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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Fourth Semester, B.E. - Civil Engineering

Semester End Examination; June - 2017

Basic Structural Analysis

Time: 3 hrs *Max. Marks: 100*

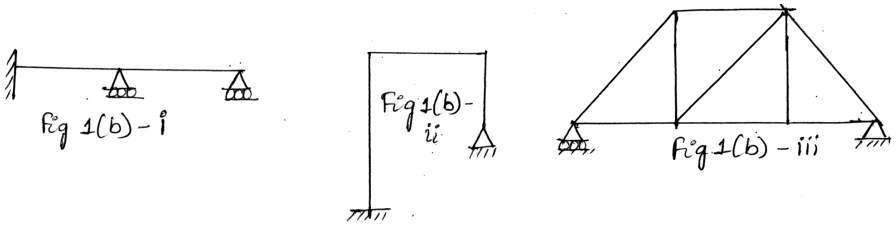
***Note**: i) Answer **FIVE** full questions, selecting **ONE** full question from each unit.*

ii) Any missing data may suitably be assumed.

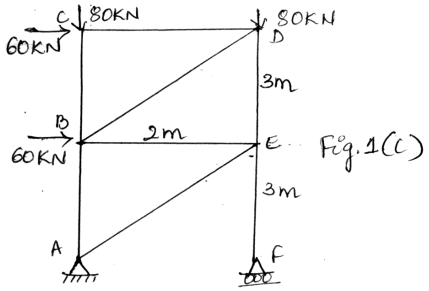
UNIT - I

1. a Define degree of static indeterminacy and kinematic indeterminacy. 4

b. Determine the degrees of indeterminacy for the following structures shown in Fig. 1(b). 6



c. Determine the forces in each number of pin jointed truss shown in Fig. 1(c) using method of joints and represent the number forces in diagram. 10



2 a. Derive Euler's formula for columns when both the ends of the column are hinged. 8

b. A simply supported beam of length 4 m is subjected to a udl of 30 kN/m over the whole span and deflects 15 mm at the centre. Determine the crippling load when this beam is used as a column with the following conditions using Euler's formula, 12

i) One end is fixed and other end hinged

ii) Both the ends pin jointed.

UNIT - II

3 a. For the beam shown in Fig. Q. 3(a), determine the slope at left support and deflection at 100 kN load using moment area method. 10

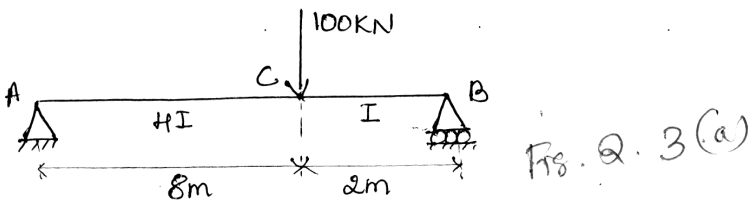


Fig. Q. 3(a)

Contd….2

b. Determine the slopes at support and deflection under the load for the beam loaded shown in Fig. Q. 3(b) using conjugate beam method. 10

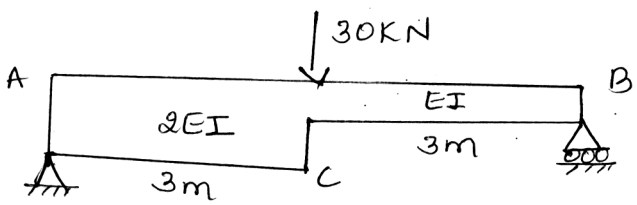


Fig. Q. 3(b)

4 a. State: 4

i) Castigliano's First theorem ii) Maxwell's Reciprocal theorem.

b. Determine the slope and deflection at the free end for the cantilever beam shown in Fig. Q. 4(b) using moment area method. 10

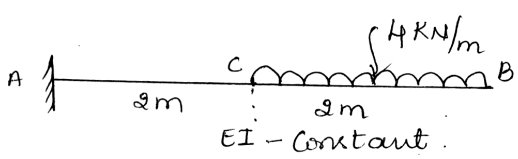


Fig. Q. 4(b)

c. A simply supported beam of span L carries a concentrated load 'P' at a distance 'a' from left hand side support as shown in Fig. Q. 4(c). Using Castigliano's theorem determine the deflection under the load. 6

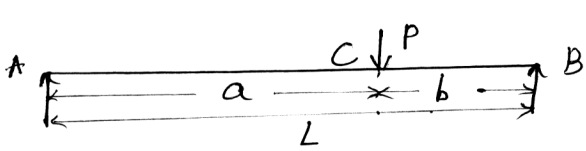


Fig. Q. 4(c)

