

This question paper contains 8 printed pages]

CODE : FRO-2017

CIVIL ENGINEERING

Roll No.

Time : 3 Hours

Maximum Marks : 200

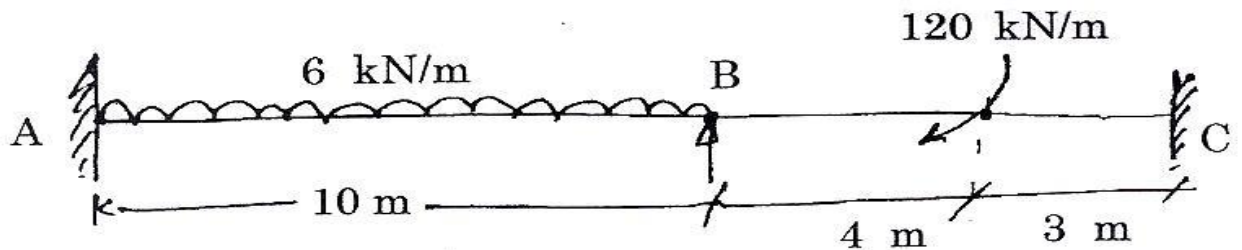
- Note :— (1) Question paper consists of *two* parts viz. Part I and Part II. Each part contains *four* questions. The paper as a whole carries eight questions. Question Nos. 1 and 5 are compulsory. The candidates are required to attempt *three* more questions out of the remaining six questions taking at least *one* question from each part *i.e.*, this is in addition to the compulsory question of each part. Attempt *five* questions in all. All questions carry equal marks. The parts of a question are to be attempt at one place in continuation. Answers should be brief and to the point.
- (2) Parts of same question must be attempted together and not to be attempted in between the answers to other questions.
- (3) The necessary data required in questions are provided. However suitable data may be assumed, if necessary.

P.T.O.

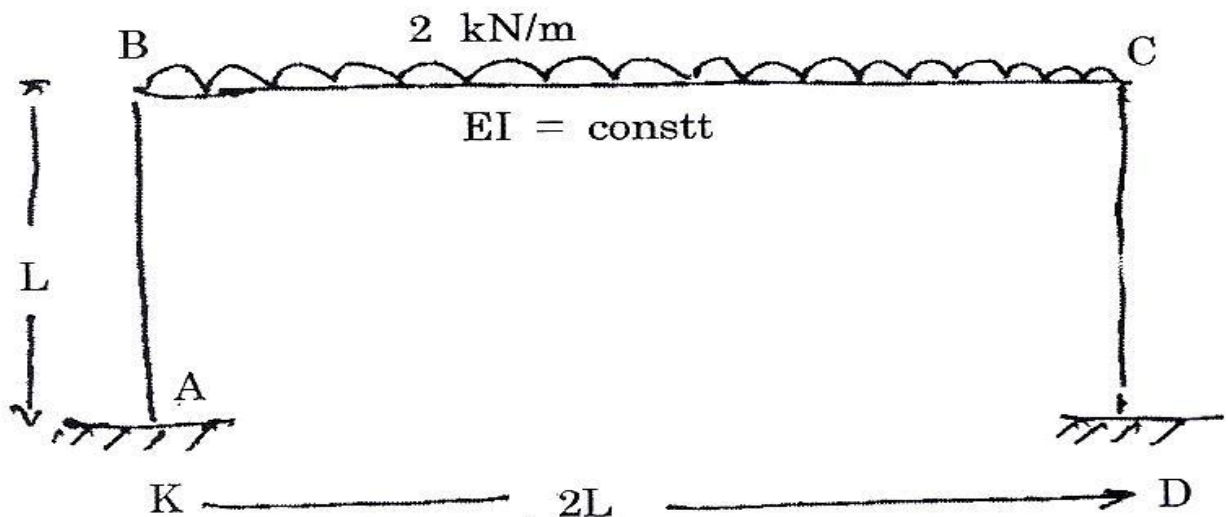
- (4) Use of non-programmable calculator is permitted.

