Code No: R05312104 **Set No. 1**

III B.Tech I Semester Regular Examinations, November 2008
AEROSPACE VEHICLE STRUCTURES-I
(Aeronautical Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. A cantilever 3 m long carries a moment at 1 m from the free end. Calculate the value of E for the material of the cantilever if a moment of 50 Nm produces a deflection of 10 mm at the free end. Second moment of area for the cantilever cross-section is 15×10^{-8} m^4. [16]

2. A beam of length L is fixed at both ends and carries a load having varying intensity of zero per unit length at one end to q per unit length at the other end. Calculate the fixed end moments and reactions. [16]

3. Figure 3 shows a rolled steel beam of an unsymmetrical I-section. If the maximum bending stress in the beam section is not to exceed 40 M Pa, find the moment which the beam can resist. [16]

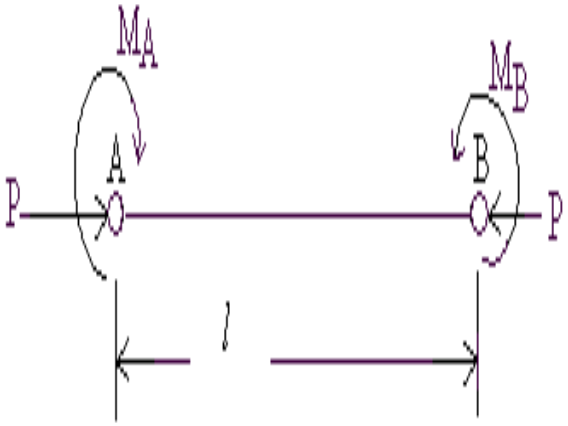

Figure 3

4. A short length of tube, 40 mm internal and 50 mm external dia, failed in compression at a load of 240 kN. When a 2m length of the same tube was used as a strut with fixed ends, the load at failure was 158 kN. Assuming that σ_c in the Rankine's formula is given by first test, find the value of constant 'a' in the same formula. Hence estimate the crippling load for a 3 m long strut made out of the tube with one end fixed and other hinged. [16]

5. A steel strut of length 3 m and dia 4 cm carries a compressive load of 40 kN and a transverse wind load of 1kN/m. Calculate the maximum stress induced. E= 200 G Pa [16]

6. (a) State the first Castigliano's theorem and derive the appropriate expression which represents the theorm.
   (b) Prove the Castiglano's first theorem by using concept of strain energy and complementary energy of a member subjected to simple tension. [6+10]

7. A mass is suspended from a spring system as shown in figure 7 Determine the natural frequency of the system. Take $k_1 = 5000$N/m, $k_2 = k_3 = 8000$ N/m, m = 25 kg. [16]

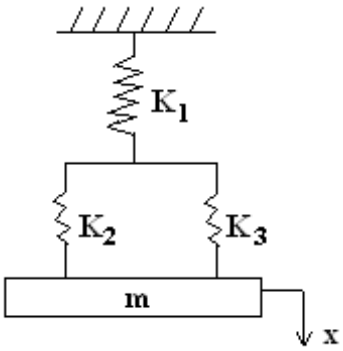

Figure 7

8. The two elastic springs are joined as shown in figure 8. Develop the stiffness matrix and then find internal forces in the springs. Explain the properties of the stiffness matrix developed. [12+4]

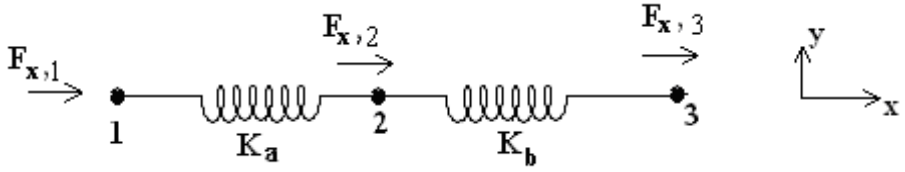

Figure 8

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Code No: R05312104 **Set No. 2**

