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Code No: 07A72103 **R07** **Set No. 2**

IV B.Tech I Semester Examinations,May 2011
STRUCTURAL ANALYSIS AND DETAILED DESIGN
Aeronautical Engineering

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

Answer any FIVE Questions
All Questions carry equal marks

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1. A mild steel shaft of 50 mm diameter is subjected to a bending moment of 2000 Nm and a torque T. If the yield point of the steel in tension is 200 MPa, find the maximum value of this torque without causing yielding of the shaft according to:
   (a) The maximum shear stress theory and
   (b) The maximum distortion energy theory of yielding. [16]
2. (a) Explain with neat sketches, the functions of aircraft structural components.
   (b) Explain briefly the air forces acting on a wing of aircraft. [10+6]
3. Explain design process of fuselage openings. [16]
4. What is reliability? What are the key elements of reliability? Explain. [16]
5. List out and explain the properties of engineering materials for use in the manufacture of an aircraft in detail. [16]
6. (a) How do you calculate the effective width of skin per side of stringer for
      i. Bending
      ii. Hydrostatic pressure
      iii. Torsion.
   (b) Explain transverse shear general instability in combined torsion and bending. [12+4]
7. A Monocoque cylinder has the following dimensions: radius r = 850 mm thickness (t) = 1.25 mm, length (L) =1500 mm. What is the torsional moment this cylinder can sustain? Use design values based on 90% probability, 95% confidence level (for this case F_{st} / e = 0.000082) and 99% probability, 95% confidence level (for this case F_{st} / E = 0.000060). Discuss the above two levels. Take μ = 0.3, E = 74 kN / mm^2. [16]

Geometrical parameter (z)	Torsional Buckling Coefficient (K_t)
2000	160
3000	235

8. Find the forces (CD, C_V, C_D, B_V, A_V, B_D, A_D) in each member of main landing gear shown in Figure 1. Assume additional data if necessary. [16]

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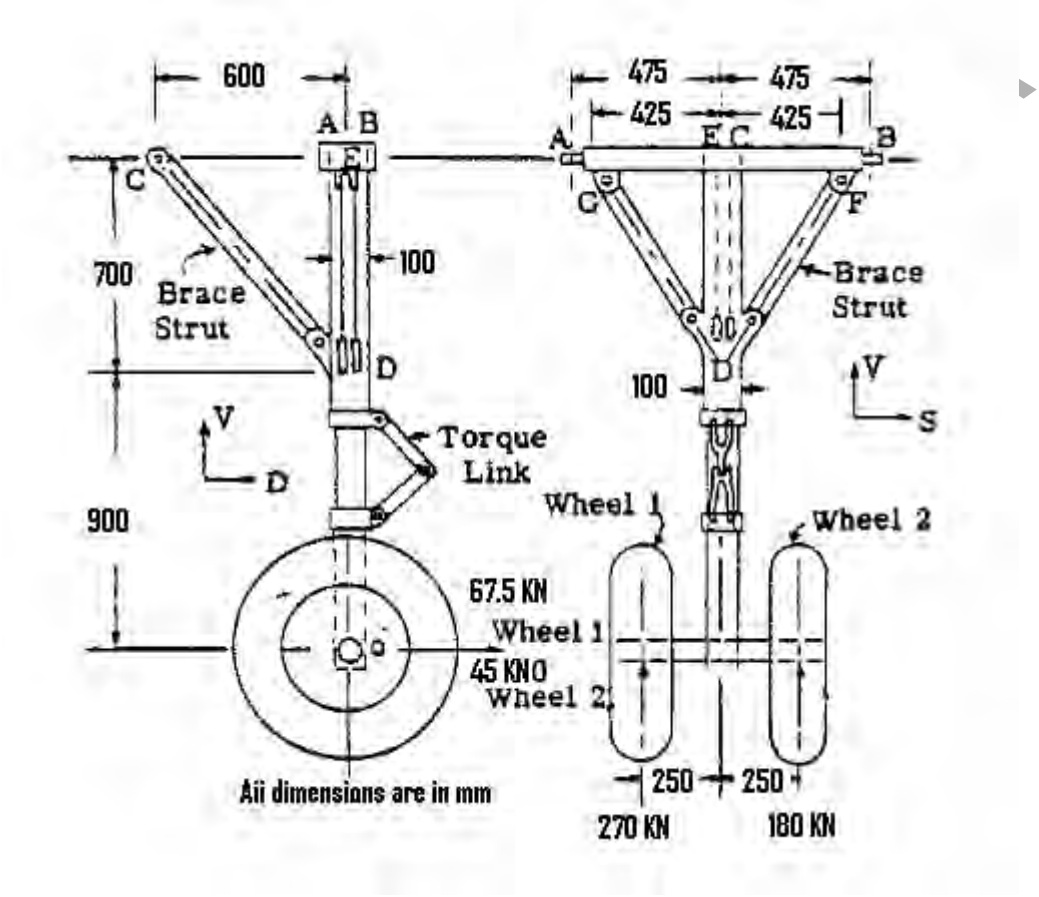

