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CIVIL / IV / CBGS / FM-II

16.6.14

QP Code : **NP-19859**

(3 Hours) [ Total Marks : 80

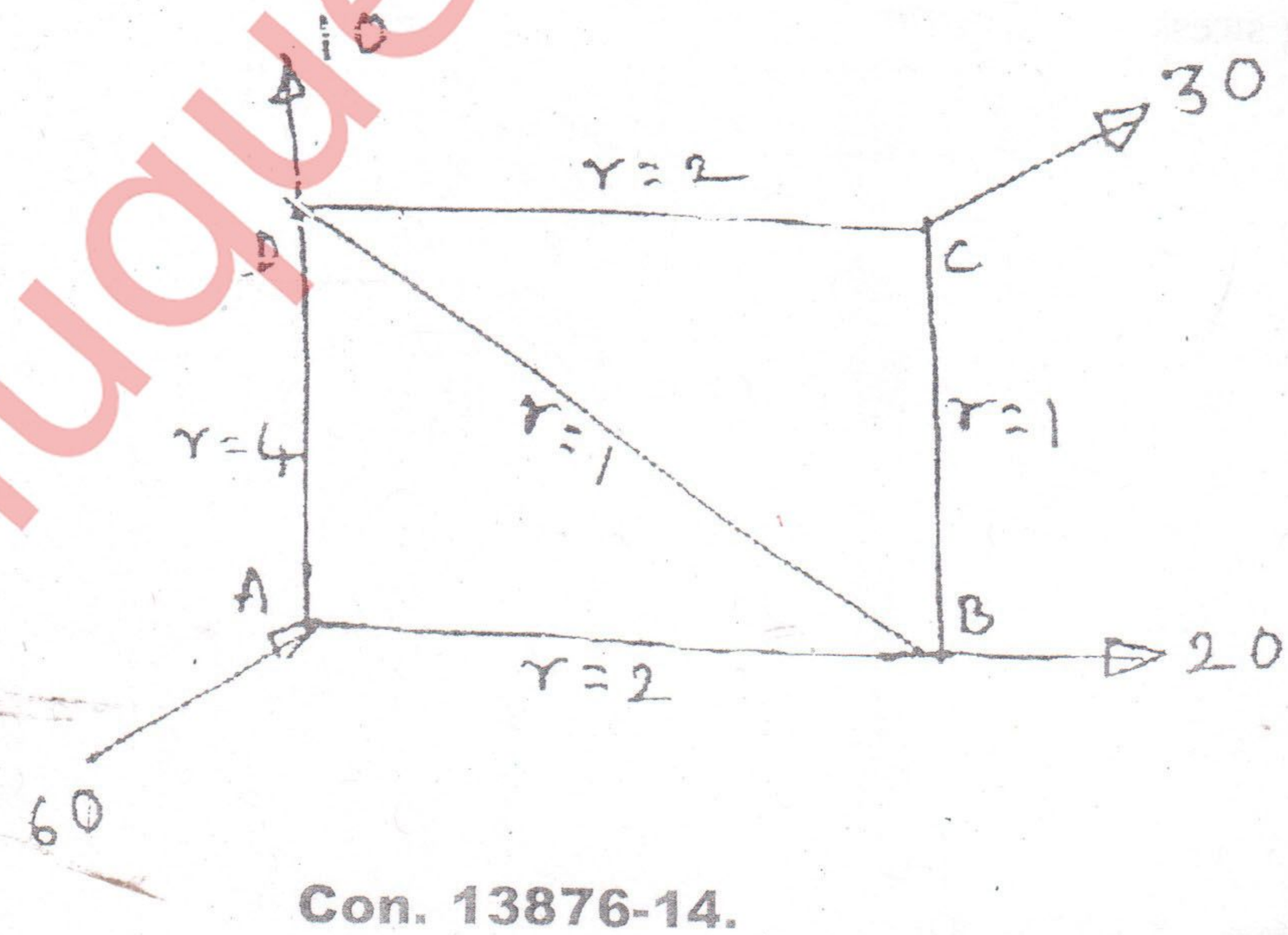
**N. B.** : (1) Question No. **1** is **compulsory**.
(2) Solve any **three** questions from remaining **five**.
(3) Assume suitable data if necessary and state clearly.

1. Solve any **four** :– **20**
(a) Define mach number. What is the significance in compressible fluid flow.
(b) Derive Dupit's equation.
(c) Explain water hammer with control measures.
(d) Explain prandtl's mixing length theory.
(e) What is kinetic energy correction factor and momentum correction factor.

2. (a) Three pipes of diameters 300 mm, 200 mm and 400 mm and length 450 m, 255 m and 315 m respectively are connected in series. The difference in water surface levels in two tanks is 18 m. Determine the rate of flow of water if co-efficients of friction are 0.0075, 0.0078 and 0.0072 respectively considering **10**
(i) Minor losses also and
(ii) Neglecting minor losses.

(b) A 300 mm diameter horizontal pipe is suddenly enlarged to 600 mm. The rate of flow of water through pipe is 0.5 $m^3/s$. If the intensity of pressure in smaller pipe is 120 $KN/m^2$ determine. **10**
(i) Loss if head due to sudden enlargement
(ii) Intensity of pressure in larger pipe
(iii) Power lost due to enlargement.

3. (a) Calculate discharge in each pipe of network as shown in fig. The pipe network consists of 5 pipes. The head loss 'hf', in pipe is given by $hf = rQ^2$. The ralues of 'r' for various pipes and also inflow or outflows at nodes are shown in figures. **10**



(b) A nozzle fitted to a pipe 100 mm diameter, and 250 m long with coefficient of friction as 0.01. If head available at nozzle is 120. Find maximum power transmitted by jet of water freely out of a nozzle and diameter of the nozzle. **10**

4. (a) Prove relationship for one dimensioal compressible flow. **10**

$$\frac{dA}{A} = \frac{dP}{PV^2}[1 - M^2]$$

(b) A supersonic aircraft flies at an altitude of 3 km where temperature is 4°C. Determine the speed of aircraft if its sound is heared 5 seconds after its passage over the head of an observer. **10**

Take $R = 287\ J/kg^0k$ and $k = 1.4$

5. (a) Derive an expression for the coefficient of viscosity in case of dashpot arrangement. **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) Mass flow rate in kg/min

(ii) The shear stress at the pipe wall

(iii) Reynolds number of flow and check the flow

(iv) The power required per 50 m length of the pipe to maintain the flow..

6. (a) Describe in detail hydrodynamically smooth and rough boundaries. What is karman–Prandtl equation for hydrodynamical rough boundaries. **8**

(b) Explain Moody's diagram. **5**

(c) A pipe of diameter 100 mm, carrying water, the velocities at the pipe centre and 35 mm from pipe centre are found tube 2.7 m/s and 2.4 m/s respectively. Find the wall shearing stress. **7**