III B.Tech I Semester Regular Examinations, November 2008
AEROSPACE VEHICLE STRUCTURES-I
(Aeronautical Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) What is statically determinate and in determine structures: Give examples with figures.
   (b) Derive formula for deflection of a simply supported beam subjected to pure bending. [8+8]

2. (a) Explain clearly the difference between statically determinate and statically indeterminate structure and how is order of redundancy determined?
   (b) A 6 m long beam of I-section is fixed at both ends and is subjected to a u.d.l., which produces a maximum stress of 100 M Pa in it. Determine the value of u.d.l. The depth of the beam section is 440 mm and value of I is 4×10^{-4} m^4. [6+10]

3. Locate principal axis for unsymmetrical sections by using
   (a) Mohr-circle method.
   (b) Circle of inertia method. [16]

4. What do you mean by 'buckling' of a column ? Derive the expression for buckling load of a column of length 'l' and having both ends fixed with compressive load 'P' acting at both the ends. [16]

5. A pin jointed strut carries a u.d.l. of intensity 'w' per unit length and an eccentric axial load P at an eccentricity of 'e' as shown in figure 5. Find the deflection at mid span of the strut. [16]

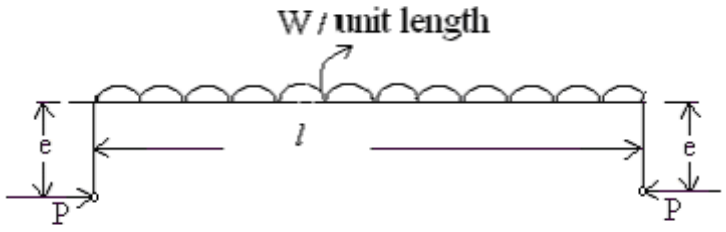

Figure 5

6. For a cantilever of length L and loaded with a point load P at its free end as shown in figure 6, the deflection equation (with x=0 at the free end) is given as $y = -(P/6EI)(2L^3 - 3L^2x + x^3)$. Use the Maxwell reciprocal theorm to determine

the deflection of free end of the cantilever when a load W is applied at a distance 'a' from the free end. [16]

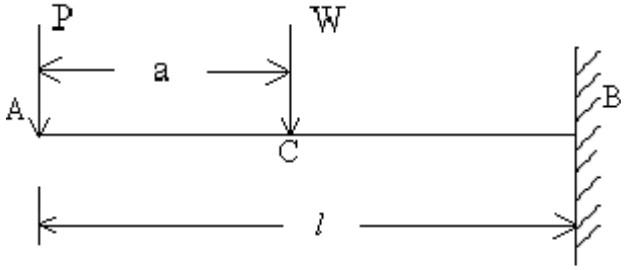

Figure 6

7. A transmission shaft is composed of straight section of diameter 30 mm and a section that tapers to a diameter of 50 mm as shown in figure 7 The input torque at point C is 50 kN.m. Determine the reactions by Rayleigh Ritz Method. Use G=50 G Pa. [16]

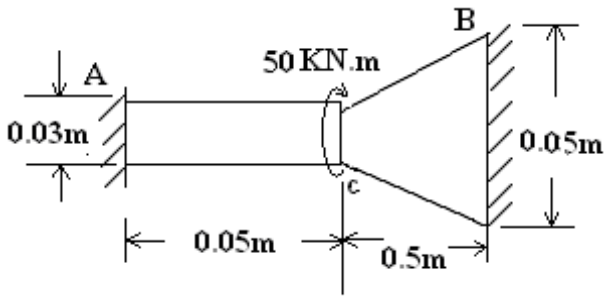

Figure 7

8. (a) Name the two methods based on matrix method which are used for structural analysis and explain them briefly.
   (b) Determine the stiffness matrix for the system shown in figure 8b [6+10]

