



Total No. of Printed Pages – 4

AERTM
CIVIL ENGINEERING
PAPER – I
SUBJECT CODE : 06

Full Marks : 200

Time : 3 Hours

Instructions For Candidates :

Please read each of the following instructions carefully before attempting questions.

- (1) *Answers must be written in **ENGLISH** only.*
- (2) *The question paper contains a total of **8** questions in **TWO** Sections : Section-A and Section-B. (**FOUR** questions in each section)*
- (3) *Question No. 1 of Section 'A' and Question No. 5 of Section 'B' are **compulsory**.*
- (4) *Candidates have to attempt another **THREE** questions from remaining **SIX** questions choosing atleast **ONE** question from each section.*
- (5) *Assume suitable data if found necessary.*
- (6) *Wherever any assumption be made for answering a question, they must be clearly indicated.*
- (7) *Marks carried by a question / section is indicated against it.*
- (8) *Unless struck off, attempt of question shall be counted even if attempted partly.*
- (9) *Any page or portion of the page left blank in the Answer Booklet must be clearly struck off.*

SECTION – A

- | | Marks |
|---|-------------------|
| 1. Answer the followings : | 5 × 8 = 40 |
| (a) What is meant by the terms 'Seasoning of timber' and 'preservation of timber' ?
Name the various methods of applying preservatives to timber. | |
| (b) State and explain the conventional and I.S. Classification of bricks. | |
| (c) Find the centroid of a T-section of dimension 120 mm × 150 mm × 20 mm. | |
| (d) Differentiate between force and displacement methods of structural analysis. | |
| (e) A propped cantilever of span 'L' is loaded with a u.d.l. of intensity w per unit length. Obtain the value of w at collapse of fully plastic moment of the section 'Mp'. | |



2. (a) A rectangular steel beam $180 \text{ mm} \times 260 \text{ mm}$ in cross-section is used as a simply supported beam over a span of 8 m and is subjected to a udl of 10 kN/m and also a concentrated load of 5 kN at 2 m from each support inclined at 30° to the vertical axis (Fig. 1). Determine the bending stresses at four corners of the beam and location of the neutral axis of the cross-section.

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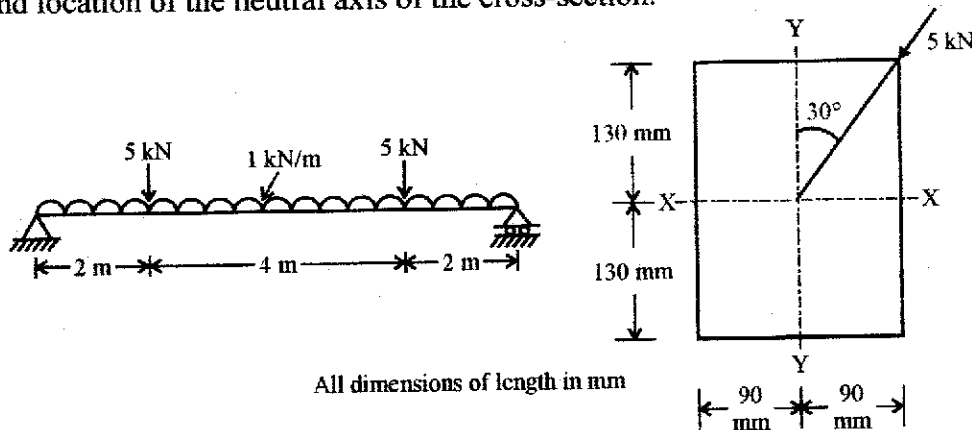


Fig. - 1

- (b) A steel rod circular in cross-section tapers from 30 mm diameter to 15 mm diameter over a length of 600 mm . Find how much its length will increase under a pull of 20 kN if Young's modulus of elasticity is equal to 200 kN/mm^2 .

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3. (a) Describe any five theories of failure (elastic) giving necessary formulae and comparing with the value obtained from direct tension test.
- (b) Analyse the continuous beam shown in figure 2 by the slope deflection method. Draw the SFD and BMD. Sketch also the deflected shape of the beam.

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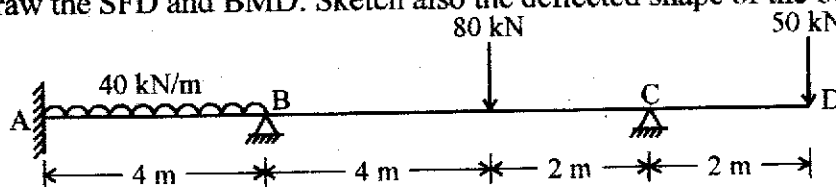


Fig. - 2

4. (a) Analyse the structure shown in figure 3 by moment distribution method. Draw the deflected shape and BMD of the frame.

