Code No: R09222104 **R09** **Set No. 2**

II B.Tech II Semester Examinations,APRIL 2011
AEROSPACE VEHICLE STRUCTURES-I
Aeronautical Engineering

Time: 3 hours **Max Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks

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1. Find the frequency of the spring shown in figure 1: [15]

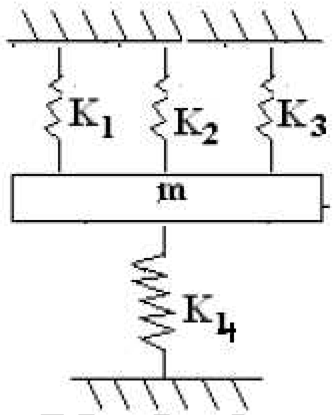

Figure 1:

2. (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 80MPa. 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. [9+6]

3. A semi infinite beam on elastic foundation is subjected to a concentrated load at the middle of the beam. Derive the expressions for slope, deflection, bending moment and shear force and sketch their variations along the beam. [15]

4. (a) Explain torsional shear flow.
   (b) A tube is made of bronze and has a rectangular cross-section shown in figure 2. If it is subjected to a torque of 35 N-m, determine the shear stress in the tube at points A and B. If the tube is having span of 2m and fixed at one end, what is the angle of twist at the free end where the torque is applied 38×10^9 N/m^2. [3+12]

5. Analyse the structure as shown in figure 3 by strain energy method. Sketch the bending moment diagram. [15]

6. A cantilever beam of length 'l' carries uniformly distributed load of w per unit run over whole length. The free end of the cantilever beam is supported on a prop. If the prop sinks by 'δ' find the prop reaction. [15]

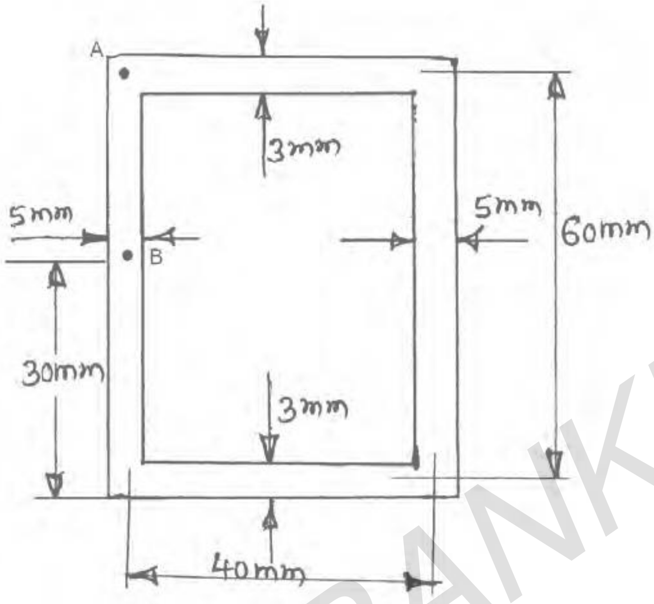

Figure 2:

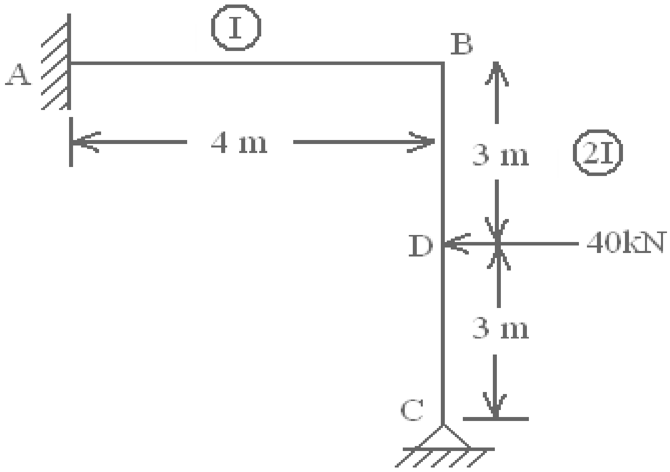

Figure 3:

7. A tubular steel strut is of 65mm external diameter and 50 mm internal diameter. It is 2.5 m long and hinged at both ends. The load acting is eccentric. Find the maximum eccentricity for a crippling load of 0.75 of the Euler load, the yield stress being 330 MPa, E = 210 GPa. [15]

