



B.E DEGREE EXAMINATIONS: NOV/DEC 2024

(Regulation 2018)

Fourth Semester

AERONAUTICAL ENGINEERING

U18AET4003: Aircraft Structures I

COURSE OUTCOMES

- CO1:** Identify statically determinate and indeterminate structures.
CO2: Analyze the response of statically indeterminate structures under various loading conditions.
CO3: Determine the reactions of structures using strain energy concept.
CO4: Identify different numerical methods available to solve a single structural problem.
CO5: Examine the structural failures using failure theories.

Time: Three Hours

Maximum Marks: 100

Answer all the Questions:-

PART A (10 x 2 = 20 Marks)

(Answer not more than 40 words)

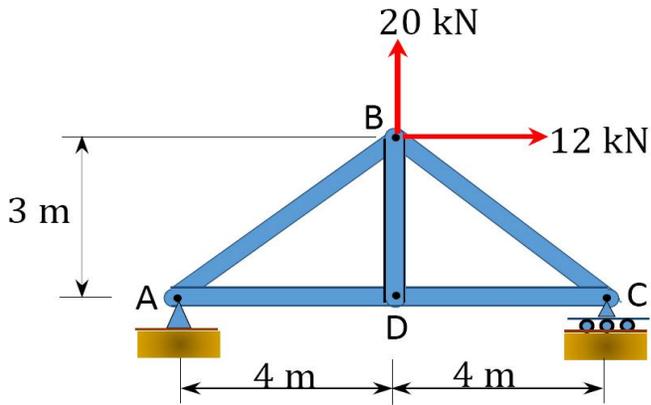
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|--|-----|-------------------|
| 1. Explain the key differences between 2D and 3D (space) trusses. | CO1 | [K ₂] |
| 2. Define a statically determinate structure and give an example. | CO1 | [K ₂] |
| 3. Write down the Clapeyron's three moment theorem in general form. | CO2 | [K ₁] |
| 4. Define stiffness factor and moment distribution factor in moment distribution method. | CO2 | [K ₁] |
| 5. How is strain energy due to axial loads calculated for a beam? | CO3 | [K ₃] |
| 6. What is the Unit Load Method and how is it used for determining displacements? | CO3 | [K ₂] |
| 7. A column has a length of 12 m and is subjected to an axial load of 90 kN. Determine the critical load using Euler's column curve. | CO4 | [K ₃] |
| 8. What is a beam column and how does eccentric loading affect its stability? | CO4 | [K ₂] |
| 9. List the needs of failure theory. | CO5 | [K ₂] |
| 10. What is the Maximum Stress Theory and how is it applied in structural design? | CO5 | [K ₂] |

Answer any FIVE Questions:-

PART B (5 x 16 = 80 Marks)

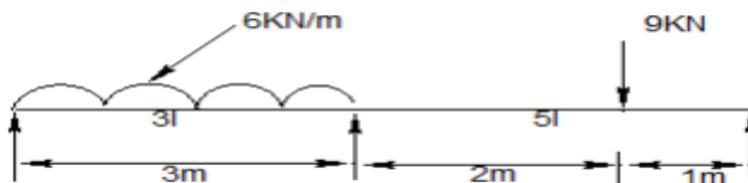
(Answer not more than 400 words)

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| 11. Using the method of joint, determine the axial force in each member of the truss shown in Figure | CO1 | [K ₄] |
|--|-----|-------------------|



12. Analyse the given beam using Clapeyron's three moment Equation.

CO2 [K₄]



13. A simply supported beam of length $L=6\text{ m}$ is subjected to a uniformly distributed load $w=5\text{ kN/m}$. The flexural rigidity $EI=4\times 10^9\text{ N/m}^2$. Using Castigliano's theorem, calculate the vertical deflection at the center of the beam.

CO3 [K₃]

14. a) Derive Euler crippling load formula for columns under Both ends hinged end conditions.

6 CO4 [K₂]

b) Calculate maximum bending moment created on hallow column of 5m length and 20cm external diameter and 16cm internal diameter subject to 12kN of eccentric load with both ends fixed. The eccentricity of the column is 2cm. Take $E = 120\text{GPa}$.

10 CO4 [K₃]

15. a) Determine the diameter of a bolt which is subjected to an axial pull of 9kN together with a transverse shear force of 4.5kN, the allowable tensile stress $\sigma_{\text{allow}}=150\text{ N/mm}^2$ using

10 CO5 [K₃]

- i) Maximum principal stress theory
- ii) Maximum principal strain theory.

b) Explain failure of brittle and ductile materials.

6 CO5 [K₂]

16. Find the Euler's crippling load for a hollow cylindrical steel column of 38mm external diameter and 2.5 mm thick. Take length of the column as 2.3 m and hinged at its both ends. Take $E = 205 \text{ GPa}$. Also determine crippling load by Rankine's formula using constants as 335 MPa and Rankine's Constant 'a' as (1/7500).

CO4 [K₃]
