HPAS (M)—2014

CIVIL ENGINEERING

Paper I

Time : 3 *Hours*   *Maximum Marks* : 150

Note :— (i)   Question No. **1** is compulsory. Attempt any *four*
                 questions out of the remaining questions. In all
                 five questions are to be attempted.

       (ii)   Use relevant I.S. codes of practice and the steel-
              sections Hand Book is permitted.

       (iii) Assume any data suitably, if required.

1.   (a)   Analyse the continuous beam shown in Fig. 1 by
           the slope deflection method. Draw SFD and
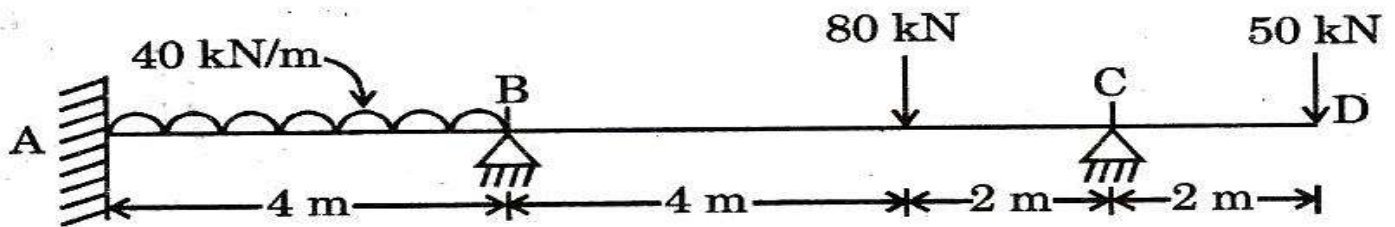   BMD.   10

Fig. 1

P.T.O.

(b) Consider a square block ABCD (as shown in Fig. 2) with side 'a' and the thickness unity, perpendicular to the plane of figure. Let the block be subjected to shear stress of intensity 'q'.

Prove that $E = 2C\left[1 + \dfrac{1}{m}\right]$
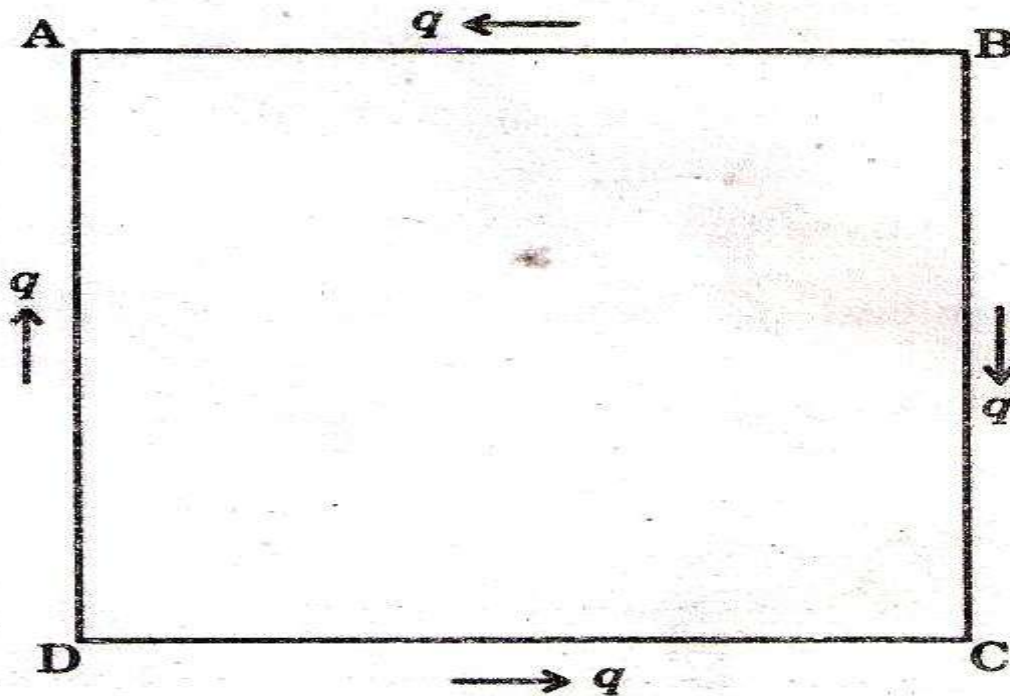
E = modulus of elasticity

C = modulus of rigidity. 10

Fig. 2

(c)　A reinforced concrete column is 300 mm × 300 mm in section. The column is provided with 8 bars of 20 mm diameter. The column carries a load of 360 kN. Find the stresses in concrete and the steel bars.

