Code No: R09222104 | R09 | SET-1

B.Tech II Year - II Semester Examinations, April-May, 2012
AEROSPACE VEHICLE STRUCTURES - I
(Aeronautical Engineering)

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

Answer any five questions
All questions carry equal marks
- - -

1.a) Derive Governing equations for deflection of simply supported beam subjected to simple bending.
b) Explain statically determinate structures and statically indeterminate structures with neat sketches and examples. [5+10]

2. Derive equation for the deflection of a continuous beam under elastic foundation. Find the expressions for maximum deflection and bending moment of beam under concentrated load. [15]

3. A steel rolled joint ISMB300 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. Consider 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. $I_{xx}= 8.603\times10^7\ mm^4$, $I_{yy}= 4.539\times10^7\ mm^4$ [15]

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

5. What are principal planes and principal stresses? Draw and explain all the four cases of Mohr circle. Also explain how maximum and minimum principal stresses and maximum shear stress are determined using Mohr circle. [15]

6.a) Explain strain energy and complementary energy.
b) Derive the deflection equation of a cantilever beam subjected to point load 'p' at the free end by strain energy method. Consider length of the beam is 'l' and MI is constant.
c) State and derive the Castigliano's theorem-II. [3+9+3]

7. Explain Rayleigh-Ritz method and compare this method with any other two methods of determining displacement. [15]

8. Derive Bredt-Batho formula for single cell thin walled closed section beams subjected to Torsion. State all the assumptions clearly. [15]

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Code No: R09222104 | R09 | SET-2

B.Tech II Year - II Semester Examinations, April-May, 2012
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) Explain with neat sketches: Beam, Frame, Truss.
b) Explain statically determinate structures and statically indeterminate structures with neat sketches and examples. [6+9]

2.a) Write short notes on infinite and semi-infinite beams.
b) Determine the maximum bending moment and the maximum deflection of a rail road. Rail is subjected to a single wheel load of 150 kN. The elastic support for the rail has a spring constant of k=14 MN / m^2. The moment of inertia of rail is $3700 \times 10^{-8} m^4$, E=200GPa. Also calculate the maximum stress in the rail assuming that the depth of the rail is 200 mm and that the distance of the centroidal axis of the cross-section of the rail from the top surface is 100 mm. [3+12]

3.a) What are the assumptions and limitations of Euler's theory?
b) Derive the equations to calculate crippling loads for the following conditions:
i) one end is fixed and other end is free.
ii) both ends are provided with frictionless hinges. [5+10]

4.a) What is Airy's stress function in theory of elasticity?
b) Prove that the following are Airy's stress functions and examine the stress distribution represented by them:
i) $\phi = Ax^2 + By^2$ ii) $\phi = Ax^3$ iii) $\phi = A(x^4 - 3x^2y^2)$. [3+12]

5. Derive the equation to find out major and minor principal stresses of an oblique section of a body subjected to direct stress in two mutually perpendicular directions accompanied by a simple shear stress. Draw neat sketches. [15]

6.a) State and derive Castigliano's first theorem.
b) Derive the equations to find out the deflections of beams and Frames by Castingliano's First Theorem. [9+6]

7. Find the Stress by Rayleigh-Ritz Method at node 2 of a fixed beam shown in Figure.1 subjected to an axial load 'P' at node 2. Consider L/2 = E =A = 1 (one unit). [15]

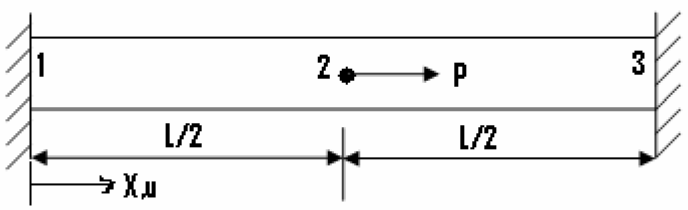

Figure.1

8.a) Derive Bredt-Batho Formula for a Thin walled single cell closed section.
b) Determine the shearing stress in each wall of a rectangular cross section of closed tube subjected to torque of 2700 N-m. Consider outer dimension of rectangular tube as width 100 mm, height 60 mm and thickness, 4 mm. [7+8]

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Code No: R09222104 | R09 | SET-3

B.Tech II Year - II Semester Examinations, April-May, 2012
AEROSPACE VEHICLE STRUCTURES - I
(Aeronautical Engineering)

