

Code No. RR312105

III B.Tech I-Semester Supplementary Examinations, May-2005

AEROSPACE STRUCTURES-I

(Aeronautical Engineering)

Set No.

1

Time : 3 hours

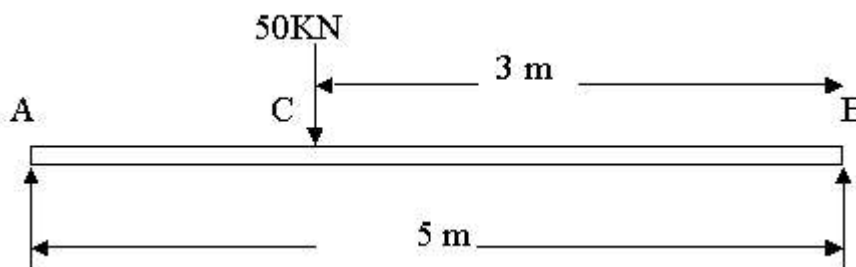
Max Marks : 80

Answer any FIVE questions
All questions carry equal marks

- - -

1. A cantilever beam of span L is loaded by a point load P , at the free end. Find the slope and deflection at the free end using double integration method. Assume uniform flexural rigidity, EI .
2. A simply supported beam of span 4 m is subjected to a point of 30 kN at the center and a end couple of 2 kN-m. Find the Maximum deflection and slope at the ends. $EI = 2 \times 10^{14} \text{ N-mm}^2$.
3. A cantilever of length 5m is subjected to uniformly distributed load of 10kN/m. The cantilever is propped at a distance of 3m from the fixed end. Find the reaction at the support using superposition method.
4. A simple supported beam AB of span L is loaded by a point load P at a distance "a" from A, distance 'b' from end B. Assuming uniform flexural rigidity, EI , determine the deflection under the load using Castiglino's theorem.

5.



A SSB is loaded at C as shown in figure. Find the deflection and slope using unit load method at C.

$$E = 2 \times 10^5 \text{ N/mm}^2$$

$$I = 4 \times 10^7 \text{ mm}^4$$

6. Derive Euler critical load formula for a column with both ends hinged.

Contd...2

7. A short cast iron column is tubular in section having 250 mm external Diameter and 200 internal diameter. The column carries an eccentric load of 250 KN at a point distant 100 from its axis. Determine the maximum tensile and compressive stresses. Also draw the stress distribution.
8. A beam-column of span L , which is hinged at one end and roller supported at the other end is subjected to axial compressive load P , at the ends followed by a transverse load ' Q ' at a distance ' a ' from the fixed end
- Write the beam column equations considering buckling at section on both sides of Q from roller support end.
 - Give the boundary conditions.

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2

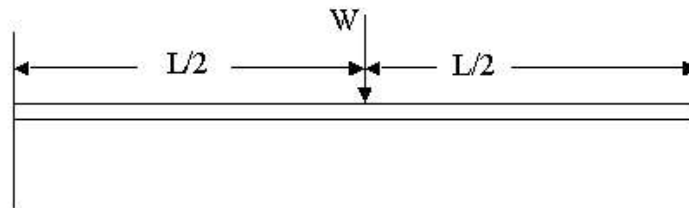
Time : 3 hours

Max Marks : 80

Answer any FIVE questions
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1. A cantilever beam of span L is subjected to uniformly distributed loading, w . Find the slope and deflection at the free end using double integration method. Assume uniform flexural rigidity, EI .
2. Simply supported beam of span L is subjected to UDL, ' w ' over its entire span and propped at the center. Find the prop reaction and draw the shear force and bending moment diagrams.
3. A cantilever of span 4m carries a point load 10KN at its free end. It is propped at 1m from the free end. Find the prop reaction at the support.
4. Calculate the central deflection for a simply supported beam of span L with uniformly distributed load w per unit length using Castiglino's theorem. Assume uniform rigidity, EI .

5.



Find the deflection and slope using unit load method at the free end of a cantilever beam loaded as shown, assuming uniform flexural rigidity, EI .

6. Derive Euler critical load formula for a column with both ends fixed.
7. A mild steel column has a least radius of gyration of 50 mm and cross-section area of 6000 mm^2 . The length of the column is 5 m and both ends are fixed. Find the crippling load by Rankine's formula.
The critical stress is 32.5 KN/cm^2 . $k_1 = 1/7500$
Also find the critical load when both ends are hinged.

Contd...2

8. A beam-column of span L , which is hinged at one end and roller supported at the other end is subjected to axial compressive load P , at the ends followed by a transverse UDL ' w ' per unit length over the entire span
- a) Write the beam column equations considering buckling at section.
 - b) Give the boundary conditions.

