HPPSC Forest Range Officer

Previous Year Paper

Mains 2017 Civil Engineering

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.

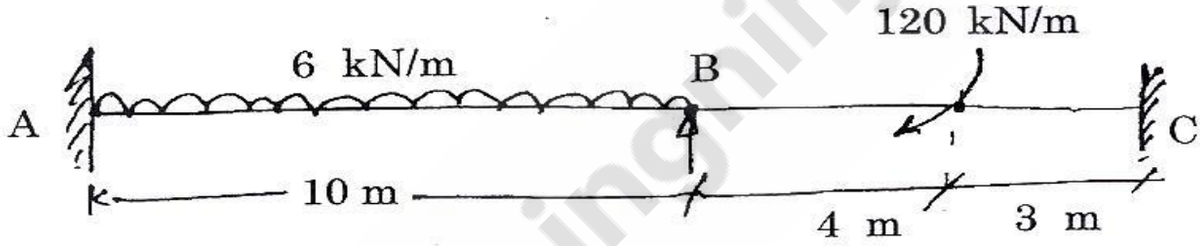
(3) The necessary data required in questions are provided. However suitable data may be assumed, if necessary.

P.T.O.

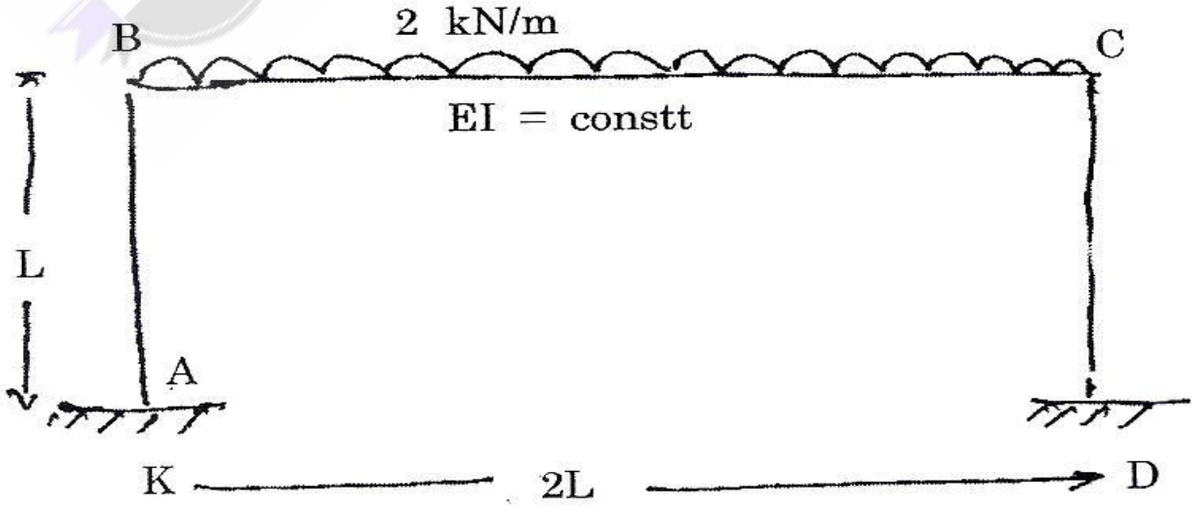
(4) Use of non-programmable calculator is permitted.