8. (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. $\phi = Ax^3$
   iii. $\phi = A(x^4 - 3x^2y^2)$ [15]

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Code No: R09222104 **R09** **Set No. 4**

II B.Tech II Semester Examinations,APRIL 2011
AEROSPACE VEHICLE STRUCTURES-I
Aeronautical Engineering

Time: 3 hours **Max Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks

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1. Explain the construction of all the four cases of Mohr's circle method and draw with neat sketch. [15]

2. (a) Write short notes on Generalized Hook's law.
   (b) Derive the differential equations of equilibrium in 2D polar and coordinates in theory of elasticity. [7+8]

3. A steel beam of length 2 m is resting on an elastic foundation and has free ends. The beam is 10 mm wide and 120 mm thick and carries two concentrated forces of 1kN, one at each end. Determine the maximum bending stresses developed in the beam. Assume E = 2×10^5 N/mm^2, $\nu = 0.30$ and modulus of foundation as 10.5 N/mm^2. [15]

4. Determine the vertical deflection under 80 KN load for the beam shown in figure 4 using Castiglino's theorem E=2×10^5N/mm^2. [15]

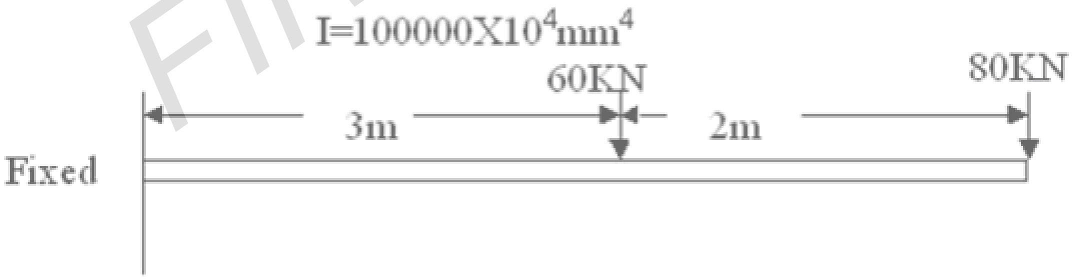

Figure 4:

5. Derive secant formula for a column both ends hinged and loading P, eccentrically with an eccentricity e. [15]

6. Derive Governing equations for deflection for any General Case of bending (not for simple bending) and also explain sign conventions with neat sketches. [15]

7. A beam of simply supported with uniformly distributed load of whole span of length 'l'.

   (a) Write expression for the potential energy.

(b) Determine the displacement u(x) using the Rayleigh-Ritz method. Assume displacement field $u(x)=a_0+ a_1x+a_2x^2$. [15]

8. (a) Explain the torsional shear flow.

(b) A structural Aluminum tuning of 60x100 mm rectangular cross section was fabricated by extrusion. Determine the shearing stress in the each of the four walls of such tubing when it is subjected to a torque of 2700 N-m(figure 5). [3+12]

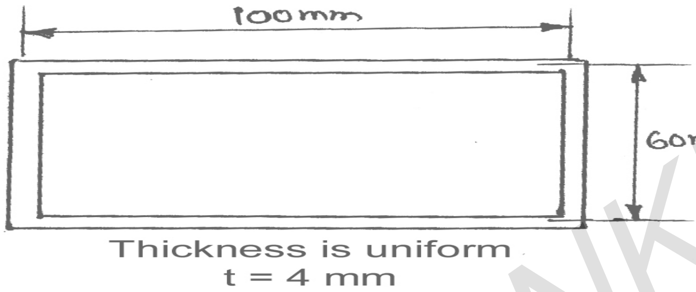

Figure 5:

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Code No: R09222104 **R09** **Set No. 1**

II B.Tech II Semester Examinations,APRIL 2011
AEROSPACE VEHICLE STRUCTURES-I
Aeronautical Engineering

Time: 3 hours **Max Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Derive equations of equilibrium.
   (b) Derive compatibility equations. [7+8]

2. A wooden beam of cross-section 80mm x 240 mm rests on an earth foundation. The modulus of elasticity of wood is 10GN/m^2 and modulus of foundation is 5MN/m^2. A uniformly distributed load of 2kN/m acts on the middle portion of this very long beam over a span of 2m. Compute the maximum deflection and the maximum bending stress in the beam. [15]