Figure1:

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Code No: 07A72103 **R07** **Set No. 4**

IV B.Tech I Semester Examinations,May 2011
STRUCTURAL ANALYSIS AND DETAILED DESIGN
Aeronautical Engineering

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

Answer any FIVE Questions
All Questions carry equal marks

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1. The thin-walled single cell beam as shown in figure 1 has been idealized into a combination of direct stress carrying booms and walls carrying only shear stress. If the section supports a vertical shear load of 10 kN acting in the vertical plane through booms 2 and 7. Calculate the distribution of shear flow around the section. Each Boom area = 200 mm^2. [16]

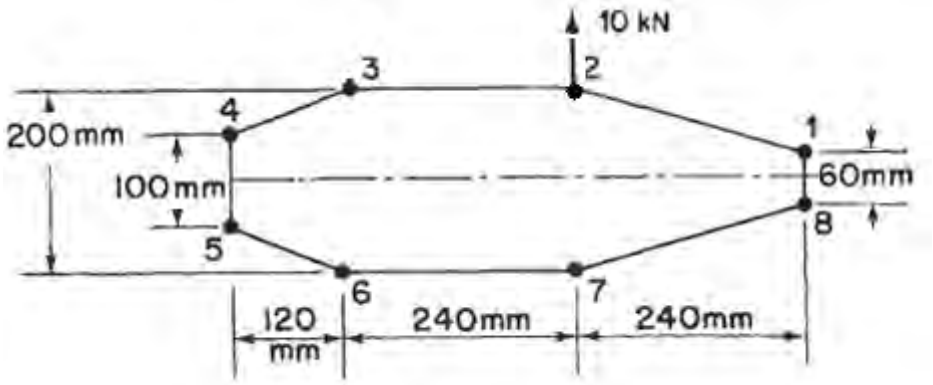

Figure 1:

2. Explain the construction, working procedure and need of a torque link in a landing gear. Find out the reaction at point 2 of torque link shown in Figure 2. Assume additional data if necessary. [16]

3. The load on a bolt consists of an axial pull of 10 kN together with a transverse shear force of 5 kN. Find the diameter of bolt required according to:
   (a) Maximum shear stress theory
   (b) Maximum strain energy theory and
   (c) Maximum distortion energy theory. [16]

4. Draw a wing box and give a brief discussion of wing box design. [16]

5. Explain the terms landing and parking in order to understand the varied design considerations of landing gear. [16]

6. Explain the role of the computers in aircraft design process. [16]

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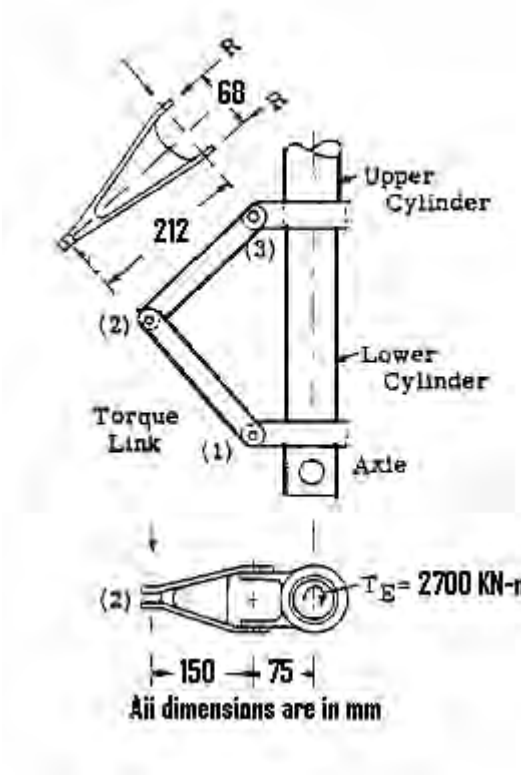

