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KUMARAGURU
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B.E DEGREE EXAMINATIONS: APRIL /MAY 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.

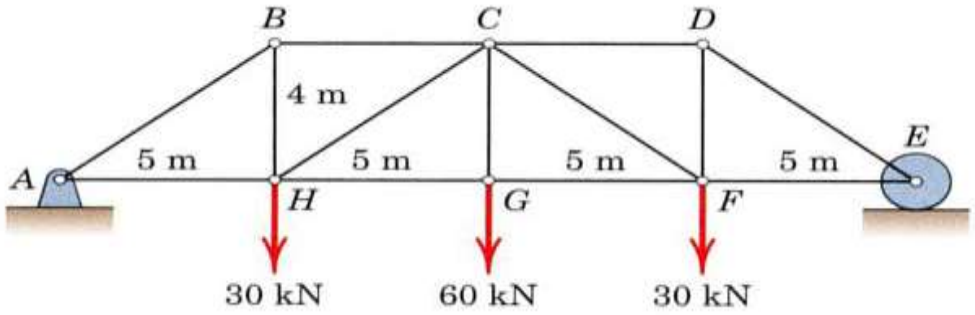
Time: Three Hours **Maximum Marks: 100**

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

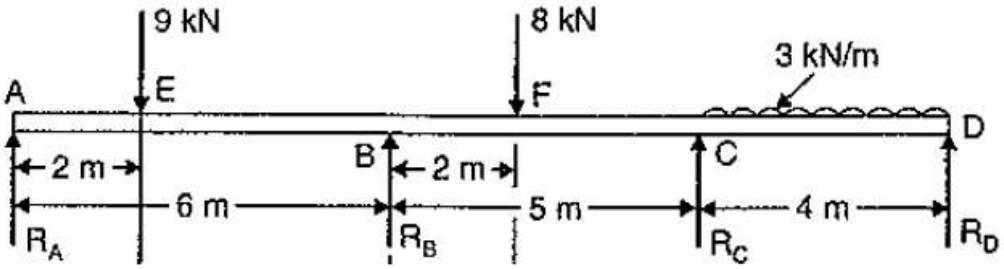
1.	Differentiate the statically determinate structures and statically indeterminate structures.	CO1	[K_2]
2.	Explain the properties of Ball and Socket Joint.	CO1	[K_2]
3.	State second-moment area theorem.	CO2	[K_1]
4.	Define: 1. Stiffness Factor & 2. Distribution Factor	CO2	[K_1]
5.	A rod of area 90 mm^2 has a length of 3 m. Determine the strain energy, if the stress of 300 MPa is applied when stretched. Young's modulus is given as 200 GPa.	CO3	[K_3]
6.	State Castigliano's first and second theorem.	CO3	[K_1]
7.	A specimen of $3m^2$ in cross section stretches 0.5cm over 10m gauge length under an axial load of 100kN. Calculate the strain energy stored and Young's modulus of the specimen.	CO4	[K_3]
8.	For the column with constant axial compressive load, which end condition of it will be more stable? Explain.	CO4	[K_2]
9.	What are the assumptions followed in Euler's equation?	CO5	[K_2]
10.	Define: Short, Medium and Long columns	CO5	[K_1]

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

11. Determine the force in each member of the loaded truss. CO1 [K3]



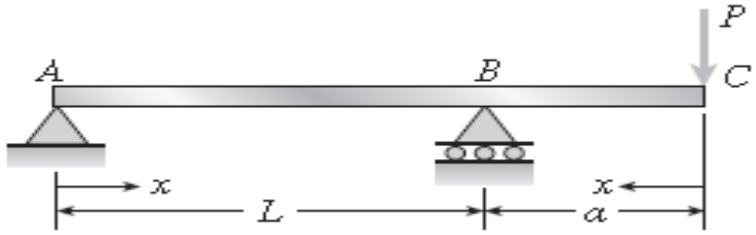
12. Using Clapeyron's Three Moment Equation, find the the reactions at the supports. CO2 [K4]



13. An overhanging beam *ABC* supports a concentrated load *P* at the end of the overhang. Span *AB* has length *L* and the overhang has length *a*. CO3 [K4]

a) Obtain the strain energy of the beam and then using Castigliano's theorem.

b) Determine the deflection δC at the end of the overhang using any one of the strain energy method



14. a) Derive the Euler buckling load for columns, when both ends of the column are fixed. 6 CO4 [K3]

b) A hollow steel strut hinged at both ends has an outside diameter of 64mm, an 10 CO4 [K3]

inside diameter of 52mm and 2.4m long. The load is parallel to the axis but is eccentric.

a) Determine the maximum value bending stress if the crippling load is 70% of Euler value. The yield stress is 300MPa and E = 205GPa.

b) Determine the maximum value of eccentricity.

15. a) A hollow mild steel shaft having 100mm external diameter and 50mm internal diameter is subjected to a twisting moment of 8kNm and a bending moment of 2.5kNm. Calculate the principal stresses and identify direct stress which, acting alone, would produce the same
(i) Maximum strain energy,
ii) Maximum shear strain energy, as that produced by the principal stresses acting together. Take Poisson's ratio = 0.25

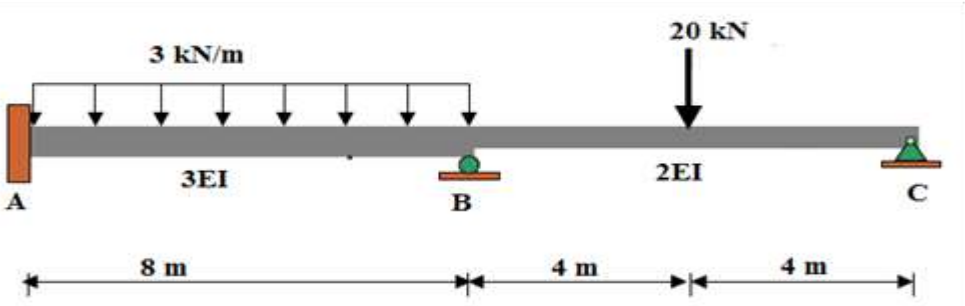
8 CO5 [K_3]

b) Explain:
(i) Maximum principal strain theory
(ii) Maximum shear stress theory

8 CO5 [K_2]

16. Analyze the following beam by moment-distribution method. Draw S.F. & B.M. diagrams.

CO2 [K_4]



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