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1

II B. Tech II Semester (R09) Regular & Supplementary Examinations, April/May 2012

AEROSPACE VEHICLE STRUCTURES I

(Aeronautical Engineering)

Time: 3 hours Max Marks: 70

Answer any FIVE questions
All questions carry equal marks
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1 (a) A simply supported beam span 'I' subjected to point load 'W' at middle of the beam. Find out maximum slope and deflection.

(b) A beam subjected to simple bending and has a uniform stress 65 N/mm^2. Find the deflection of simply supported beam at mid span. Take depth of the beam as 400 mm. E = 2 x 10^5 N/mm^2. Span 'I' is 7000 mm.

2 (a) What do you mean by beams on elastic foundation?

(b) An aluminum alloy I – beam (depth 100 mm, I_x = 2.45 x 10^6 mm^4, E = 70 GPa) has a length L = 7 m and is supported by 8 springs (k = 100 N/mm)spaced at a distance l=1.0 m centre to centre along the beam. A load P = 15 kN is applied at the centre of the beam over one of the springs. Determine the deflection of the beam under the load, the maximum bending moment and the maximum bending stress in the beam.

3 A steel rolled joint ISMB 300 is to be used as a column of 3 m long with both ends fixed. Find safe axial load on the column using Rankine's theory. Factor of safety is 3. Crushing stress is 320 N/mm^2. K = α= 1/7500. Properties of the column section, Area = 5626 mm^2, I_{xx} = 8.603 x 10^7 mm^4, I_{yy} = 4.539 x 10^7 mm^4.

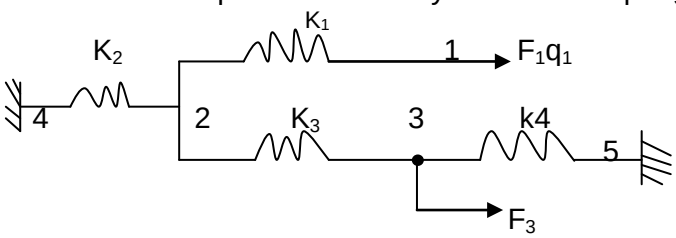
4 Derive the equations of equilibrium in polar coordinates while describing all the effects involved. Also state the assumptions.

5 (a) Derive all stress on an oblique section of a body subjected to direct stress in two mutually perpendicular directions.

(b) A tie bar is subjected to a tensile stress of 80 MPa. Find the intensity of shear stress, normal stress and resultant stress on a plane. The normal of which is inclined at 30^0 to the axis of the bar.

6 A simply supported beam length 6 mts subjected to a udl of 3KN/m throughout the beam. Take Young's modulus of the beam material is E and I is moment of inertia. Find the maximum deflection by using unit load method.

7 Calculate the nodal displacement in a system of four springs shown in figure.



8 Explain the procedure of finding the shear flow in to symmetric closed section and location of shear centre for both single and multi – cell sections.

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AEROSPACE VEHICLE STRUCTURES I

(Aeronautical Engineering)

Time: 3 hours Max Marks: 70

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1 A horizontal cantilever beam of uniform section of length l carries two point loads, W at the free end and 2 W at a distance of α from the free end. Find the maximum deflection due to this loading. If the cantilever is a steel tube of circular section 100 mm external diameter and 6 mm thick and ℓ = 1.50 m and a = 0.60 m, determine the value of W so that the maximum bending stress is 140 N/mm^2 and calculate the maximum deflection for the loading. Take E = 2 x 10^5 N/mm^2.

2 A wooden beam of cross-section 80 mm x 240 mm rests on an earth foundation. The modulus of elasticity of wood is 10 GN/m^2 and modulus of foundation is 5 MN/m^2. A uniformly distributed load of 2 kN/m acts on the middle portion of this very long beam over a span of 2 m. Compute the maximum deflection and the maximum bending stress in the beam.

3 Explain Rankine's theory for critical loads and derive Rankine's critical load formula.

4 (a) What is an Airy's stress function in theory of elasticity?
(b) Prove that the following are Airy's stress function and examine the stress distribution represented by them:
(i) $\phi = Ax^2 + By^2$ (ii) $\phi = Ax^3$ and (iii) $\phi = A(x^4 - 3x^2 y^2)$

5 The principal tensile stresses at a point across two perpendicular planes are 80 N/mm^2 and 40 N/mm^2. Find the normal, tangential and resultant stress and its obliquity on a plane at 20^0 with the major principal plane. Find also the intensity of stress which acting alone can produce the same maximum strain. Take Poisson's ratio = 0.25. Also draw the Mohr's circle for the above values and explain construction details.

6 (a) Explain what are PVD and PVF.
(b) Define and give the proof of Castigliano's first theorem.

7 Explain Rayleigh Ritz method with suitable examples and also explain some important characteristics of Rayleigh Ritz method.