Figure 2:

7. Explain the following:
   (a) Control surface
   (b) Emergency crash loads
   (c) Ditching and Breakway design
   (d) Ground gust loads. [16]

8. What are the design strategies for improving system reliability? Explain in general and in the context of structures. [16]

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Code No: 07A72103 **R07** **Set No. 1**

IV B.Tech I Semester Examinations,May 2011
STRUCTURAL ANALYSIS AND DETAILED DESIGN
Aeronautical Engineering

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

Answer any FIVE Questions
All Questions carry equal marks

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1. Give a brief summary of aircraft wing loads and explain the design of a variable swept wing of aircraft. [16]
2. Explain the following with neat sketches: Instability of aircraft structures. [16]
3. (a) Explain the altitudes of the airplane that are specified by government aviation agencies for design of landing gear with neat sketches.
   (b) Explain the construction of Oleo strut with neat sketches. [8+8]
4. Explain the important roles of the following aspects of a high speed aircraft:
   (a) Structural stiffness
   (b) Aerodynamic characterstics
   (c) Load analysis of high speed aircraft. [5+5+6]
5. Write a procedure for setting up the reliability block diagram (RBD) for a system with four levels. [16]
6. The thin-walled single cell beam as shown in figure 6 has been idealized into a combination of direct stress carrying booms and walls carrying only shear stress. The section supports a vertical shear load of 10 kN acting in the vertical plane through booms 3 and 6. Calculate the distribution of shear flow around the section. Boom areas: B1 = B8 = 200 mm^2 ,B2 = B7 = 250 mm^2, B3=B6=400 mm^2, B4 = B5=100 mm^2.

   [16]
7. Explain Kinematic Guidelines and Gear Lock Design Guidelines while designing the landing gear. [16]
8. A cylindrical shaft made of steel of yield strength 700 MPa is subjected to static loads consisting of bending moment 10 kN-m and a tensional moment 30 kN-m. Determine the diameter of the shaft using two different theories of failure, and assuming a factor of safety 2. Take E = 210 GPa and Poisson's ratio = 0.25. [16]

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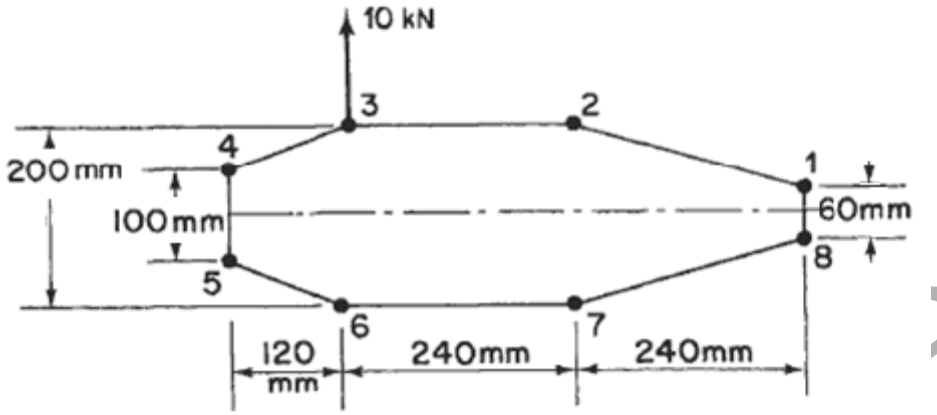

Figure 6:

