(3 hours)

Note: Max. Marks 100

Question no.1 is compulsory

Solve any 4 questions out of remaining

Assume data wherever necessary and clearly mention the assumptions made.

Draw neat figures as required.

1. Answer any 4 of the following. 20
   a. Derive Dupit's Equation
   b. Explain Water Hammer and control measures
   c. Write a note on Propagation of Disturbance in Compressible Flow
   d. Write a note on Prandlts mixing length theory.
   e. Explain Dash Pot Mechanism.

2. a. Two parallel plates kept 100 m apart have laminar flow of oil between them with a amaximum velocity of 1.5 m/s. Calculate the discharge per meter width; the shear stress at the plates; the difference in pressure between two points 20 m apart; the velocity gradient at the plates and the velocity at 20 mm from the plate. Assume viscosity of oil to be 24.5 poise. 10

   b. Derive Hagen Poiseuille Equation 10

3. a. A pipe of 25 cm diameter carries air ($\rho = 1.22$ kg/m^3, $\nu = 1.5 \times 10^{-5}$ m^2/s) at an average velocity of 8m/sec. The equivalent sand green roughness of the pipe is 0.50mm. Calculate the friction factor f assuming the flow to be fully rough and turbulence. What is the shear stress at the boundary. 10

   b. A piping system consist of 3 pipes arranged in series: the lengths of the pipes are 1200m, 750m and 600m and diameters 750mm, 600mm and 450mm respectively. Transform the system to an equivalent 450mm diameter pipe and find its length (b) also determine an equivalent diameter for the pipe 2550m long. 10

4. a. In an smooth pipe of diameter 0.5m and length 100m water is flowing at the rate of 0.50m^3/s. Assuming the kinematic viscosity of water as 0.02stokes, Find head lost due to friction ; wall shear stress ; centerline velocity and; thickness of laminar sublayer. 12

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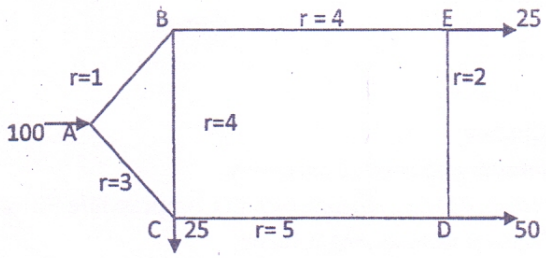
b. Three pipes of diameter 300mm, 200mm and 400mm and lengths 300m, 170m and 210 m respectively are connected in series. The difference in water surface levels in 2 tanks is 12m. Determine the rate of flow if coefficients of frictions are 0.005, 0.0052 and 0.0048 respectively considering minor losses. 08

5. a. For a given pipe network system determine discharges in all pipes using Hardy cross method. Carry out 2 iterations. 12



b. Two reservoirs having a difference in elevation of 15m, are connected by a 200mm diameter syphon. The length of siphon is 400m and the summit is 3m above the water level in the upper reservoirs. The length of the pipe from the upper reservoir to the summit is 120m. if the coefficient of friction is 0.005 determine discharge through the siphon and pressure at the summit. 08

6. a. The water levels in the 2 reservoirs A and B are 104.5m and 100m respectively above the datum. A pipe joins each to a common point B, where pressure is 98.1kN/m^2 gauge and height is 83.5m above datum. Another pipe connects D to another tank C. what will be the height of water level in C assuming the same value of f for all pipes. Take friction coefficient = 0.0075. The diameters of pipe AD, BD and CD are 300mm, 450mm, 600mm respectively and their lengths are 240m, 270m, 300m respectively. 12

b. Find the stagnation temperature and pressure for carbon dioxide flowing at 150m/sec if the pressure and temperature in undisturbed flow are 500kPa (abs) and 30^0 C respectively. For carbon dioxide k = 1.28 and R = 188 J/kg.K. 08

7. a. Derive Area Velocity Relationship
b. Derive the condition for maximum power transmission
c. Explain hydraulically rough and smooth boundaries
d. Explain HGL and TEL with neat sketches 20

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