Part-I

1. (a) A two span continuous beam fixed at the ends is loaded as shown in the following figure. Find the reactions and support moments. Also draw the BM diagram. 15

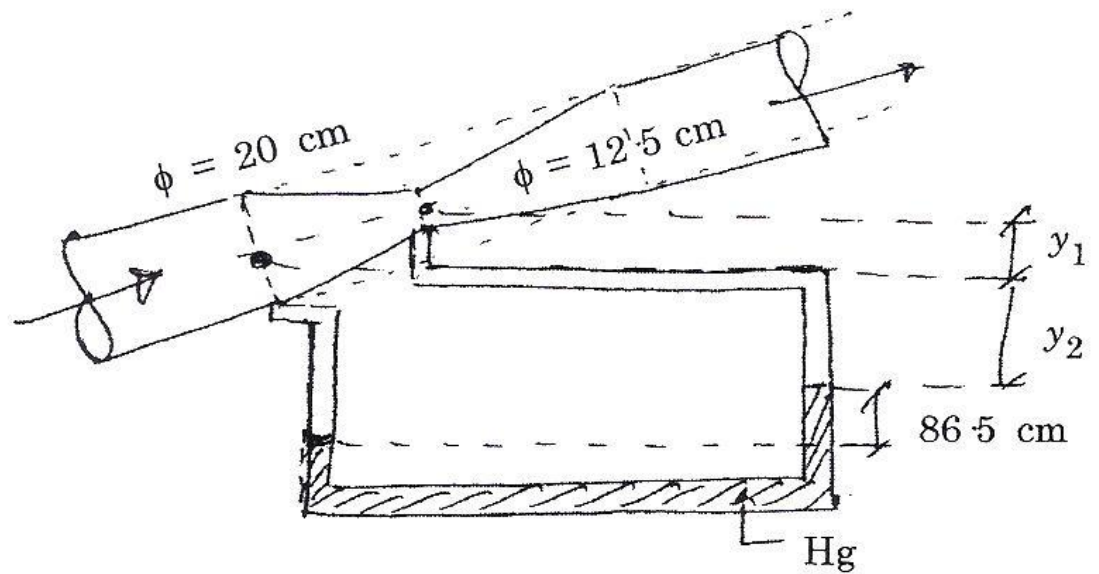


- (b) A portal frame ABCD is fixed at A and D and is loaded as shown in the following figure. Treating joints B and C as rigid, calculate the moments at A, B, C and D. Draw the bending moment diagram and sketch the deflected shape of the frame. 15



- (c) Briefly discuss the methods of analysing the statically indeterminate structures. 10
2. (a) Describe the advantages and disadvantages of pre-stressed concrete. 10
- (b) Design a lintel over a 2.5 m wide opening in an industrial shed wall. Thickness of wall is 40 cm, height of opening is 2.75 m and eaves level is 6.0 m above the floor level. Use M20 mix and T.O.R. steel. Density of masonry 19.0 RN/m^3 . 15
- (c) A beam of 6 m span carries a uniformly distributed load of 4 ton/m including its own weight. The available section is IS MB-400. Design the beam. The cover plates required, if any, may, be provided only on the top flange. Given for : 15
- IS MB-400, $z = 1022.9 \text{ cm}^2$
- $A = 78.46 \text{ cm}^2$, $I = 20458.4 \text{ cm}^4$
- $t_f = 16 \text{ mm}$, $t_w = 8.9 \text{ mm}$
3. (a) A 20 cm water pipe has in it a venturimeter of throat diameter 12.5 cm as shown in the figure, which is connected to a mercury manometer showing a difference of 86.5 cm. Find the velocity in the throat and discharge. 15

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- (b) Show that the loss of energy in a hydraulic jump occurring in a rectangular open channel will be given by

$$\Delta E = \frac{(y_2 - y_1)^3}{4y_1 y_2}$$

where y_1 and y_2 are the pre and post jump depths. 15

- (c) With the aid of a neat sketch, describe the working of a centrifugal pump. Describe the main components of it. 10
4. (a) A retaining wall with a smooth vertical back is 10 m high and retains a 2-layers cohesionless backfill with the following properties :
- 0 – 5 m depth, $c' = 0$, $\phi' = 30^\circ$, $r = 18$ kN/m³
- below 5 m, $c' = 0$, $\phi' = 34^\circ$, $r = 20$ kN/m³

Show the active earth pressure distribution assuming that the water table is well below the base of the wall. 15

