B.Tech. AEROSPACE ENGINEERING (BTAE)

Term-End Examination

June, 2016

00458

BAS-014 : AIRCRAFT STRUCTURES

Time : 3 hours   *Maximum Marks : 70*

Note : *Answer any **seven** questions. All questions carry equal marks. Use of non-programmable calculator is permitted.*

1. Answer the following in brief :

    (a) In relation to an aircraft structure, explain the term 'torsion'.   *3*

    (b) Explain three types of fuselage structures.   *4*

    (c) Explain Slenderness Ratio.   *3*

2. A timber beam is freely supported on supports 6 metres apart. It carries a uniformly distributed load of 12 kN per metre run and a concentrated load of 9 kN at 2·5 metres from the left support. If the stress in the timber is not to exceed 8 N/mm², design a suitable section making the depth twice the width.   *10*

3. A hollow column has an outer diameter of 200 mm and thickness of 20 mm. It is 5 metres long and both its ends are hinged. Compute

(a) Safe load by Rankine's formula, if factor of safety is 4,

(b) Slenderness Ratio,

(c) Ratio of Euler's and Rankine's critical loads.

Given : $\sigma_c = 550$ N/mm^2, $a = \dfrac{1}{1600}$, and

$E = 9.4 \times 10^4$ N/mm^2.   *10*

4. Explain the following parameters in brief :   *10*

(a) Shear stress

(b) Stress – Strain curve

(c) Bending Moment

(d) Buckling of Column

(e) Difference between Thick and Thin cylinders

5. (a) Derive an expression for Euler's critical load of a column when both its ends are fixed.   *7*

(b) Differentiate between short and long columns.   *3*

6. A simply supported beam ABC with supports at A and B, 6 metres apart and with an overhang BC, 2 metres long, carries a uniformly distributed load of 15 kN per metre over the whole length as shown in Figure 1. Draw Shear Force and Bending Moment diagrams. *10*
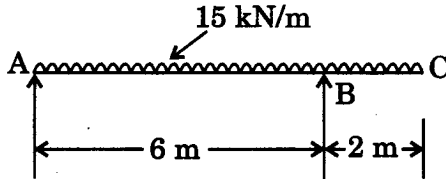

Figure 1

7. Write short notes on the following :

(a) Strain gauges *4*

(b) Load cells *3*

(c) Torque wrenches *3*

8. A vessel in the shape of a spherical shell, 800 mm in diameter, 10 mm shell thickness, is completely filled with a fluid at atmospheric pressure. Additional fluid is then pumped in till the pressure increases by 5 N/mm². Find the volume of this additional fluid. Given that $\mu = 0.25$ and $E = 2 \times 10^5$ N/mm² for the shell material. *10*

9. Explain the following terms :

   (a) Section modulus   *3*

   (b) Poisson ratio   *3*

   (c) Assumptions made in Euler's theory   *4*

10. A solid aluminium shaft, 1 metre long and 50 mm diameter, is to be replaced by a tubular steel shaft of the same length and the same outside diameter (i.e., 50 mm) such that each of the two shafts could have the same angle of twist for unit torsional moment over the total length. What must be the inner diameter of the tubular steel shaft ? Modulus of rigidity of steel is three times that of aluminium.   *10*