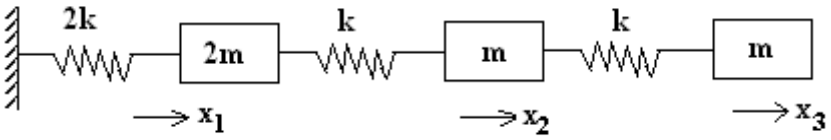

Figure 8b

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Code No: R05312104 **Set No. 3**

III B.Tech I Semester Regular Examinations, November 2008
AEROSPACE VEHICLE STRUCTURES-I
(Aeronautical Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. A cantilever beam A B 6 mm long is subjected to u.d.l of w KN/m. Spread over the entire lenght. Assume rectangular cross-section with depth equal to twice the breadth. Determine the minimum dimension of the beam so that the vertical deflection at free end does not exceed 1.5 cm and minimum stress due to bending does not exceed $10KN/Cm^2$. Take $E = 2 \times 10^7 N/Cm^2$. [16]

2. (a) Explain clearly the difference between statically determinate and statically indeterminate structure and how is order of redundancy determined?

   (b) A 6 m long beam of I-section is fixed at both ends and is subjected to a u.d.l., which produces a maximum stress of 100 M Pa in it. Determine the value of u.d.l. The depth of the beam section is 440 mm and value of I is 4×10^{-4} m^4. [6+10]

3. The cross-section of a beam is shown in figure 3. The beam is made of material with permissible stress in compression and tension equal to 100 M Pa and 140 M Pa respectively. Calculate the moment of resistance of the cross-section, when subjected to moment causing compression at the top and tension at the bottom. [16]

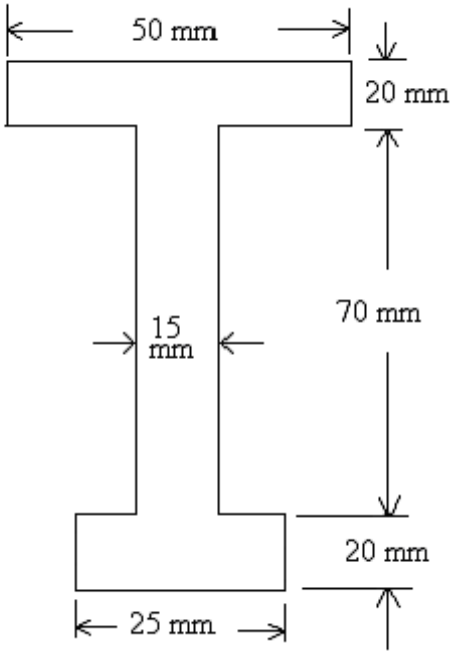

Figure 3

4. Find the safe axial load on a steel section of 8 m height having one end fixed and the other hinged which is built up of two 250 mm × 100 mm standard channels placed 10 cm apart back to back with two 300 mm × 10 mm plates riveted to each flange. For individual channel section, I_{XX} = 3687.9 cm^4; I_{YY} = 298.4 cm^4; A = 35.65 cm^2; distance of C.G. from base = 2.70 cm. Adopt factor of safety = 4. Use Rankine's formula. [16]

5. A beam column as shown in figure 5 has both ends hinged and carries a load W at a distance 'a' from the right hand support. Determine the expression of deflection for this beam-column. [16]

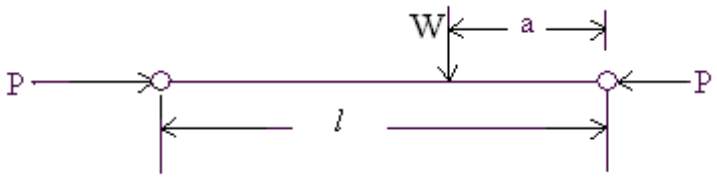

Figure 5

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. [16]

7. A mass is suspended from a spring system as shown in figure 7 Determine the natural frequency of the system. Take k_1 = 5000N/m, $k_2 = k_3$ = 8000 N/m, m = 25 kg. [16]