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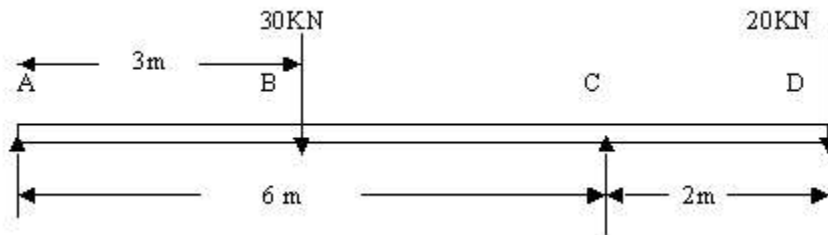
3

Time : 3 hours

Max Marks : 80

Answer any FIVE questions
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1. A cantilever beam of span L is subjected to uniformly varying loading, ' w ' per unit width. Find the slope and deflection at the free end using double integration method. Assume uniform flexural rigidity.
2. A simple supported flitched beam (composite) of span 4m carries a point load 50 KN at the center. The beam is made of wood $200 \times 150 \text{ mm}^2$ reinforced with steel plates $150 \times 10 \text{ mm}^2$. Determine the maximum deflection and slope for the composite beam. $E_{\text{steel}} = 15E_{\text{wood}}$, $E_{\text{steel}} = 2 \times 10^5 \text{ N/mm}^2$.
3. A fixed beam of 4m span is subjected to point load at 2m from its one end. Find the reactions and end moments. Draw the free moment, fixing moment and net moment diagrams.
4. State Castiglino's theorem for deflection of beams. Derive Castiglino's theorem.
- 5.



An overhang beam supported at A and C with over hang portion CD is loaded as shown in figure. Find the deflection using unit load method at the free end D.

$$I = 2 \times 10^8 \text{ mm}^4$$

$$E = 2 \times 10^5 \text{ N/mm}^2$$

6. Derive Euler critical load formula for a column with one end fixed, other end free.
7. Find the max length of a steel rod of 50mm dia, used as a column with both ends fixed and carrying a load of 25 KN. Allow factor of safety 3. $K = \alpha = 1/7500$
Crushing stress $f_c = 320 \text{ N/mm}^2$.

Contd...2

8. A beam-column of span L , which is hinged at one end and roller supported at the other end is subjected to axial compressive load P , at the ends followed by a clockwise couple M at the center
- a) Write the beam column equations considering buckling at a section.
 - b) Give the boundary conditions.

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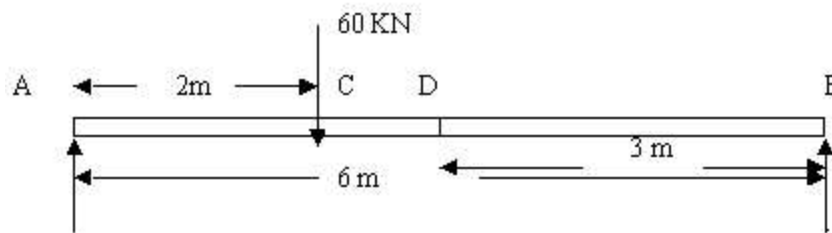
4

Time : 3 hours

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Answer any FIVE questions
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1. Cantilever beam of span 4 m is loaded with UDL of 5KN/m over its entire span and a point load of 10 KN at the free end. Find the deflection at the free end using double integration method.
 $I = 1400 \times 10^4 \text{ mm}^4$ $E = 2 \times 10^5 \text{ N/mm}^2$
2. A Simply supported beam of span L is loaded with U.D.L, w per unit length. The cross section of the beam is rectangular. Determine the section of the beam for uniform strength
 - a) When depth is constant.
 - b) When breadth is constant. σ_b -bending stress.
3. A fixed beam of 3m span is subjected multiple point loads of 10KN from both ends at a distance of 1m. Find the end reactions and fixing moments Draw free, fixing and net moment diagrams.
- 4.a) Derive the total strain energy stored in beam subjected to bending.
b) Calculate the total strain energy stored in a cantilever beam of span L subjected to concentrated load, P at the free end assuming uniform flexural rigidity EI.
- 5.



A SSB is loaded at C by 60 kN as shown. Determine the central deflection at D using unit load method

$E = 2 \times 10^5 \text{ N/mm}^2$

$I = 4 \times 10^7 \text{ mm}^4$.

Contd...2

6. Derive Euler critical load formula for a column with one end fixed ,other end hinged.
7. A steel rolled joint ISMB300 is to be used as a column of 3m long with both ends fixed. Find safe axial load on the column using Rankine's theory. Factor of safety is 3. Crushing stress is 320N/mm^2 $K=\alpha=1/7500$. Properties of the column section
Area= 5626mm^2
 $I_{xx}=8.603\times 10^7\text{mm}^4$
 $I_{yy}=4.539\times 10^7\text{mm}^4$.
8. A beam-column of span L, which is hinged at one end and roller supported at the other end is subjected to axial compressive load P, at the ends followed by transverse uniform varying load, 'w' per unit width over the entire span
- Write the beam column equations considering buckling at a section.
 - Give the boundary conditions.

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