This question paper contains 7 printed pages]

HPAS (Main)—2013

CIVIL ENGINEERING

Paper I

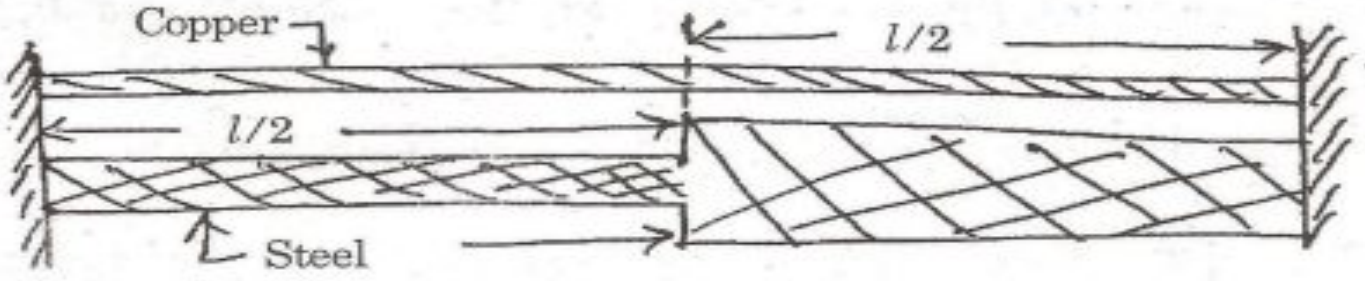
Time : 3 Hours *Maximum Marks : 150*

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

(B) Use of relevant I.S. codes of practice and the Steel-Sections Hand-Book is permitted.

(C) Assume data suitably, if missing.

1. (*a*) A bar (combined) made by connecting steel and copper rods, rigidly fixed at ends, is as shown below :



P.T.O.

Cross-sectional area of copper bar = Am^2 throughout.

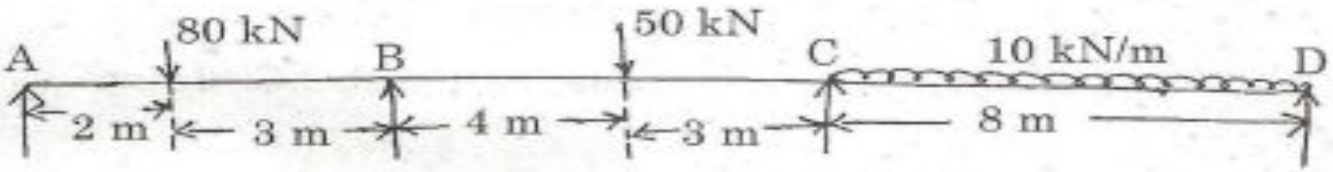
Cross-sectional area of steel bar = Am^2 and $2A^2$ for each half of the length (as shown above). Co-efficients of expansion of copper and steel are α and 1.3α, while elastic moduli for these materials are E and 0.5 E respectively. Find the stresses induced in the bars due to rise (t°C) of temperature. 10

(*b*) Determine the principal stresses on a plate, on which the principal strains acting are 3.24×10^{-4} and 1.28×10^{-4}. Values of modulus of elasticity of Poisson's ratio are 200 GN/m^2 and 0.25 respectively. 10

(*c*) Briefly describe the maximum strain energy theory of failure. 10

2. (*a*) Giving all the assumptions, derive the bending equation for a beam, using theory of simple bending. 15

(*b*) For the beam shown below, find bending moments and reactions at the supports. Also, draw the bending moment and shear force diagrams. 15



3. (*a*) Prove that a three hinged parabolic arch (of span l and rise h) carrying uniformly distributed loading (WkN/m) will have zero bending moment at any section. 10

(*b*) Briefly describe various theorems applied in plastic analysis of structures. 10

P.T.O.

(c) Describe briefly the column analogy method of structural analysis. 10

4. (a) Briefly describe the following : 3×5=15

(i) Effective length of a weld

(ii) Failure of bolted joints

(iii) Working stress method of R.C.C. design.

(b) Design a rectangular beam to carry a bending moment of 45 kNm using M-15 mix and mild steel. Use limit state method of design. 15

5. (a) Briefly describe various systems of prestressing. 10

(b) Describe briefly the anchorage losses in prestress due to factors other than creep of concrete. 10

(c) A beam of 150 mm × 300 mm cross-section is prestressed by a force of 250 kN using steel cables (6 in number each of 7 mmϕ) located at an eccentricity of 60 mm (below the centre-line of the beam). Find prestress loss due to concrete-creep for the following data :

σ_{ck} = 45 N/mm^2, Creep co-efficient = 2, E_s = 200 kN/mm^2 and $E_c = 4500\sqrt{\sigma_{ck}}$. 10

6. (a) Giving neat sketches, briefly describe various defects in timber. 10

(b) Describe briefly various constituents of a paint used in buildings. 10

P.T.O.

(c) Describe in brief the procedure used for preparation of surkhi mortar. 10

7. (a) Briefly describe various time estimates used in scheduling by PERT. 10

(b) Giving neat and labelled sketches, describe each of the following briefly : 4×5=20

(i) Dog-legged staircase

(ii) Venetian door

(iii) Bay window

(iv) Cavity wall.

8. (a) Describe briefly different methods applied for obtaining flow-nets in case of flow through soils. 10

(*b*) Giving neat and labelled diagrams, describe Rankine's theory of earth pressure in brief. 10

(*c*) Giving a neat and labelled sketch, describe different components of a well-foundation. 10