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

Answer any five questions
All questions carry equal marks
- - -

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

2.a) What do you mean by beams on elastic foundation.
b) An aluminum alloy I-beam (depth 100 mm, $I_x=2.45\times10^6$ mm^4, E=70GPa) has a length L=7m and is supported by 8 springs (*k*=100N/mm) spaced at a distance *l* =1.0m 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 bending stress in the beam. [3+12]

3. A hollow cylinder of 150 mm external diameter 15 mm thick and 3 m long is hinged at one end and fixed at other. Find
a) The ratio of Euler and Rankin load.
b) For what length are the critical loads by Euler's and Rankin's formulae will be equal. [15]

4.a) Write short notes on Generalized Hooke's law.
b) Derive the differential equations of equilibrium in theory of elasticity in 2D polar coordinates and Cartesian coordinates. [5+10]

5.a) Derive the equations to find out the normal, tangential and resultant stresses of an oblique section of a body subjected to direct stress in two mutually perpendicular directions.
b) Explain the stress concentration due to holes and notches and also explain the three modes of fracture with neat sketches [8+7]

6.a) State and explain Maxwell's reciprocal theorem.
b) Determine the central deflection for the beam of Figure.1 by using unit load method. Take E=2 × 10^5 N/mm^2, I = 4 × $10^7 mm^4$.

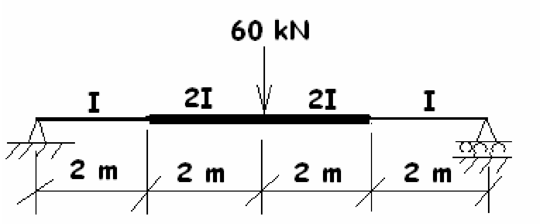

Figure.1

c) Find out the maximum deflection of a simply supported beam subjected to udl, by Castingliano's theorem. The length of the beam 'l' and 'EI' are constant. [3+8+4]

7. Explain Rayleigh-Ritz method and also explain its important characteristics. [15]

8. Explain the procedure to find out the shear flow in symmetric closed sections, and location of shear centre for both single and multi-cell sections. [15]

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Code No: R09222104	R09	SET-4

B.Tech II Year - II Semester Examinations, April-May, 2012
AEROSPACE VEHICLE STRUCTURES - I
(Aeronautical Engineering)

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

Answer any five questions
All questions carry equal marks
- - -

1. A simply supported beam span 'l' is subjected to uniformly distributed load 'W' kN/m throughout the beam. Find out maximum slope and deflection. [15]

2.a) What are the different types of elastic foundations? Give examples.
b) Derive the differential equation for the elastic line of a beam resting on an elastic foundation. [5+10]

3. Explain the design of the column with reference to short, intermediate and long columns. What are the various empirical relations used to predict the failure of columns? [15]

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 Airy's stress function in theory of elasticity? [6+4+5]

5.a) Draw the S-N curve with the help of Rotating beam machine experiment and also explain the methods to reduce the stress concentration effect with neat sketches.
b) The principal stresses at a point in the section of aircraft fuselage are 80 MPa and 40 MPa, both in tension. Find the normal, tangential and resultant stress intensities across a plane having 80 MPa stress. [10+5]

6. Derive the strain energy equations for
a) axial member b) Spring element
c) Rod twisting d) Flexural loading. [4+3+3+5]

7. Calculate the nodal displacement of the spring system shown in Figure.1 by Rayleigh-Ritz Method. [15]

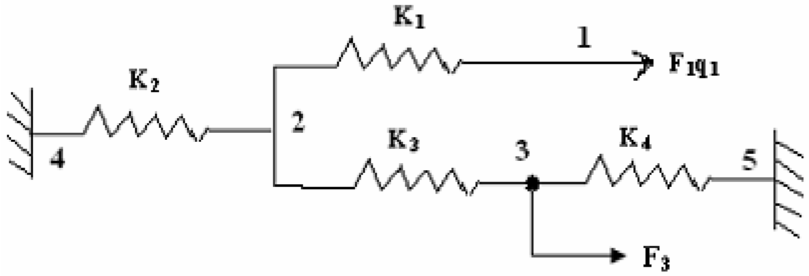

Figure.1

8. Determine the variation of shear flow throughout the tube of a rectangular cross section whose outer width and height are 100 mm and 200 mm respectively. The uniform thickness (t) of the tube is 4 mm. The tube is subjected to shear force of 20 kN. [15]

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