S E Civil IV CBGS FM-II

19-12-14

QP Code : 12574

Note: (3 Hours) Max. Marks 80

Question no.1 is compulsory

Solve any 3 questions out of remaining

Assume data wherever necessary and clearly mention the assumptions made.

Draw neat figures as required.

Q 1 Answer any four out of the following **20**

a Define the terms: Major energy losses and Minor energy losses.

b Write a short note on Dash pot mechanism.

c Explain water hammer and control measures.

d Define Mach number and state its significance in compressible fluid flow.

e What is kinetic energy correction factor and momentum correction factor?

Q2 a A horizontal pipe-line 50 m long is connected to a water tank at one end and discharges freely into the atmosphere at the other end. For the first 30 m of its length from the tank, the pipe is 200 mm diameter and its diameter is suddenly enlarged to 400 mm. The height of water level in the tank is 10 m above the center of pipe. Considering all minor losses, determine the rate of flow. Take f = 0.01 for both sections of the pipe **10**

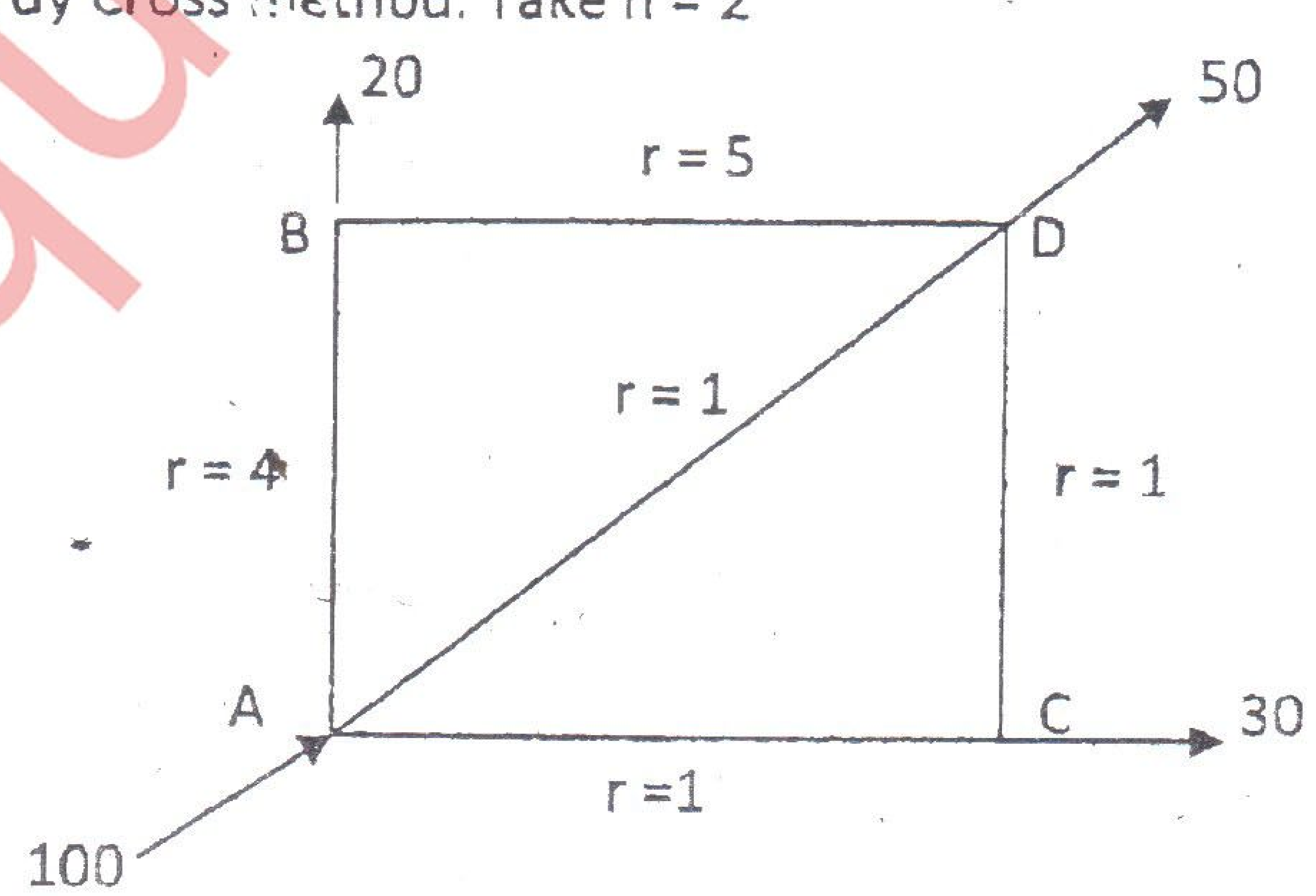
b Two reservoirs are connected by a pipe line consisting of two pipes, one of 15 cm diameter and length 6 m and the other of diameter 22.5 cm and 16 m length. If the difference of water levels in the two reservoirs is 6 m, calculate the discharge and draw the energy gradient line. Take f = 0.04. **10**

Q3 a Prove that the velocity through the Nozzle is given by **5**

$$V = \sqrt{\frac{2gH}{1+\frac{4fL}{D}\times\frac{a^2}{A^2}}}$$

b Show that the pressure rise due to sudden closure of valve at the end of pipe, through which water is flowing is given by $p = V\sqrt{\frac{d}{\frac{1}{K}+\frac{D}{Et}}}$ **5**

c Calculate the discharge in each pipe of the Network shown in figure below by Hardy Cross method. Take n = 2 **10**



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Q4 a (i) Prove the following relationship for one dimensional compressible flow 5

$$\frac{dA}{A} = \frac{dV}{V}\left[M^2 - 1\right]$$

(ii) Derive an expression for Stagnation temperature and Stagnation Density. 5

b (i) Find the Mach number when an aero plane is flying at 900 Km/hour through still air having a pressure of 8 N/cm^2 and temperature -15^{0}C. Take k = 1.4 and R = 287 J/kg K. Calculate the pressure, density and temperature of air at the stagnation point on the nose of plane. 8

(ii) A projectile is travelling in air having pressure and temperature as 8.829 N/cm^2 and -5^{0}C. If the Mach angle is 30^0, find the velocity of projectile. Take k = 1.4 and R = 287 J/kg K. 2

Q5 a Derive Hagen Poiseuille Law for flow of viscous fluid in circular pipes. 10

b A lubricating oil of viscosity 1 poise and specific gravity 0.9 is pumped through a 30 mm diameter pipe. If the pressure drop per meter length of pipe is 20 kN/m^2, determine : 10

(i) The mass flow rate in kg/min,
(ii) The shear stress at the pipe wall,
(iii) The Reynolds number of flow, and
(iv) The power required per 50 m length of the pipe to maintain the flow.

Q6 a Obtain an expression for velocity distribution for turbulent flow in smooth pipes. 10

b For turbulent flow in a pipe of diameter 300 mm, find the discharge when the center line velocity is 2.0 m/s and the velocity at a point 100 mm from the center as measured by pitot tube is 1.6 m/s. 10