3. Calculate the nodal displacement in a system of four springs as shown in figure 6. [15]

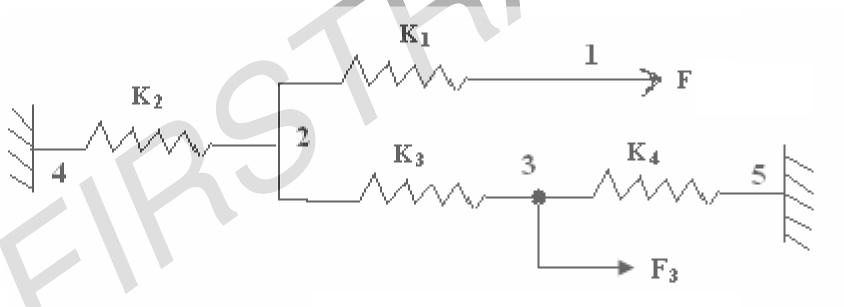

Figure 6:

4. A hollow cylindrical cast iron of 150mm external diameter and 15mm thickness, 3m 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 Eulers and Rankins formula will be equal. [15]

5. Explain the torsion of thin walled multicell structure section subjected to twisting. [15]

6. A steel rod of uniform circular cross-section is bent as shown below in figure 7, AB and BC being horizontal and CD vertical. The arms AB, BC and CD are of equal length. The rod is fixed at A and the other end D is free. A uniformly distributed load covers the length BC. Find the components of the displacement of the free end D in terms of EI and GJ. [15]

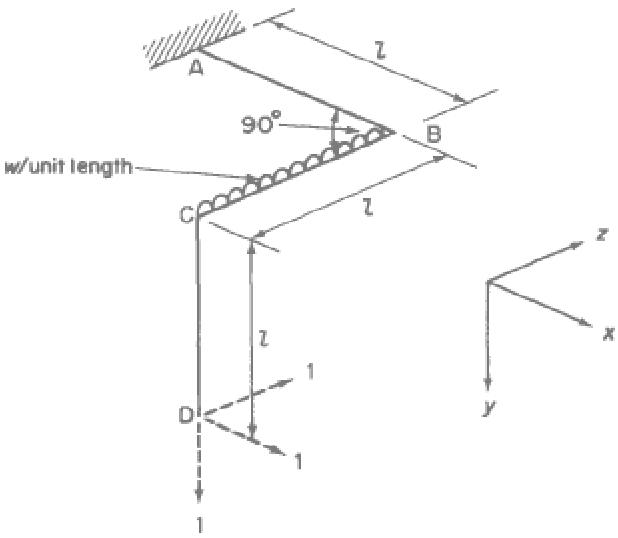

Figure 7:

7. A continuous beam of constant Moment of Inertia 'I' has three supports and two over hanging ends as shown in figure 8 The overhangs are adjusted such that the reactions on the three supports due to uniformly distributed load covering the entire beam are equal. Find the value of 'x' in terms of 'l'. [15]

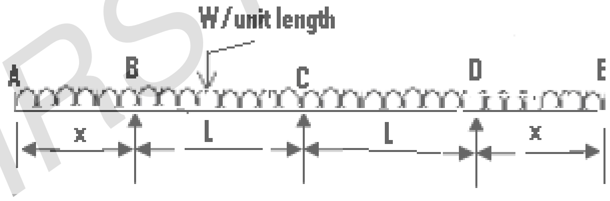

Figure 8:

8. (a) Explain with neat sketch basic modes of crack growth.
   (b) What is mean by S-N Curve and explain its significance in Fatigue failure? [7+8]

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Code No: R09222104 **R09** **Set No. 3**

II B.Tech II Semester Examinations,APRIL 2011
AEROSPACE VEHICLE STRUCTURES-I
Aeronautical Engineering

Time: 3 hours **Max Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) What are the different types of elastic foundation? Give examples.
   (b) Determine the maximum bending moment and the maximum deflection for a rail road rail subjected to a single wheel load of 125kN. The elastic support for the rail has a spring constant of k=14MN/m^2. The moment of inertia of rail is 3700×10^{-8}m^4, E=200GPa. Also calculate the maximum stress in the rail assuming that the depth of the rail 200 mm and that the distance of the centroidal axis of the cross-section of the rail from the top surface is 120 mm. [6+9]