8 Explain the torsion of thin walled multi-cell structure section subjected to twisting.

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II B. Tech II Semester (R09) Regular & Supplementary Examinations, April/May 2012

AEROSPACE VEHICLE STRUCTURES I

(Aeronautical Engineering)

Time: 3 hours Max Marks: 70

Answer any FIVE questions
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1 A beam section is 10 m long and is simply supported at ends. It carries concentrated loads of 100 kN and 60 kN at a distance of 2 m and 5 m respectively from the left end. Calculate the deflection under the each load find also the maximum deflection. Take $I = 18 \times 10^8$ mm^4 and $E = 200$ kN/mm^2.

2 Compute the maximum bending moment, maximum deflection and the maximum bending stress for a railroad rail subjected to a single wheel load of 10 kN. The foundation modulus $k = 15$ MN/m^2. Assume that $I = 400 \times 10^{-8}$ m^4, $E = 200$ GN/m^2, the depth of the rail is 180 mm and that the distance of the centroidal axis of the cross-section of the rail from the top surface is 100 mm.

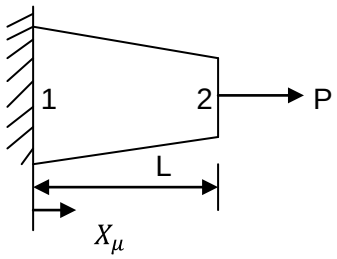
3 A hollow cylindrical cast iron of 150 mm external diameter and 15 mm thickness, 3 m long and is hinged at one end and fixed at other. Find (a) the ratio of Euler and Rankin load. (b) For what length, the critical load by Euler's and Rankin's formula will be equal.

4 (a) Define the following :(i) Compatibility (ii) Plane stress (iii) Plane strain (iv) Body forces.
(b) Illustrate all the six components of stresses on a cubic element.
(c) What is an Airy's stress function in theory of elasticity?

5 Determine endurance limit by means of rotating beam machine with, explain experimental procedure, draw and explain S-N curve.

6 Compare the strain energy of a beam, simply supported at its ends and loaded with U.D.L, with that of the same beam centrally loaded and having the same value of maximum bending stress.

7 Calculate displacement at node 2 of a tapered bar shown in figure with area of cross-section A_1 at node I and A_2 at node 2 subjected to an axial tensile load 'P'.



8 Derive the equation for torque and angle of twist for two cell closed section.

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II B. Tech II Semester (R09) Regular & Supplementary Examinations, April/May 2012

AEROSPACE VEHICLE STRUCTURES I

(Aeronautical Engineering)

Time: 3 hours Max Marks: 70

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1 (a) What is Macauly's method? Explain the two Mohr's theorems, as applicable to the slope and the deflection.
(b) A cantilever beam of length l carrying a uniformly distributed load w per unit run for a distance a from 'A' from the fixed end. Find the maximum deflection and slope.

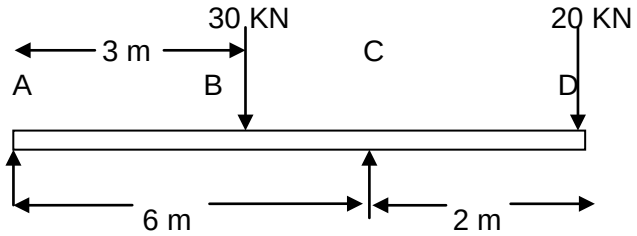
2 A semi-infinite beam with free ends is resting on an elastic foundation. The beam is 60 mm wide and 80 mm thick. It carries a uniformly distributed load of 50 N/mm over a length of 0.5 m at one end. 12 N-m is applied at the hinged end. Determine the maximum deflection and the stresses in the beam. Assume E = 2 x 10^5 N/mm^2, v = 0.30 and modulus of elastic foundation as 63 N/mm^3.

3 (a) What are the assumptions made in Euler's theory?
(b) What are the limitations of Euler's theory?
(c) A column made of mild steel tube is 5 metres long having 30 mm internal diameter and 38 mm external diameter it is used as a column with both ends hinged. Find the crippling load. Take E = 2.1 x 10^5 N/mm^2.

4 (a) Derive equations of equilibrium.
(b) Derive compatibility equations.

5 Explain construction of Mohr-circle in four cases, with figures.

6 An overhang beam supported at A and C with overhang portion CD is loaded as shown in figure. Find the deflection using unit load method at the free end D.
I = 2 x 10^8 mm^4
E = 2 x 10^5 N/mm^2.



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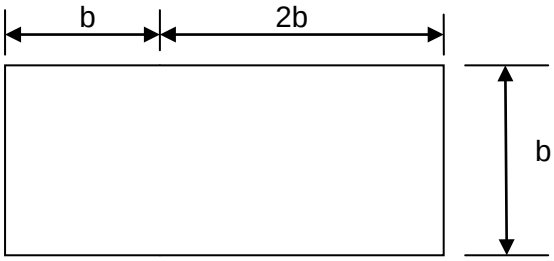
7 Explain what the important characteristics of Rayleigh Ritz method are. And explain Rayleigh Ritz method with suitable examples also.

8 Locate the shear centre of a uniform thickness t = 10 mm two compartment box beam shown in figure below. Also draw the shear flow variation take b = 500 mm.



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