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, $z = 1022.9$ cm^2

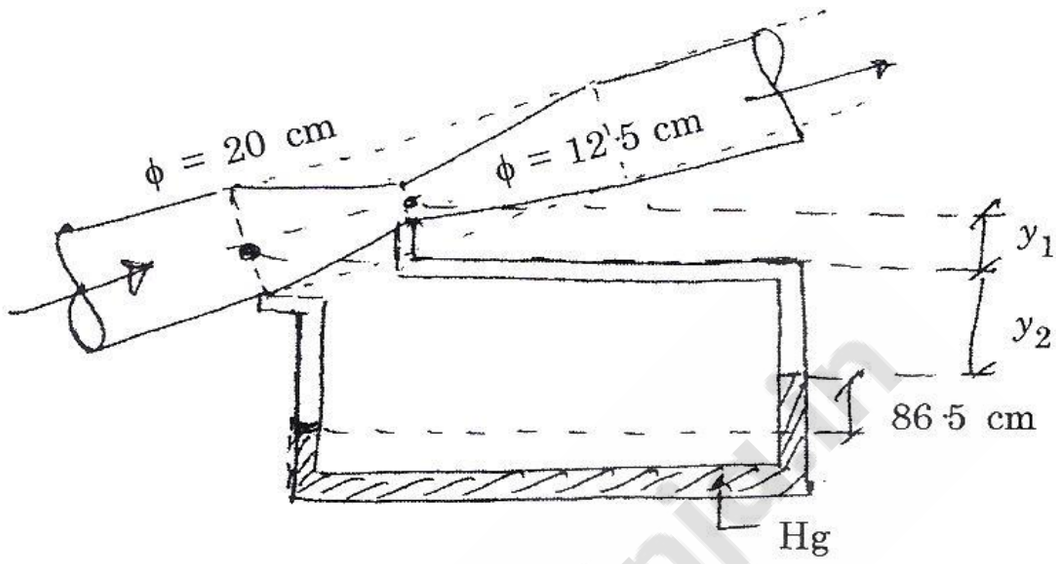
$A = 78.46$ cm^2, $I = 20458.4$ cm^4

$t_f = 16$ mm, $t_w = 8.9$ 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

P.T.O.

1



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

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

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, $c' = 0$, $\phi' = 30°$, $r = 18$ kN/m^3

below 5 m, $c' = 0$, $\phi' = 34°$, $r = 20$ kN/m^3

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 :

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

$\phi_u = 0$, $C' = 10\ kN/m^2$, $\phi' = 20°$

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 :

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

Silt factor $f = 1.00$

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

Also find the longitudinal slope. 15

P.T.O.

(*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

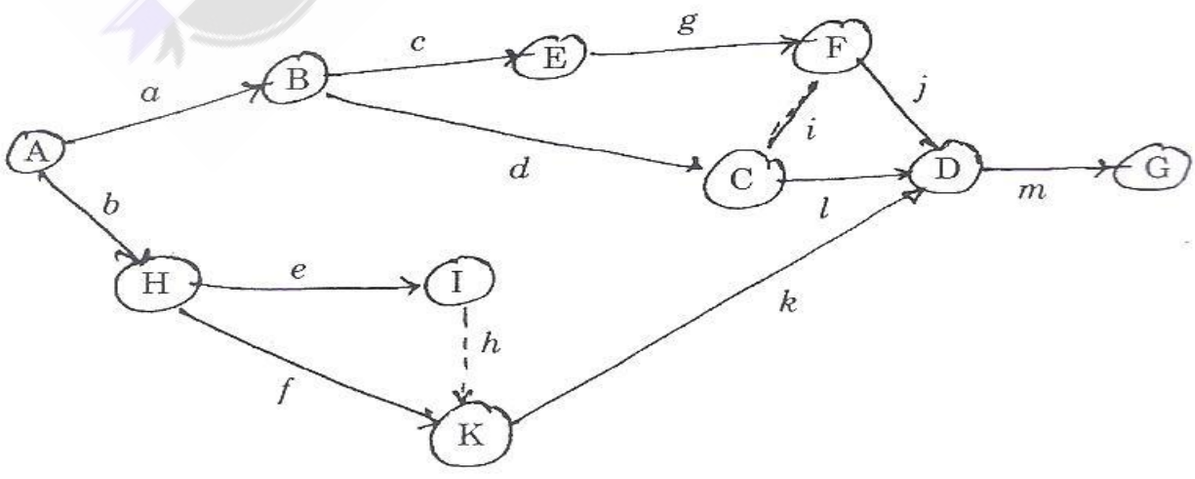
(*ii*) Cornice

(*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

P.T.O.

8. (*a*) A flog cloud composed of 1 μm particles in air at 27°C. Determine the setting velocity of the particles and explain why fog appears to float in the atmopshere. 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