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

Answer any FIVE Questions
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1. A cylindrical shell made of mild steel plate, 1.2 m in diameter is to be subjected to an internal pressure of 1.5 MN/m^2. If the material yields at 200 MN/m^2, calculate the thickness of the plate on the basis of the following theories, assuming a factor of safety 3, using
   (a) Maximum shear stress theory and
   (b) Maximum shear strain energy theory. [16]
2. Draw and explain wing spars of aircraft wings. [16]
3. Explain the buckling of spherical plates under uniform external pressure. [16]
4. Explain the design of wing and fuselage intersection with the help of neat sketches. [16]
5. The landing gear brace struts (circular in cross section) are as shown in figure 5. The member ED is subjected to an axial Force of 10 kN and transverse shear force of 5 kN. The yields strength of the struts material is 300 MPa. Determine the diameter of brace struts by using
   (a) Maximum normal stress theory.
   (b) Maximum shear stress theory. Take FOS is 2.5, Poisson's ratio (μ) = 0.25. [16]

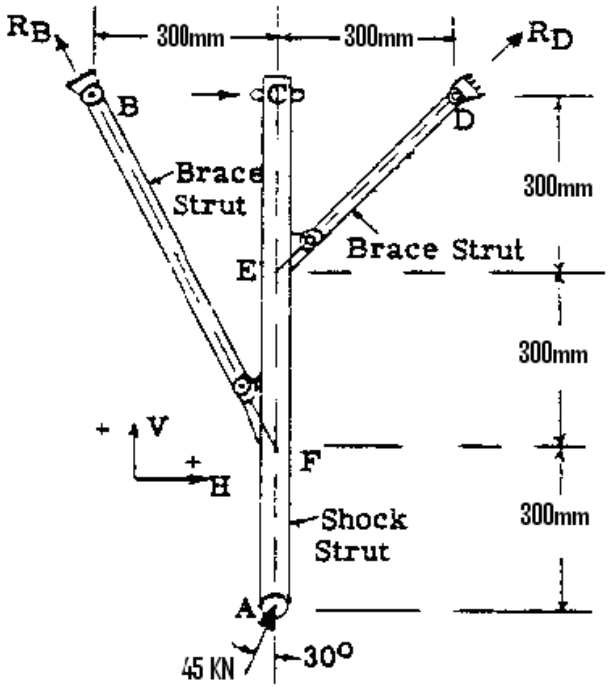

Figure 5:

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6. Explain the engineer's responsibility in designing an aircraft. [16]

7. (a) Find out the maximum stresses developed in a plate with holes and notches subjected to tensile loads.

   (b) Explain different design methods to reduce stress concentration effect with the help of neat sketches. [8+8]

8. A 762 mm radius circular cross-section fuselage having 0.8 mm skin thickness and 16 numbers of stringers equally placed around the circumference is shown in figure 8. The stringers numbers 1 and 9 are placed on y-axis, numbers 5 and 13 are placed on x-axis. The cross-sectional area of each stringer is 100 mm^2 and the vertical distance from mid line of the section wall to stringer number (1) is 381.0 mm, to (2) and (16), 352.0 mm, to (3) and (15), 269.5 mm, to (4) and (14), 145.8 mm. The fuselage is subjected to a bending moment of 200 kNm applied in the vertical plane of symmetry at this section. Calculate the direct stress distribution. [16]

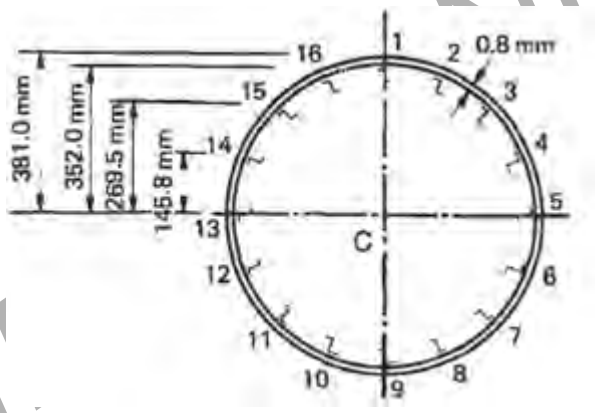

Figure 8:

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