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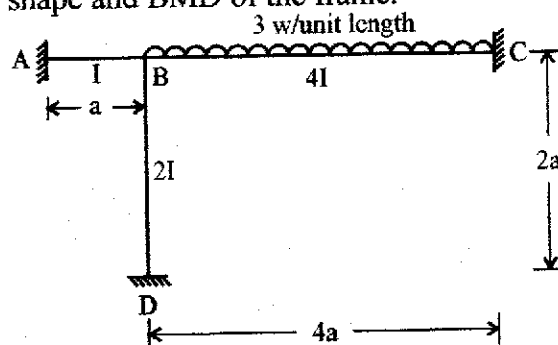


Fig. - 3



- (b) A floating column AB of length 'L' is modelled with top end fixed and bottom end yielding under column load. The yielding can be visualized as an axial spring of stiffness 'k'. If an axial force 'P' is applied at a distance 'a' from the top, determine reactions at the ends A and B and displacement at the end B. (Fig 4)

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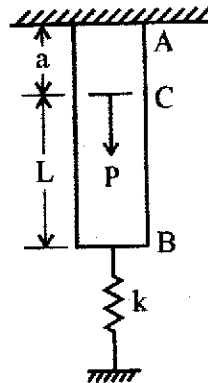


Fig. - 4

SECTION - B

5. Answer the following :

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- Enumerate the assumptions for plastic analysis of steel sections.
- A room designed as one way slab carries a load of 4 kN/m^2 with a thickness of 100 mm and its finishing as 75 mm. Determine the factor loads for (i) strength and (ii) for serviceability limit states. Take unit wt of concrete = 25 kN/m^3 and finishing wt as 20 kN/m^3 .
- What are the various losses in prestressed concrete ? Indicate the formulae with standard notations.
- List the different types of equipments used for excavation work.

6. (a) Design a prestressed concrete slab spanning 12 m carrying an imposed load of 20 kN/m^2 using M40 grade of concrete and steel with a ultimate tensile stress of 1600 N/mm^2 . The permissible stresses in concrete are 14 N/mm^2 in compression and zero in tension. Neglect the loss in prestressing. Cables of 12 wires of 5 mm diameter capable of carrying an effective prestress of 225 kN are available. Indicate the zone in which resultant cable must lie.

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- (b) Calculate the ultimate moment of resistance of an RC rectangular beam with the following data :

Breadth of beam = 230 mm, overall depth of beam = 550 mm, Tension steel consist of 4 numbers of 20 mm diameter bars of grade Fe415. Clear Cover = 30 mm. Concrete grade M20. Also determine the intensity of safe superimposed load (excluding self weight) of this above beam can carry on a simply supported span of 5 m.

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Marks

7. (a) Discuss the concept of plastic hinge. Obtain the shape factor for a circular section. 20

- (b) A mild steel T-Section has the following cross-sectional dimensions :

Total depth = 200 mm

Width of flange = 120 mm

Thickness of flange = 20 mm

Thickness of web = 20 mm

If the yield stress $\sigma_y = 250$ MPa, determine the plastic moment capacity of the section, also calculate the shape factor of the section. 20

8. (a) What is the difference between 'Free Float' and 'Total Float' ? Explain the significance of each term. 20

- (b) Determine the total float, free float and critical path for the installation project represented by the network shown in Fig. 5. The estimated duration in days for activities are shown in the figure. 20

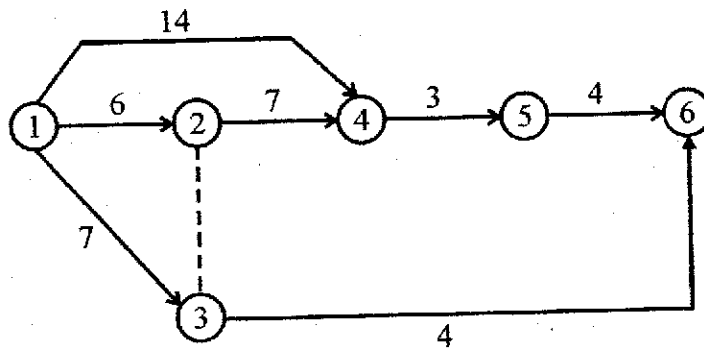


Fig. - 5