Code No: 57114

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech IV Year I Semester Examinations, November - 2015
AIRFRAME STRUCTURAL DESIGN
(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 design considerations for design of any aircraft?
 b) Define limit and ultimate loads and also explain the load factor. [8+7]

2.a) How to determine the wing design loads and explain with appropriate the equations and free body diagrams?
 b) Explain the propulsion loads for the design of airplane. [9+6]

3.a) What is crippling stress and explain the procedure how to determine the crippling stress for a channel section with necessary equations?
 b) Find the critical buckling load for simply supported beam of rectangular 40 mm × 50mm cross section as shown in figure 1. Take G = 200 GPa and L = 2 m. [9+6]
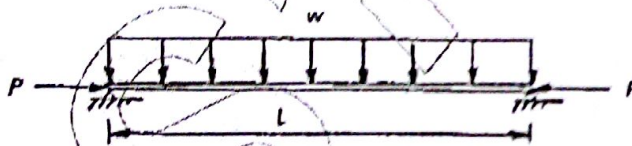

Figure 1

4.a) What are the different types of removable fasteners used in aircraft joints?
 b) Explain the different types of fasteners and their advantages and limitations. [7+8]

5.a) Explain the functions of wing control surfaces.
 b) What is fail-safe design and explain? [9+6]

6.a) Explain the various typical fuselage configurations of commercial airplanes.
 b) Explain the different configurations of stabilizer and aft fuselage intersections. [8+7]

7.a) What are the precautions might be helpful for stowage and retraction for landing gear?
 b) Explain the selection of shock absorbers for airframe structure design requirements. [7+8]

8.a) Explain briefly about fatigue design philosophy.
 b) Explain the terms design life, fatigue life, safe life and service life related to airframe structural design. [7+8]

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1. How is an airplane built? Explain with the help of a block diagram. [15]

2.a) Explain structural stiffness, aerodynamic characteristics in structural design criteria
 b) Explain the physical properties of the Engineering materials. [15]

3.a) Define and explain the following theories of failure:
 (i) Maximum shear stress,
 (ii) Maximum strain energy theory,
 (iii) Maximum shear strain energy theory.
 b) Explain Flight loads in brief. [15]

4.a) What are the advantages and disadvantages of riveted joints?
 b) Write a short note on semi tubular rivets, Blind rivets, Hi-Lok fastener and Taper fasteners. [15]

5.a) Draw and explain different types of wing leading and trailing edges used to increase the maximum lift at low speed flight and also explain the advantages and disadvantages of different drive systems used in aircraft wings.
 b) What are the advantages of single, double and triple slotted flaps? [15]

6. A Fuselage has the circular cross-section as shown in figure below the cross-sectional area of Each stringer is 100mm^2 and the fuselage is subjected to bending moment of 200 KNm applied in the vertical plane of Symmetry, at this section. Calculate the direct stress distribution. [15]
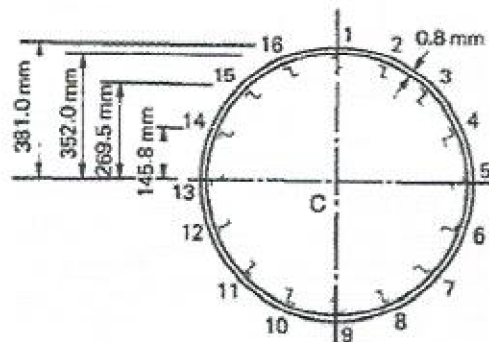
7. The load on a landing gear bolt consists of an axial pull of 8kN together with a transverse shear force of 4kN. Estimate the diameter of the bolt required according to (i) maximum shear stress theory (ii) shear energy theory and (iii) shear strain energy theory. Assume elastic limit in tension as 240 N/mm², Poisson's ratio=0.3 and a factor of safety of 3. [15]

8. a) What is mean by S-N Curve and explain its significance in Fatigue failure.
   b) Describe the concept of fatigue crack propagation. [15]

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