KUMARAGURU
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B.E DEGREE EXAMINATIONS: NOV/DEC 2023

(Regulation 2018)

Third Semester

CIVIL ENGINEERING

U18CEI3201: Solid Mechanics

COURSE OUTCOMES

CO1: Apply the fundamental concepts of stress and strain in the analysis of various structural Components and machines.

CO2: Analyze the beams to determine shear forces, bending moments.

CO3: Determine the bending, shear stresses and deflection produced in a beam.

CO4: Analyze and design shafts and springs used in vehicles and structures.

CO5: Find out the design forces in truss members.

Time: Three Hours   **Maximum Marks: 100**

Answer all the Questions: -
PART A (10 x 2 = 20 Marks)
(Answer not more than 40 words)

1. State Hooke's law.	CO1	[K$_2$]
2. What type of stress will be induced in a bar when the ends are restrained and subjected to i) rise in temperature and ii) a fall in temperature?	CO1	[K$_2$]
3. When will the bending moment is maximum?	CO2	[K$_2$]
4. What is maximum bending moment in a simply supported beam of span 'L' subjected to Uniformly distributed load of 'w' over entire whole span?	CO2	[K$_2$]
5. What are the methods for finding out the slope and deflection at a section?	CO3	[K$_1$]
6. Write the theory of simple bending equation?	CO3	[K$_1$]
7. State any two functions of springs.	CO4	[K$_2$]
8. What are the assumptions made in Torsion equation	CO4	[K$_2$]
9. How will you determine the stability and determinacy in trusses	CO5	[K$_2$]
10. Write the basic equilibrium equation used to analyse a frame member	CO5	[K$_2$]

Answer any FIVE Questions: -
PART B (5 x 16 = 80 Marks)
(Answer not more than 400 words)

11.	a)	A tensile load of 60 KN is gradually applied to a circular bar of 4 cm diameter and 5 m long. If the value of $E = 2 \times 10^5$ N/mm^2 determine. i) Stretch in the rod, ii) Stress in the rod, iii) Strain energy absorbed by the rod	8	CO1 [K$_3$]

b)	A steel rod is 2 m long and 50 mm in diameter. An axial pull of 100 KN is suddenly applied to the rod. Calculate the instantaneous stress induced and the instantaneous elongation produced in the rod. E = 200 GN/m²	8	CO1 [K₃]

12. A beam freely supported over an effective span of 5 m carries point loads 3 KN, 4.5 kN and 7 kN at 1 m, 2.5 m, and 3.5 m respectively from the left-hand support. Construct the Shear force and Bending moment diagrams for simply supported beam as shown in Figure .1 — 16 CO2 [K₃]

3KN   4.5 KN   7 KN
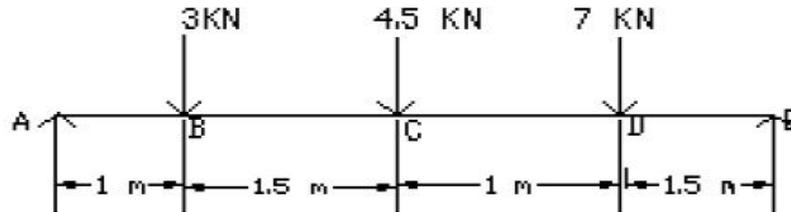
A B C D E

|←1 m→|←1.5 m→|←1 m→|←1.5 m→|

Figure.1

13. Derive the expression for Flexural formula for pure bending equation. Also list some of the assumptions made in theory of simply bending. — 16 CO3 [K₃]

14. A beam is loaded as shown in Figure.2. Determine the deflection under the load points. Take E=200 Gpa and $I = 160 \times 10^{6}$ mm⁴. Use Macaulay's method. — 16 CO3 [K₃]
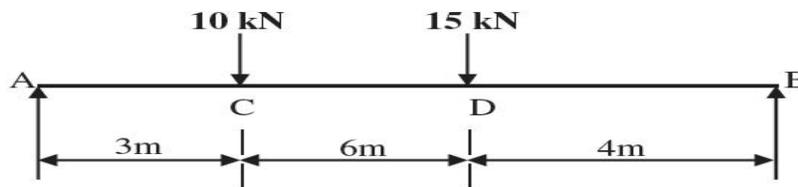
10 kN   15 kN

A   C   D   B

3m   6m   4m

Figure.2

15 a) Differentiate open coiled helical spring from the close coiled helical spring and state the type of stress induced in each spring due to an axial load with neat sketches — 8 CO4 [K₂]

b) A helical spring is made of 4.0 mm steel wire with a mean radius of 25 mm and number of turns of coil 15. What will be deflection of the spring under a load of 6 Newton. Take C = 80 x 10³ N/mm² — 8 CO4 [K₃]

16. Determine the force in members AB, BD, BE, and DE of the Howe roof truss shown in Figure.3, by using method of joints. — 16 CO5 [K₃]
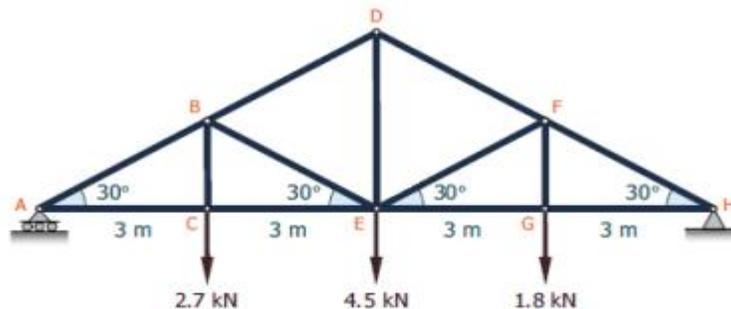
D

B   F

A 30°   30°   30°   30°   H

3 m   C   3 m   E   3 m   G   3 m

2.7 kN   4.5 kN   1.8 kN

Figure.3

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