 and carries a discharge of 1000 litres/sec when flowing half full. Take the value of Manning's N =0.03. 8

6. a) Explain the working principle of a centrifugal pump with a neat sketch. 6

   b) The outer and inner diameter of the impeller of a centrifugal pump are 40cm and 20cm respectively and are bent back at 40^{o} to the tangent at exit. Pump delivers a discharge of $0.12m^3/s$ of water against a head of 10m at a speed of 500rpm. If the flow area of the pump remains constant from inlet to the outlet, determine the manometric efficiency and vane angle at inlet. Draw the velocity triangle. 10

   c) What is specific speed of a pump? 4

7. Write short note (any FOUR) 4 X 5 20

   a) Equivalent pipe

   b) Draft tube

   c) Specific energy and specific energy curve

   d) Hydraulic jump

   e) Kaplan turbine