- (b) Determine the ultimate bearing capacity of a strip footing 2 m in width, with its base at a depth of 1.5 m below ground surface and resting on a saturated clay soil with the following properties :

$$\gamma_{\text{sat}} = 20 \text{ kN/m}^3; C_u = 40 \text{ kN/m}^2$$

$$\phi_u = 0, C' = 10 \text{ kN/m}^2, \phi' = 20^\circ$$

The natural water table is at 1.0 m below ground level. 15

- (c) Explain, on what factors the permeability of soil depends. 10

Part-II

5. (a) Using Lacey's method design a canal section :

$$\text{max}^m \text{ discharge } Q = 30 \text{ m}^3/\text{s}$$

$$\text{Silt factor } f = 1.00$$

$$\text{Side slope} = \frac{1}{2} H : 1V$$

Also find the longitudinal slope. 15

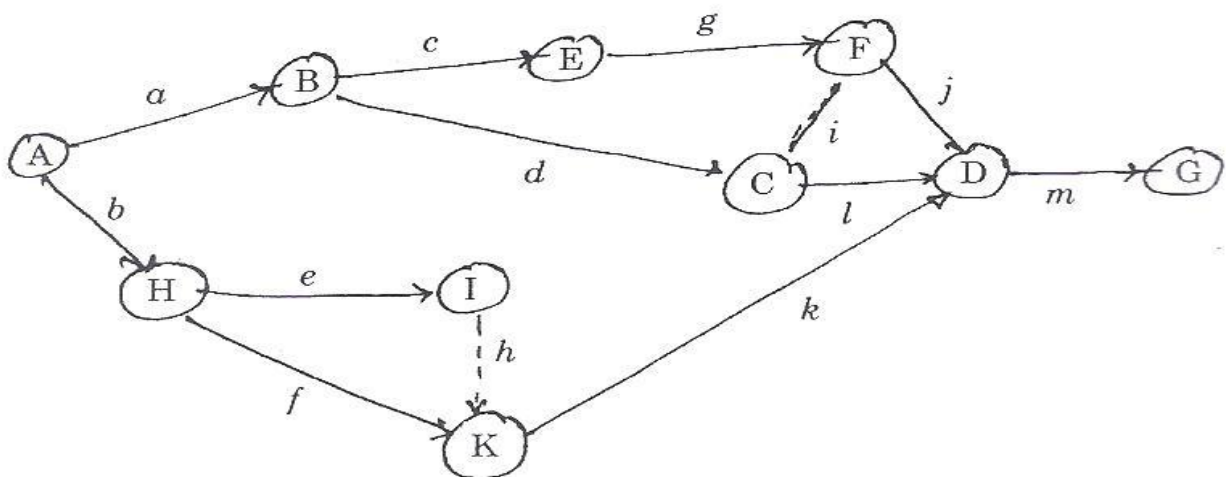
(b) A water course has a culturable command area of 1200 ha. The intensity of irrigation for crop A is 40% and that of B is 35%. Both crops being Rabi crops. Crop A has a kor period of 20 days and crop B has kor period of 15 days. Calculate the discharge of the water course if the depth of kor for crops A and B are 10 cm and 16 cm respectively. 15

(c) Differentiate among aquifer, aquifuge and aquitard. 10

6. (a) Explain the following terms : 10

- (i) Parapet
- (ii) Cornice
- (iii) Quain
- (iv) Queen closure
- (v) Bond.

(b) Using Fulkerson's rule, numbering the following events : 15



- (c) What is the object of plastering ? State in brief, the different types of plasters adopted for internal and external finishing of wall surfaces. 15
7. (a) Find the total width of a pavement on a horizontal curve for a new national highway to be aligned a rolling terrain with a ruling minimum radius. Take the following data : 15
- Design speed $V = 80$ km/hr
- Normal width of pavement $W = 7.0$ m
- Number of lanes $n = 2$
- Wheel load base truck $l = 6$ m
- Minimum value of super elevation $e = 0.07$
- Skid resistance $f = 0.15$
- (b) Write short notes on any *two* of the following : 10
- (i) Types of Rails
- (ii) Points and crossing
- (iii) Signal and interlocking.
- (c) With the aid of neat sketch discuss various channelized and unchannelized intersections. 15

8. (a) A fog cloud composed of $1 \mu\text{m}$ particles in air at 27°C . Determine the setting velocity of the particles and explain why fog appears to float in the atmosphere. 15
- (b) Briefly explain the working of a cyclone collector which is used to separate solid particles. 10
- (c) A town of 2,00,000 population is to be supplied water from a source 2.5 km away. The lowest water level in the source is 15.0 m below the waterworks of the town. The demand of water is estimated as 150 l/s/capita/day. A pump of 300 hp is operated for 15 hours. If the maximum demand is 1.5 times the average demand, the velocity of flow through the rising main is 1.3 m/s and efficiency of pump = 70%, determine :
- (i) hydraulic gradient i and
- (ii) friction factor ' f '. 15