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Fourth Semester B.E. Degree Examination, July/August 2021
Structural Analysis - I

Max. Marks:100

Note: Answer any FIVE full questions.

- 1 a. Differentiate between linear structure and non-linear structure. (04 Marks)
- b. Explain statically and kinematically determinate and indeterminate structures with an example. (06 Marks)
- c. Derive an expression to determine strain energy stored due to axial load. Hence calculate the strain energy stored in the bar of length 2m and 50mm diameter when it carries a tensile load of 100kN. Take $E = 200\text{GN/m}^2$. (10 Marks)

- 2 a. Find the slope and deflection at the free end by moment area method Fig.Q.2(a) $EI = 1 \times 10^5 \text{ kN m}^2$. (10 Marks)

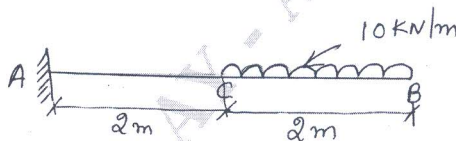


Fig.Q.2(a)

- b. Determine the maximum slope and maximum deflection of the beam using conjugate beam method. Fig.Q.2(b). $E = 210\text{GPa}$, $I = 120 \times 10^6 \text{ mm}^4$. (10 Marks)

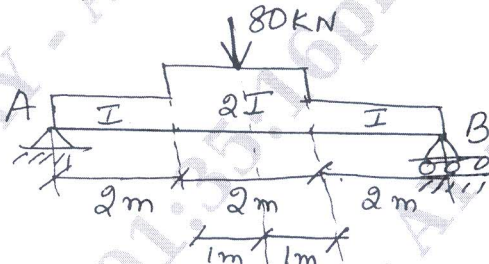


Fig.Q.2(b)

- 3 a. State Clarke Maxwell's law of reciprocal deflection. (02 Marks)
- b. Using strain energy method, determine the deflection at free end of the cantilever beam shown in Fig.Q.3(b) EI is constant. (08 Marks)



Fig.Q.3(b)

- c. Determine the deflection at mid span using Castigliano's method for the simply supported beam shown in Fig.Q.3(c). (10 Marks)

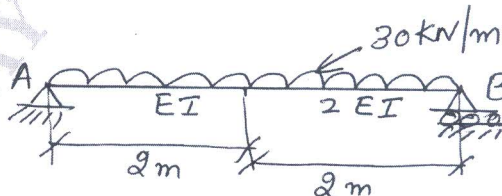


Fig.Q.3(c)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
 2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

- 4 a. Analyze the propped cantilever shown in Fig.Q.4(a) by strain energy method and draw B.M.D and S.F.D. (10 Marks)

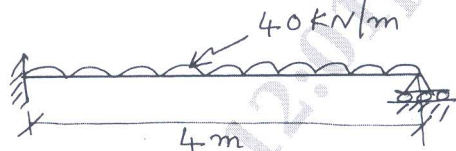


Fig.Q.4(a)

- b. Determine the vertical component of deflection at the point C of the truss shown in Fig.Q.4(b) using unit load method. Cross sectional area of tension member is 1500mm^2 and of compression member is 1000mm^2 $E = 2 \times 10^5 \text{N/mm}^2$. (10 Marks)

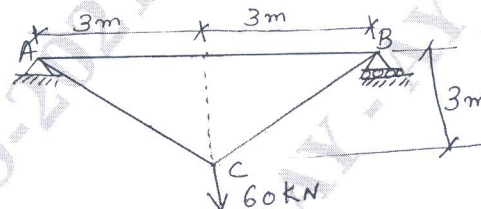


Fig.Q.4(b)

- 5 A three hinged parabolic arch of rise 8m and span 40m carries a wdl of 60kN/m over the left half of the arch only. Evaluate the values of i) Reaction at the supports ii) Position and magnitude of maximum positive and negative bending moment and sketch B.M.D. iii) Normal thrust and radial shear at the left quarter span. (20 Marks)
- 6 Analyze the propped cantilever beam shown in Fig.Q.6, using consistent deformation method, if support B sinks by 5mm. Take $EI = 16 \times 10^3 \text{kN/m}^2$. Also draw B.M.D and S.F.D. (20 Marks)

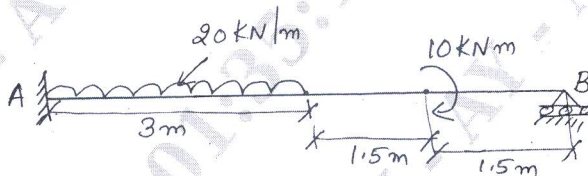


Fig.Q.6

- 7 Find support moments and reactions for the continuous beam using theorem of three moments shown in Fig.Q.7. EI constant also draw elastic curve, S.F.D and B.M.D. (20 Marks)

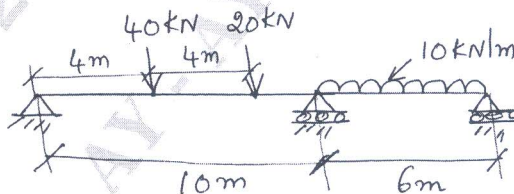


Fig.Q.7

- 8 A two hinged parabolic arch of span 40m and central rise 6m carries a point load of 80kN at a distance of 10m from the left hand support. If the moment of inertia of the arch rib varies as the recant of the slope of the arch axis, calculate: i) horizontal thrust ii) Normal thrust, radial shear and bending moment at a section of 15m from left support. (20 Marks)