UNIT-III

5 a. Analyze the cable under udl acts on entire span or show that the equation of a cable is, 10

$$y = \frac{4h\left(Lx - x^2\right)}{L^2}.$$

b. A suspension cable having supports at same level has a span of 30 m and maximum dip of 3 m. The cable is loaded with udl of 10 kN/m throughout its length and the concentrated load of 30 kN and 90 kN at middle third points. Find the maximum tension in the cable. 10

6 a. A 3-hinged circular arch has a span of 40 m and a central rise of 8 m. It carries a udl 20 kN/m over the left-half of the span and a concentrated load 100 kN at the right quarter span point. Find the Support reactions, Normal thrust and Shear at a section 10 m from left support. 10

b. Show that the parabolic shape is a funicular shape for a three-hinged arch subjected to a udl over its entire span. 10

UNIT-IV

7 a. A SSB 8 m span is traversed by a 10 m long udl of 20 kN/m. Draw the influence line diagram for reactions, the SF and BM at a section 3 m from left support. Calculate the maximum values of their function. 10

b. Using influence line diagrams determine the shear force and BM at section C in the simply supported beam shown in Fig. Q. 7(b). 10

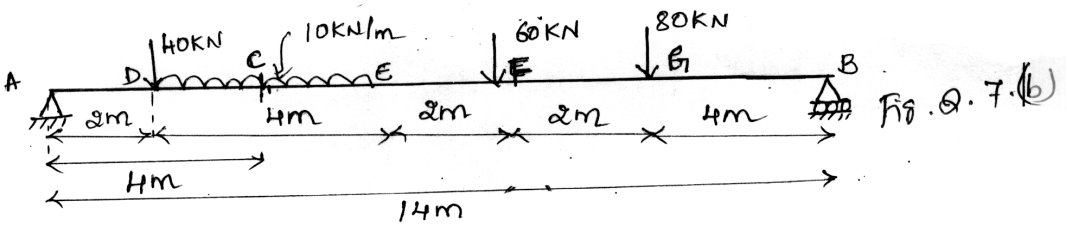


Fig. Q. 7(b)

8 a. A SSB has a span of 15 m udl of 40 kN/m and 5 m long crosses the girder from left to right. Draw ILD for SF and BM at a section 6 m from left end. Use these diagrams to calculate the maximum SF and BM at this section. 10

b. A train of concentrated loads shown in Fig. Q. 8(b) moves from left to right on a simply supported girder of span 16 m. Determine the absolute max SF and BM developed in the beam. 10

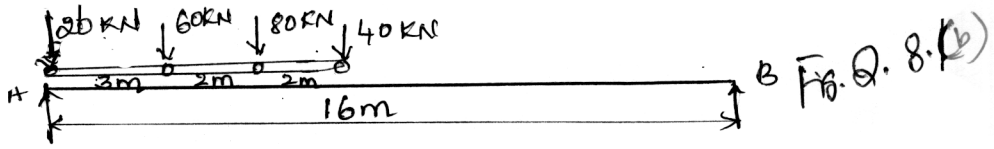


Fig. Q. 8(b)

UNIT - V

9. Find the deflection under the load for the beam shown in Fig. Q. 9 using strain energy method. Take E = $2x10^8$ kN/m^2 and I = $14x10^{-6}$ m^4. 20

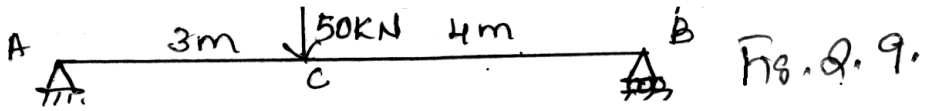


Fig. Q. 9.

10. Analyse the continuous beam shown in Fig. Q. 10 by Clapeyorn's three-moment equation. Sketch BMD, SFD and elastic curve. 20

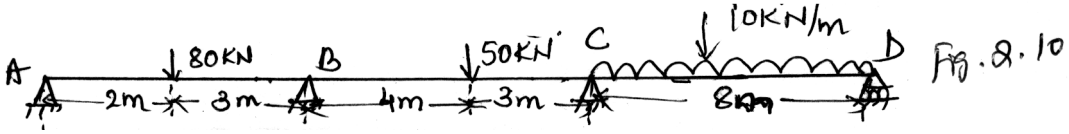


Fig. Q. 10

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