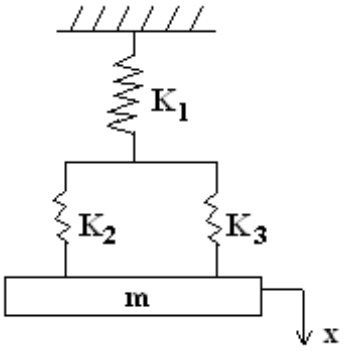

Figure 7

8. (a) Name the two methods based on matrix method which are used for structural analysis and explain them briefly.
   (b) Determine the stiffness matrix for the system shown in figure 8b [6+10]

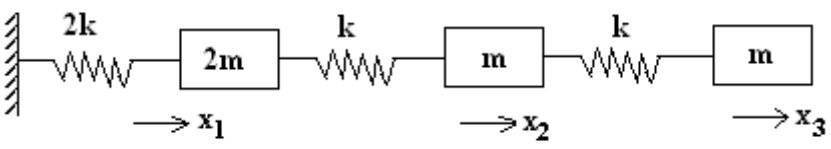

Figure 8b

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Code No: R05312104 **Set No. 4**

III B.Tech I Semester Regular Examinations, November 2008
AEROSPACE VEHICLE STRUCTURES-I
(Aeronautical Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. A timber beam of rectangular section has a span of 4.8 m and is simply supported at its ends. It is required to carry a total load of 45 kN uniformly distributed over the whole span. Find the values of the breadth 'b'and depth 'd' of the beam, if breadth of the beam is equal to to third of the depth. The maximum bending stress is not to exceed 7 M Pa and maximum deflection is limited to 9.5 mm. Take E for timber = 10.5 G Pa. [16]

2. (a) Explain clearly the difference between statically determinate and statically indeterminate structure and how is order of redundancy determined?
   (b) A 6 m long beam of I-section is fixed at both ends and is subjected to a u.d.l., which produces a maximum stress of 100 M Pa in it. Determine the value of u.d.l. The depth of the beam section is 440 mm and value of I is 4×10^{-4} m^4. [6+10]

3. A bending moment of 2 kN.m is applied to a Z - shaped beam as shown in figure3. Determine the stress at point A. For the section $I_X = 4.18 \times 10^6$ mm^4, $I_Y = 3.25 \times 10^6$ mm^4 and $I_{XY} = 2.87\times 10^6$ mm^4. [16]

