Code : 011511

B.Tech 5th Semester Exam., 2015

STRUCTURAL ANALYSIS—I

Time : 3 hours *Full Marks* : 70

Instructions :

(i) The marks are indicated in the right-hand margin.

*(ii) There are **NINE** questions in this paper.*

*(iii) Attempt **FIVE** questions in all.*

*(iv) Question No. **1** is compulsory.*

1. Choose the correct option (any *seven*) : 2×7=14

(a) Maximum bending moment in a beam occurs, where

(i) deflection is zero

(ii) share force is maximum

(iii) shear force is minimum

(iv) shear force changes sign

(b) The diagram showing the variation of axial load along the span is called

(i) shear force diagram

(ii) bending moment diagram

(iii) thrust diagram

(iv) influence line diagram

(c) A prismatic beam fixed at both ends carries a uniformly distributed load. The ratio of bending moment at the supports to the bending moment at mid-span is

(i) 0·5

(ii) 1·0

(iii) 1·5

(iv) 2·0

(d) If the deflection at the free end of a uniformly loaded cantilever beam is 15 mm and the slope of the deflection curve at the free end is 0·02 radian, then the length of the beam is

(i) 0·8 m

(ii) 1·0 m

(iii) 1·2 m

(iv) 1·5 m

(e) The Castiglione's second theorem can be used to compute deflections

(i) in statically determinate structures only

(ii) for any type of structure

(iii) at the point under the load only

(iv) for beams and frames only

(f) A single-rolling load of 8 kN rolls along a girder of 15 m span. The absolute maximum bending moment will be

(i) 8 kN-m

(ii) 15 kN-m

(iii) 30 kN-m

(iv) 60 kN-m

(g) Select the correct statement.

(i) Flexibility matrix is a square symmetrical matrix

(ii) Stiffness matrix is a square symmetrical matrix

(iii) Both (i) and (ii)

(iv) None of the above

(h) The fixed support in a real beam becomes in the conjugate beam a

(i) roller support

(ii) hinged support

(iii) fixed support

(iv) free end

(i) Rate of change of bending moment is equal to

(i) share force

(ii) deflection

(iii) slope

(iv) rate of loading

(j) Muller Breslau's principle for obtaining influence lines is applicable to

1. trusses
2. statically determinate beams and frames
3. statically indeterminate structures, the material of which is elastic and follows Hooke's law
4. any statically indeterminate structure

The correct answer is

(i) 1, 2 and 3

(ii) 1, 2, and 4

(iii) 1 and 2

(iv) only 1

2. (a) Evaluate the forces in all the members of the truss shown in Fig. 1 by method of tension coefficient. 7

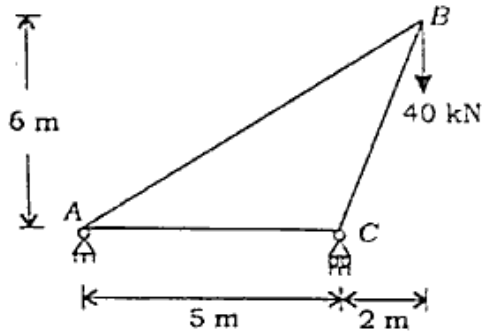

Fig. 1

(b) Determine the forces in the members of the truss shown in Fig. 2 7

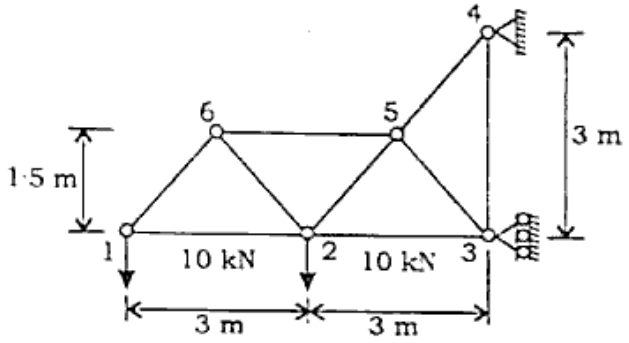

Fig. 2

3. A simply supported beam has a span of 12 m uniformly distributed load of 40 kN/m and 5 m long crosses the girder from left to right. Draw the influence line diagram for SF and BM at a section 4 m from left end. Use the diagram to calculate maximum SF and BM at this section 14

4. (a) A three-hinged circular arch hinged at the springing and crown points has a span of 40 m and a central rise of 8 m. It carries a uniformly distributed load 10 kN/m over the left half of the span together with a concentrated load of 80 kN at the right quarter span point. Find normal thrust and shear at a section 10 m from the left support. 7

(b) A symmetrical three-hinged parabolic arch of span L and central rise of h carries a single-point load of W kN that may be placed anywhere on the span. Locate the position of load on the arch in order to get the maximum bending moment in the arch. 7

5. The load system shown in Fig 3 crosses a beam simply supported over a span of 24 m. Using influence line, calculate maximum Bending Moment under 25000 N load. 14

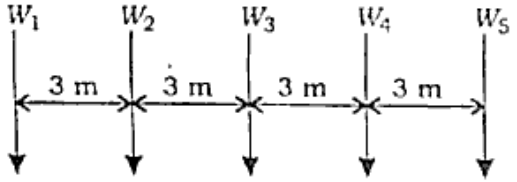

Fig. 3

$W_1 = 10000$ N
$W_2 = 20000$ N
$W_3 = 20000$ N
$W_4 = 25000$ N
$W_5 = 15000$ N

6. Using conjugate method, determine the rotations at A, B and deflection at C point for a beam shown in Fig. 4. 14

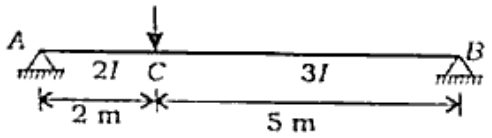

Fig. 4

7. (a) Explain with suitable sketch, the principle of virtual work and Castiglione's theorem. 6

(b) State and explain Maxwell-Betty's theorem with figure. 8

8. Determine the vertical deflection of joint E of a truss shown in Fig. 5. Take $A = 2000$ mm^2 and $E = 200$ kN/mm^2. 14

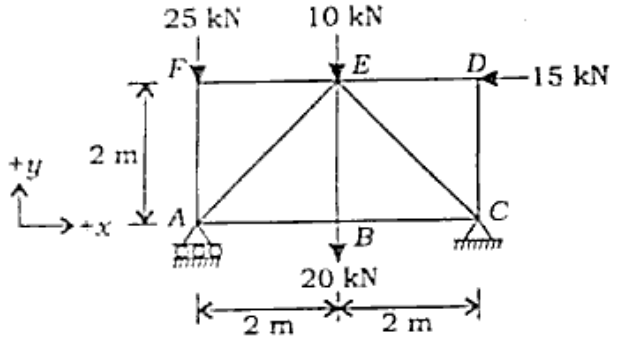

Fig. 5

9. (a) Discuss about flexibility and stiffness method. Give suitable examples. 7

(b) Find the stiffness matrix for the cantilever shown in Fig. 6. 7

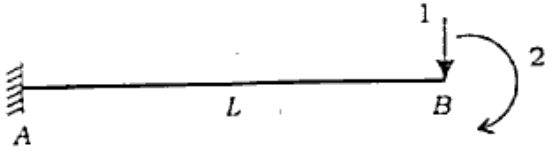

Fig. 6

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