4E1208

Roll No.

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B. Tech. IV-Sem. (Back) Exam., Oct.-Nov. - 2020

Civil Engineering

4CE4 – 05 Strength of Materials

Time: 2 Hours

Maximum Marks: 82

Min. Passing Marks: 29

Instructions to Candidates:

Attempt all ten questions from Part A, four questions out of seven questions from Part B and two questions out of five from Part C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used /calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. NIL

2. NIL

PART – A

(Answer should be given up to 25 words only) **[10×2=20]**

All questions are compulsory

Q.1 Define Hooke's law.

Q.2 Write the term Normal stress & Shear stress.

Q.3 Write the Formula of Modulus of Elasticity.

Q.4 Express the term Yield Stress Point & Proof Stress.

Q.5 What is Poisson's ratio?

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Q.6 Write the formula of Euler critical load.

Q.7 Write the applications of Mohr's circle.

Q.8 State the relation between Young's modulus and Bulk modulus.

Q.9 Write the formula of longitudinal stress & hoop stress.

Q.10 What is maximum value of Poisson's ratio for an elastic material?

PART – B

(Analytical/Problem solving questions) **[4×8=32]**

Attempt any four questions

Q.1 A symmetric I section (with width of each flange = 50 mm, thickiness of web 10 mm.) of steel is subjected to a shear force of 100 kN. Find the magnitude of shear stress (in N/mm^2) in the web at its junction with the top flange.

Q.2 An overhanging beam ABC supported at A and B is loaded as shown in fig. (i) Determine by double integration method-

(a) Deflection of free end C

(b) Maximum deflection between A & B.

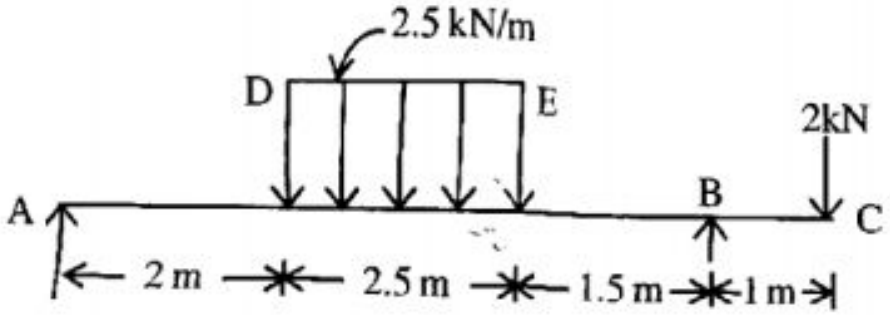


fig.(i)

Q.3 Derive the relation between load, shear force and bending moment.

Q.4 Derive the relation for a solid circular shaft.

$$\frac{T}{J} = \frac{\tau_{max}}{R} = \frac{N\theta}{l}$$

Q.5 Compare the crippling loads given by Euler's and Rankine's formula for a tubular steel strut 2.3m long having outer and inner diameters 38mm & 33mm respectively, having pin joints at each end. Take Yield stress as 335 N/mm^2, the Rankine constant $\frac{1}{7500}$, $E = 2.05 \times 10^5$ N/mm^2.

Q.6 A simply supported beam of length 6m carries a point load of 12 kN at a distance of 2m from the left end. If $E = 2\times10^5$ N/mm^2 and $I = 10^8$ mm^4, determine the slope at the left support and deflection under the point load using conjugate beam method.

Q.7 Draw a neat diagram of stress – strain curve for a mild steel bar subjected to tensile load. Also define the following term –

(a) Gauge length

(b) Yield point

(c) Proof stress

(d) Factor of safety

PART – C

(Descriptive/Analytical/Problem Solving/Design Questions) **[2×15=30]**

Attempt any two questions

Q.1 (a) Derive an expression for the elongation of a tapered bar of length 'ℓ' whose diameter varies uniformly 'd' at one end to 'D' at other end when subjected to an axial pull of 'P'.

(b) A steel rod of 30mm diameter and 5m long connected to two grips and the rod is maintained at a temperature of 95°C. Determine the stress and pull exerted when the temperature falls to 30°C, if –

(i) The end do not yield

(ii) The end yield by 1.2mm

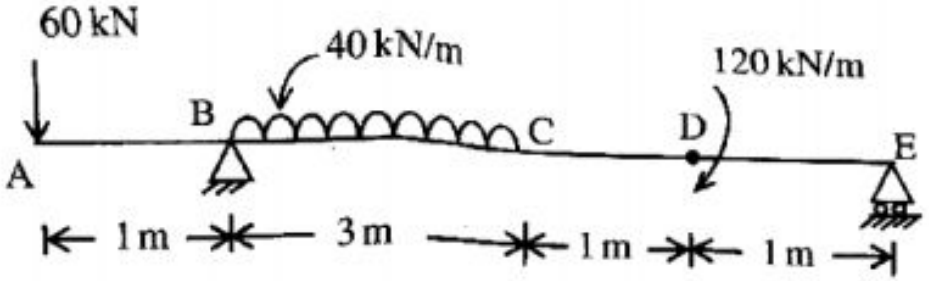
Take $E = 2\times10^5$ N/mm^2 and coefficient of thermal expansion $\alpha = 12\times10^{-6}$/°C.

Q.2 (a) Explain what do you mean by Principal stresses?

(b) At a certain point in a strained material, the stresses are 1000 N/cm^2 and 400 N/cm^2, both tensile. Explain the Mohr's circle of stresses.

Q.3 (a) Draw a neat diagram of 'fixed support". What type of support reactions are available at fixed support?

(b) Draw the shear force and bending moment diagram for the following beam shown in fig. Locate the point of contraflexure, if any. Also find out the maximum bending moment.



(Fig)

Q.4 (a) Write the assumption made and derive the equation for Simple Theory of bending.

(b) A Rectangular beam 200mm wide and 300mm deep carries a UDL of 10 kN/m over a simply supported span of 6m. Determine –

(i) The maximum stress in the beam due to bending.

(ii) The radius of curvature for the section where bending is maximum, if E = 200 GPa.

Q.5 (a) Derive the Euler's theory for long columns which have both ends hinged and its limitations.

(b) Describe the middle third rule for eccentrically loaded compressive members.