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10CV43

Fourth Semester B.E. Degree Examination, Dec.2016/Jan.2017

Structural Analysis – I

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Define: i) One, two and three dimensional structural systems with examples.
ii) Degrees of freedom with examples.
iii) Linear and non-linear structures. **(08 Marks)**

b. Find the degree of static indeterminacy of the following structures as shown in Fig.Q1(b).

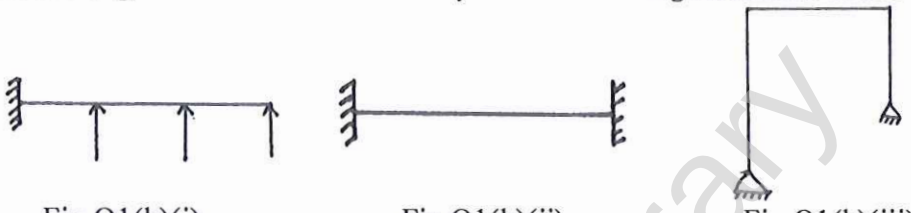

Fig.Q1(b)(i) Fig.Q1(b)(ii) Fig.Q1(b)(iii) **(06 Marks)**

c. Derive an expression for strain energy stored in a bar due to axial load. **(06 Marks)**

2 a. Find the slope at A, and deflection at C, in the beam shown in Fig.Q2(a), by moment area method. Take EI as constant.

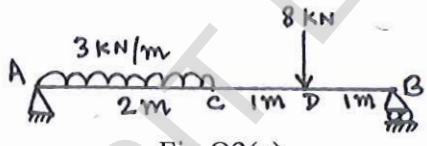

Fig.Q2(a) **(10 Marks)**

b. Find the slope and deflection at the free end of the cantilever beam shown in Fig.Q2(b) using conjugate beam method. Take EI = 2.5×10^6 kNm^2.

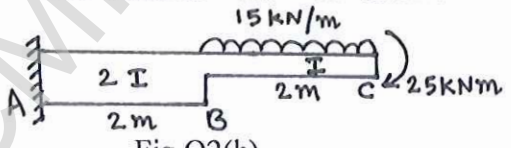

Fig.Q2(b) **(10 Marks)**

3 a. State: i) The first and second theorem of Castigliano, ii) The Bettis law and Maxwells theorem of reciprocal deflections. **(08 Marks)**

b. Compute the vertical displacement at the free end D, of the frame by strain energy method. If EI = 2×10^4 kNm^2, the frame is as shown in Fig.Q3(b).

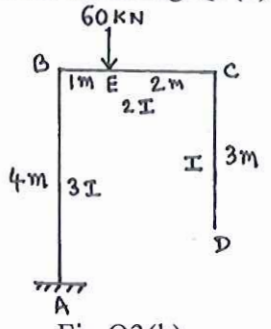

Fig.Q3(b) **(12 Marks)**

4 a. Analyze the propped cantilever subjected to the loadings as shown in the Fig.Q4(a), using strain energy method. EI is constant. Calculate "R" and "M_A".

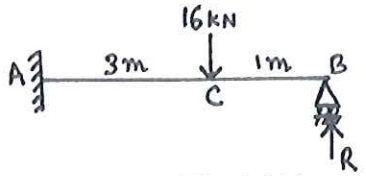

Fig.Q4(a) **(08 Marks)**

b. Analyze the fixed beam subjected to the loadings as shown in the Fig.Q4(b), using strain energy method. Calculate the fixed end moments and the vertical reactions at A and B.

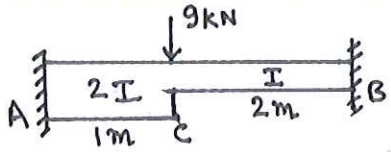

Fig.Q4(b) **(12 Marks)**

PART – B

5 a. Prove that the bending moment diagram follows the Funicular polygon in a three hinged parabolic arch subjected to uniformly distributed load throughout. **(10 Marks)**

b. A symmetrical suspension cable is parabolic in shape, and has a span of 250 m and a dip of 25 m. It supports a UDL of 25 kN/m over the whole span. If the maximum allowable stress is 130 N/mm^2, determine the length of the cable and area of the cable. **(10 Marks)**

6 a. Analyze the propped cantilever beam subjected to the loadings as shown in the Fig.Q6(a), by consistent deformation method. Support B sinks by 25 mm. Take E = 10 GPa and I = 20×10^6 mm^4. Draw BMD and SFD.

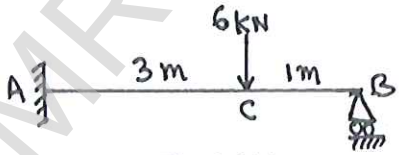

Fig.Q6(a) **(10 Marks)**

b. Analyze the fixed beam subjected to the loadings as shown in the Fig.Q6(b), by consistent deformation method. Draw SFD.

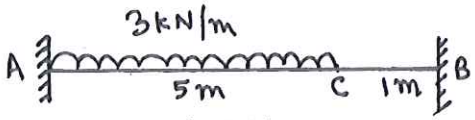

Fig.Q6(b) **(10 Marks)**

7 Analyze the continuous beam subjected to the loadings as shown in the Fig.Q7, using Claperons three moment theorem. Draw BMD. EI is constant throughout.

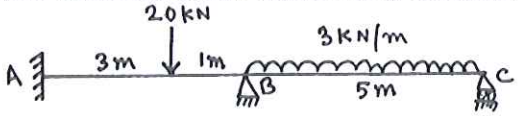

Fig.Q7 **(20 Marks)**

8 A parabolic arch hinged at the ends has a span of 60 m, and a rise of 12 m. A concentrated load of 8 kN acts at 15 m from the left hinge. The second moment of area varies as the secant of the inclination of the arch axis. Calculate the horizontal thrust and the reactions at the hinges. **(20 Marks)**

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