Take $E_s = 2.1 \times 10^5$ N/mm^2 and $E_C = 0.14 \times 10^5$ N/mm^2.　　　　10

(a)　An 'I' section ISHB 300 is selected as a column with pinned ends :　　　　10

　(i)　Find the safe axial load on the column if it is 6 m long. Assume a factor of safety = 2.0.

　(ii)　If the column has to carry a safe axle load of 800 kN, what can be the maximum length of a column with pinned ends ? Take $E = 2 \times 10^5$ N/mm^2, for ISHB 300 section, $I_{xx} = 12950.2$ cm^4, and $I_{yy} = 2246.7$ cm^4.

(b)	A welded bracket connects a plate to a column flange as shown in Fig. 3. Determine the size of weld, if the allowable stress in the weld is 110 N/mm². 	20
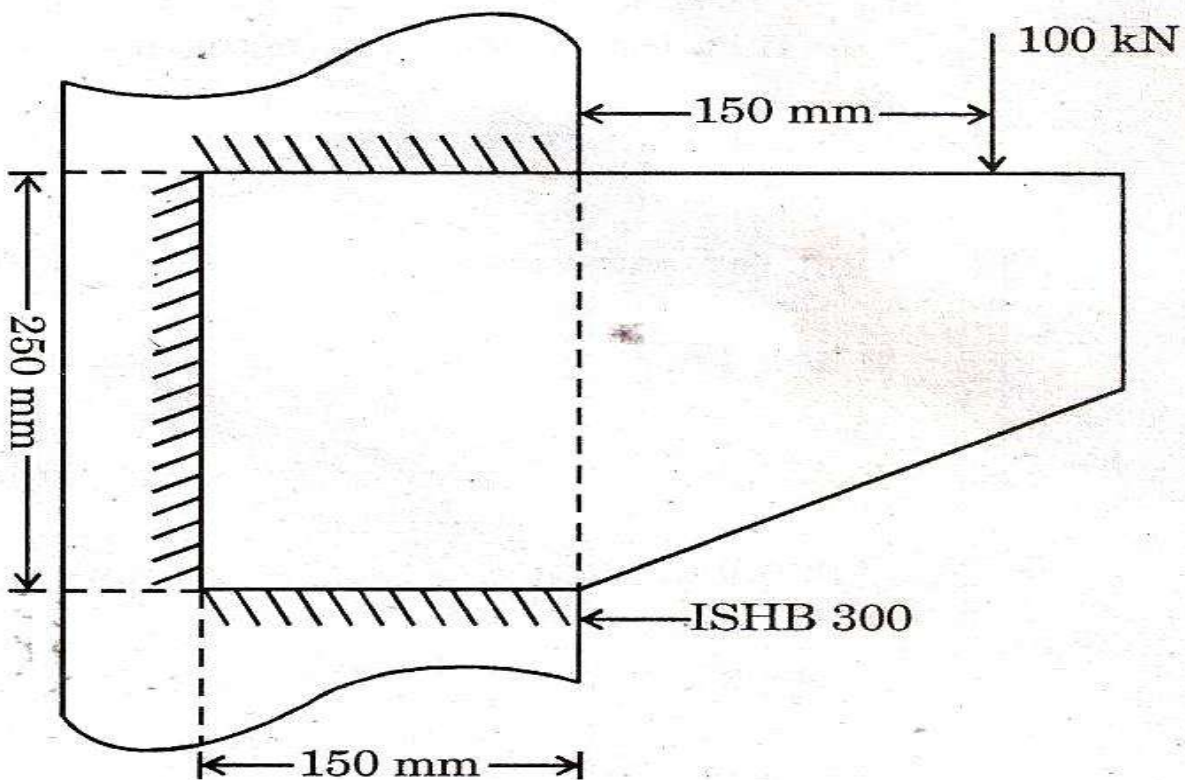

Fig. 3

3. (a) State the advantages of Plate Girders with corrugated webs. What are the steps involved in the design of a Plate Girder ? 10

(b) Determine the moments and forces due to vertical and horizontal loads carrying on a simply supported gantry girder. Use the following data : 20

(i) Simply supported span = 6.0 m

(ii) Crane's wheel centers = 3.6 m

(iii) Self weight of girder (say) = 1.6 kN/m

(iv) Maximum crane wheel load (static) = 220 kN

(v) Weight of crab/trolley = 60 kN

(vi) Maximum hook load = 200 kN.

Calculate also the serviceability deflection (working load).

4. (a) A rectangular concrete beam 100 mm wide by 250 mm deep spanning over 8.0 m is prestressed by a straight cable carrying an effective prestressing force 250 kN, located at an eccentricity of 40 mm. The beam supports a live load of 1.2 kN/m.