2. A thin walled Box beam is use in the support structure of an aero plane wing. Locate its shear centre.(figure 9) [15]

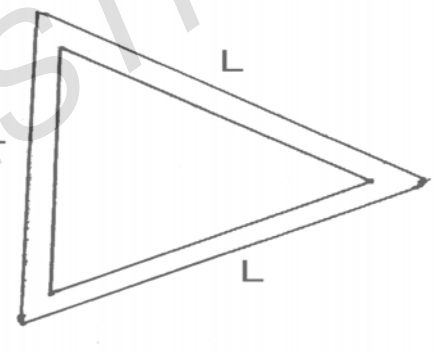

Figure 9:

3. (a) Explain with neat sketches, what is Beam, Frame, and Truss.
   (b) Explain what is statically determinate structures and statically indeterminate structures with neat sketches and examples. [6+9]

4. Calculate displacement at node 2 of a tapered bar as shown in figure 10 with area of cross-section A_1 at node 1 and A_2 at node 2 subjected to an axial tensile load 'P' [15]

5. A steel tube initially straight has an internal diameter of 50 mm and external diameter of 70 mm. Its length is 2m and carries a compressive load of 30kN acting parallel to the axis at an eccentricity of 20 mm. Determine the maximum stress induced in the tube. Take E = 2.1×10^5 N/mm^2. [15]

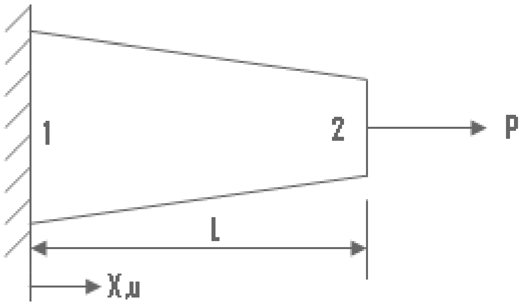

Figure 10:

6. Find the deflection of the beam as shown in figure 11 at the point of application of 1000 N load. Assume elastic deflections with EI = 10^6 N-m^2. [15]

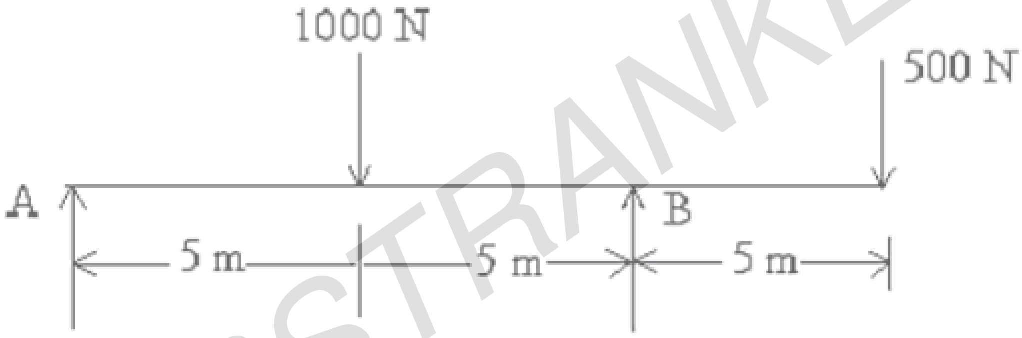

Figure 11:

7. (a) A rectangular block of material is subjected to a tensile stress of 100N/mm^2 on one plane and a tensile 50N/mm^2 on a plane at right angles, together with shear stress of 60N/mm^2 on the same planes. Find magnitude and direction, the magnitude of the greater shear stress.

   (b) The direct tensile and compressive stress is 60N/mm^2 and 40N/mm^2 respectively are applied on planes at right angles to each other. If the maximum principal stress is limited to 75N/mm^2 (tensile), find the shear stress that may be allowed on the planes. Also determine the minimum principal stress and the maximum shear stress. [7+8]

8. (a) Define the following

   i. Compatibility
   ii. Plane stress
   iii. Plane strain
   iv. body forces

   (b) Show that the Airy's stress function $\phi = A(xy^3 - \frac{3}{4}xyh^2)$ represents the stress distribution in a cantilever beam loaded at the free end with load P. Find the value of A if τ_{xy} =0 at $y = \pm\frac{h}{2}$ where b and h are width and depth respectively of the cantilever. [15]

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