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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)

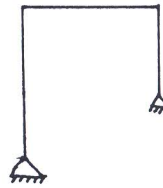


Fig.Q1(b)(iii)

- 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.

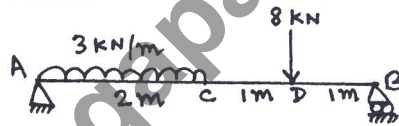


Fig.Q2(a)

- b. Find the slope and deflection at the free end of the cantilever beam shown in Fig.Q2(b) using conjugate beam method. Take $EI = 2.5 \times 10^6 \text{ kNm}^2$.

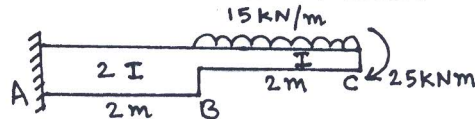


Fig.Q2(b)

- 3 a. State: i) The first and second theorem of Castigliano, ii) The Betti's law and Maxwell's theorem of reciprocal deflections. (08 Marks)
- b. Compute the vertical displacement at the free end D, of the frame by strain energy method. If $EI = 2 \times 10^4 \text{ kNm}^2$, the frame is as shown in Fig.Q3(b).

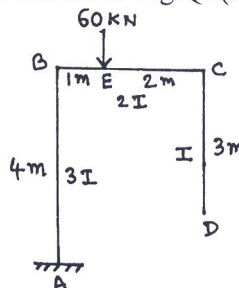


Fig.Q3(b)

(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 ".

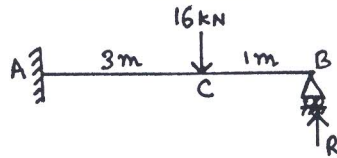


Fig.Q4(a)

(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.

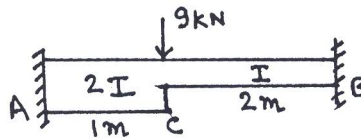


Fig.Q4(b)

(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 $E = 10 \text{ GPa}$ and $I = 20 \times 10^6 \text{ mm}^4$. Draw BMD and SFD.

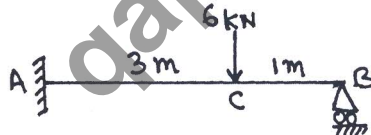


Fig.Q6(a)

(10 Marks)

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

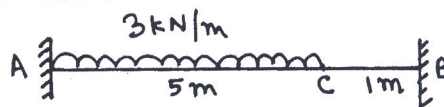


Fig.Q6(b)

(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.

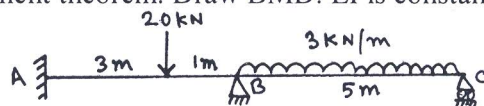


Fig.Q7

(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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