(i) Calculate the resultant stress distribution for the central cross-section of the beam. The density of the concrete is 24 kN/m³.

(ii) Find the magnitude of the prestressing force with an eccentricity of 40 mm, which can balance the stresses due to dead and live loads at the bottom fibre of the central section of the beam. 15

(b) (i) Discuss the salient features of working stress method and ultimate load method.

(ii) What are the different limit states of design ? What are the merits of limit state design philosophy over other design philosophies ? 15

5. (a) Design a simply supported slab to cover a room with internal dimensions of 4.0 m × 5.0 m and 230 mm thick brick walls allaround. Assume a live load of 3 kN/m² and a finish load of 1 kN/m². Use M20 concrete and Fe415 steel. Assume that the slab corners are free to lift up. Assume mild exposure conditions. Assume any other data suitably. 20

(b) What is meant by seasoning of timber ? Explain the different process of seasoning of timbers. 10

6. (a) Classify with the help of sketches, various types

of windows based on their method of operation

or opening.   20

   (b) A saturated soil mass has a porosity of 40% and

a specific gravity of 2.6.   10

Determine :

   (i)   Water content

   (ii) Dry unit weight

   (iii) Saturated unit weight.

7. (a) What do you understand by permeability of

soils ? What are the various factors which

affect the permeability and how is it

determined ?   15

(b) In a drained triaxial test on a dense sand the cell pressure was 150 kPa and the deviator stress to cause failure was 540 kPa. Calculate the angle of internal friction. Also find the angle made by the failure plane with respect to the major principal plane. 15

(a) Explain the Terzaghi's theory of bearing capacity. How does the shape of footing and water table affect the bearing capacity ? 15

(b) In a network shown in Fig. 4 for a construction project with the three time estimates of each activity as marked in the figure, determine : 15

(i) Critical path and its standard deviation.

(ii) Probability of competition of the project in

40 days.

(iii) Time duration that will provide 95% probability

of its competition in time.
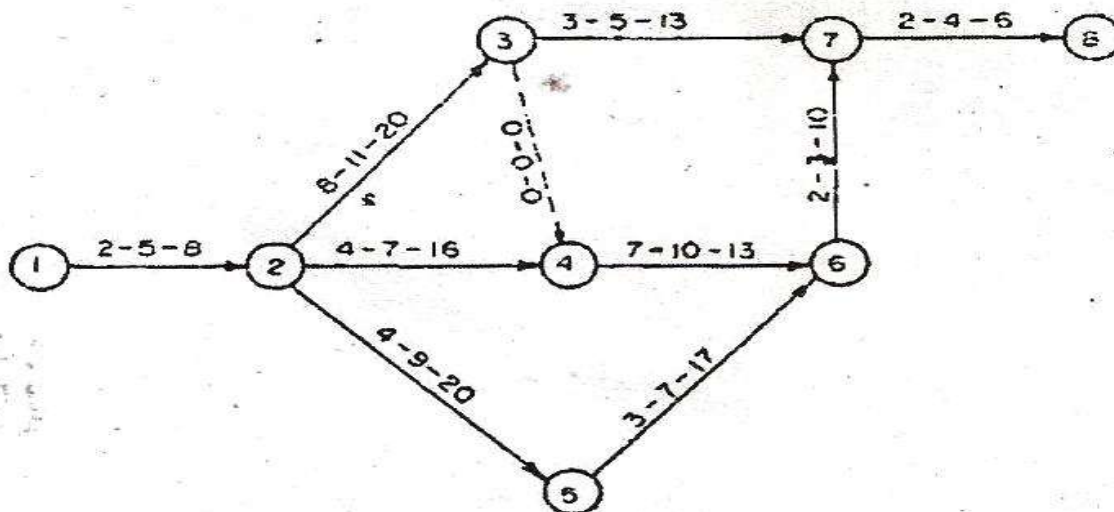
Use data given in Table-1.

Fig. 4

Table-1 : Standard Normal Distribution Function

Z(+)	Probability P_r %	Z(−)	Probability P_r %
+1.0	84.13	−1.0	15.87
+1.1	86.43	−1.1	13.57
+1.2	88.49	−1.2	11.51
+1.3	90.32	−1.3	9.68
+1.4	91.92	−1.4	8.08
+1.5	93.32	−1.5	6.68
+1.6	94.52	−1.6	5.48
+1.7	95.54	−1.7	4.46
+1.8	96.41	−1.8	3.59
+1.9	97.13	−1.9	2.87
+2.0	97.72	−2.0	2.28