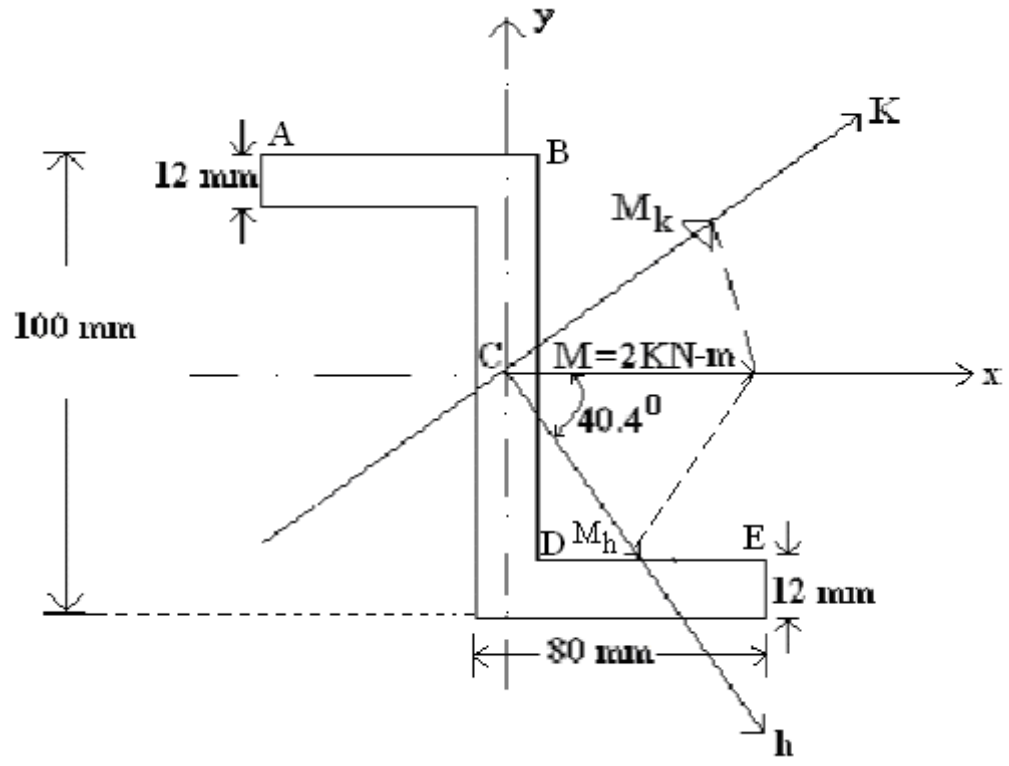

Figure 3

4. A strut 50 mm dia and 2.5 m long is subjected to an axial thrust of 6 kN along with a concentrated transverse central load of 3 kN. Calculate the maximum stress produced in the strut which is pin - jointed at ends. E=205 G Pa. [16]

5. The coupling rod of a locomotive 2.5 m long is 4 cm broad and 10 cm deep and of rectangular section. The maximum direct thrust in the rod is 150 kN applied axially. Self weight etc. give the rod a uniform lateral load of 4500 N/m length. Find the maximum bending moment and fibre stress at the centre. E= 210 G Pa. [16]

6. For a cantilever of length L and loaded with a point load P at its free end as shown in figure 6, the deflection equation (with x=0 at the free end) is given as $y = -(P/6EI)(2L^3 - 3L^2x + x^3)$. Use the Maxwell reciprocal theorm to determine the deflection of free end of the cantilever when a load W is applied at a distance 'a' from the free end. [16]

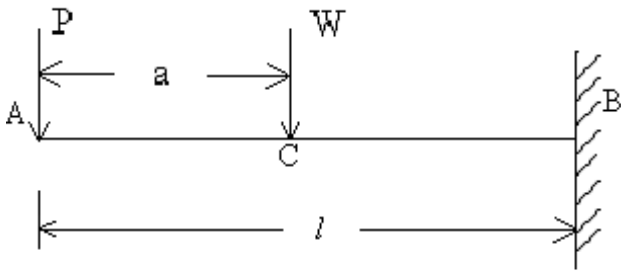

Figure 6

7. A mass is suspended from a spring system as shown in figure 7 Determine the natural frequency of the system. Take $k_1 = 5000$N/m, $k_2 = k_3 = 8000$ N/m, m = 25 kg. [16]

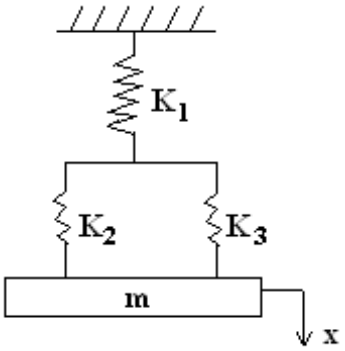

Figure 7

8. Determine the stiffness matrix for the uniform cantilever beam as shown in figure 8. [16]

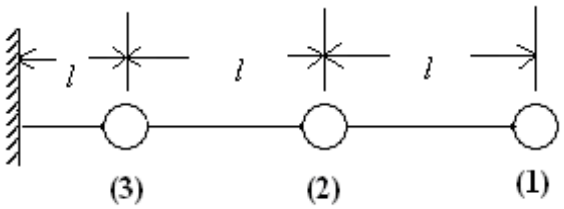

Figure 8

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