SE-CE / FM / Sem-IV / CBSGS) dt. 22/12/2017

Q. P. Code: 26419

(3 hours) **Total marks: 80**

N.B.: (1) Question no.1 is compulsory.

(2) Attempt any 3 questions out of the remaining 5 questions.

(3) Assume data wherever necessary and clearly mention the assumptions made.

(4) Draw neat figures as required.

Q1 Solve any four from the following **20**

a Define and explain the terms (i) Hydraulic gradient line and (ii) Total energy line.

b Write a note on Water Hammer & Control measures.

c Define Mach Cone, Mach angle, Zone of action and Zone of Silence.

d Explain Prandtl's Mixing Length Theory.

e Explain the term co-efficient of friction. On what factors does this co-efficient depend?

Q2 a The difference of water levels of two water reservoirs is 8 m. They are connected by a 40 m long pipe. For the first 25 m length, the diameter of the pipe is 120 mm and for the remaining length, the diameter is 200 mm, the change in diameter being sudden. Find the discharge into the lower reservoir. Take f = 0.008. **10**

b. A syphon pipe 800 m long connects two reservoirs whose water surface levels differ by 9 m. The diameter of the pipe is 400 mm. Taking f = 0.008, find the discharge. If the summit of the syphon pipe is 6 m above the surface level of the upper reservoir, calculate the maximum length of the inlet leg for the pipe to run full. Neglect all losses other than friction. Take atmospheric pressure head = 10.3 m of water and separation pressure head = 2.3 m of water. **10**

Q3 a Two sharp ended pipes of diameters 50 mm and 100 mm respectively, each of length 100 m are connected in parallel between two reservoirs which have a difference of level of 10 m. If the co-efficient of friction for each pipe is (4f) 0.32, calculate the rate of flow for each pipe and also the diameter of a single pipe 100 m long which would give the same discharge, if it were substituted for the original two pipes. **10**

b Find the maximum power transmitted by a jet of water discharging freely out of a nozzle fitted to a pipe = 300 m long and 100 mm diameter with co-efficient of friction as 0.01. The available head at the nozzle is 90 m. **5**

c Show that the diameter of nozzle for maximum transmission of power is given by $d = \left[\frac{D^5}{8fL}\right]^{1/4}$ **5**

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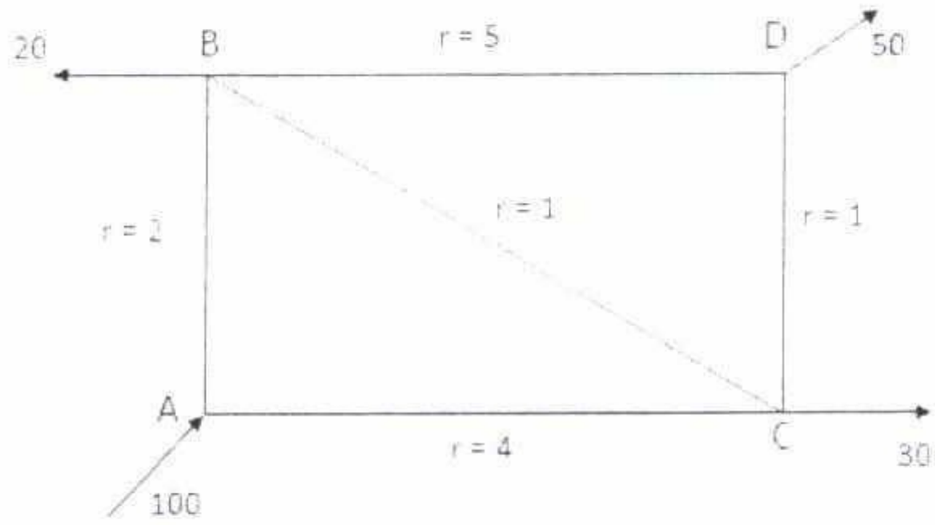
Q4 a For a pipe network shown below, determine the flow in each pipe. The value of n may be assumed as 2.0. **10**



b Calculate the stagnation pressure, temperature and density on the stagnation point on the nose of a plane, which is flying at 800 km/hour through still air having a pressure 8.0 N/cm^2 (abs) and temperature -10^{0}C. Take R = 287 L/kg K and k= 1.4. **10**

Q5 a Determine (i) the pressure gradient, (ii) the shear stress at the two horizontal parallel plates and (iii) the discharge per meter width for the laminar flow of oil with a maximum velocity of 2m/s between two horizontal fixed plates which are 100 mm apart. Given $\mu = 2.4525$ Ns/m^2. **10**

b Prove that the velocity distribution for viscous flow between two parallel plates when both plates are fixed across a section is parabolic in nature. Also prove that maximum velocity is equal to one and a half times the average velocity. **10**

Q6 a For turbulent flow in a pipe of diameter 300 mm, find the discharge when the centre-line velocity is 2 m/s and the velocity at a point 100 mm from the centre as measured by pitot tube is 1.6 m/s. **10**

b A rough pipe of diameter 400 mm and length 1000 m carries water at the rate of 0.4 m^3/s. the wall roughness is 0.012 mm. Determine the co-efficient of friction, wall shear stress, centre-line velocity and velocity at a distance of 150 mm from the pipe wall. **10**

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