KUMARAGURU
college of technology
character is life
1984

B.E DEGREE EXAMINATIONS: APRIL / MAY 2023

(Regulation 2018)

Fourth Semester

CIVIL ENGINEERING

U18CET4004**:** Strength of Materials

COURSE OUTCOMES

CO1: Understand the deformation and strains under different load action and response in terms of forces and moments.

CO2: Apply engineering principles to calculate the reactions, forces and moments.

CO3: Analyze the state of stress in three dimension and structural members using various theories of failure.

CO4: Analyse the long and short columns and determine the design loads.

CO5: Analyse the unsymmetrical sections and curved beams.

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

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

1.	Write the strain energy formula for determinate beam.	CO1	[K_1]
2.	Define the term Resilience.	CO1	[K_1]
3.	Differentiate the statically determinate structures and statically indeterminate structures.	CO2	[K_1]
4.	Explain Propped Cantilever Beam with a net sketch.	CO2	[K_1]
5.	Express the term Tri-axial stress.	CO3	[K_1]
6.	State Distortion energy theory.	CO3	[K_1]
7.	State the assumptions for Euler's Critical Load for Long Column	CO4	[K_1]
8.	Write the Rankine's formula for columns.	CO4	[K_1]
9.	State the assumptions made in Winkler's Bach Theory.	CO5	[K_1]
10.	Define shear center of a section.	CO5	[K_1]

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

11.	A simply supported beam is subjected to a single force P at a distance b from one of the supports. Obtain the expression for the deflection under the load using Castigliano's theorem. How do you calculate deflection at the mid-point of the beam?	16	CO1	[K_3]

12. A continuous beam ABC covers two consecutive span AB and BC of lengths 4 m — 16 — CO2 — [K4]
and 6 m, carrying uniformly distributed loads of 6 kN/m and 10 kN/m respectively. If the ends A and C are simply supported, find the support moments at A, B and C. Draw also B.M.D and S.F.D.

13. The rectangular stress components of a point in three-dimensional stress system — 16 — CO3 — [K3]
are defined as a σ_x = 20 Mpa, σ_y = - 40Mpa, σ_z = 80 Mpa, τ_{xy} = 40 Mpa, τ_{yz} = - 60 Mpa, τ_{xz} = 20Mpa. Determine the principal stresses and principal planes.

14. A hollow cast iron column of 300 mm external diameter and 220 mm internal — 16 — CO4 — [K3]
diameter is used as a column 4 m long with both ends hinged. Determine the safe compressive load the column can carry without buckling using Euler's formula and Rankine's formula E = 0.7×10^5 N/mm², FOS = 4, Rankine constant (a) = 1/1600 Crushing Stress (σc) = 567 N/mm²

15. A rectangular section beam 80 mm x 50 mm is arranged as a cantilever 1.3 m — 16 — CO5 — [K3]
long and loaded at its free end with a load of 5 kN inclined at an angle of 300 to the vertical as shown in Fig-1. Determine the position and magnitude of the greatest tensile stress in the section. What will be the vertical deflection at the end? E = 210 GN/m².
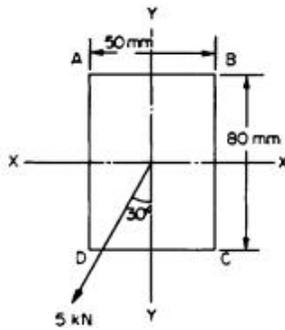

Fig-1

16. A fixed beam AB of length 6 m carries point load of 160 kN and 120 kN at a — 16 — CO2 — [K4]
distance of 2 m and 4m from the left end A. Find the fixed end moments and the reactions at the supports. Draw B.M and S.F diagrams.

****