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BAS-008

B.TECH. (AEROSPACE ENGINEERING) (BTAE)

Term-End Examination

June, 2013

BAS-008 : STRENGTH OF MATERIALS

Time : 3 Hours *Maximum Marks : 70*

Note : *Attempt **any seven** questions. All questions carry equal marks. Use of scientific calculator is permitted.*

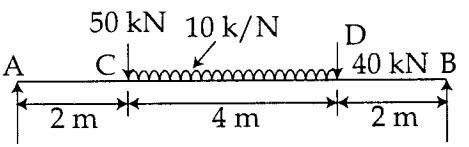
1. (a) What is a bulk modulus ? Derive an expression for Young's Modulus in terms of bulk modulus and Poisson's ratio. 5+5=10

   (b) Find an expression for the total elongation of a bar due to its own weight, when the bar is fixed at its upper end and hanging freely at the lower end.

2. A steel rod of 20mm diameter passes centrally through a copper tube of 50mm external diameter and 40mm internal diameter. The tube is closed at each end by rigid plates of negligible thickness. The nuts are tightened lightly on the projecting parts of the rod. If the temperature of the assembly is raised by 50°, calculate the stress developed in copper and steel. Take E for steel and copper as 200GN/m^2 and 100 GN/m^2 and α for steel and copper as 12×10^{-6} per °C and 18×10^{-6} per °C. 10

3. An elemental cube is subjected to tensile stresses of $30N/mm^2$ and $10N/mm^2$ acting on two mutually perpendicular planes and a shear stress of $10N/mm^2$ on these planes. Draw the Mohr's circle and hence or otherwise determine the magnitudes and directions of principal stress and also the greatest shear stress. **10**

4. A simply supported beam of length 10m, carries the uniformly distributed load and two point loads as shown in fig. Draw the shear force and bending moment diagram for the beam. Also calculate the maximum bending moment. **10**



5. (a) What do you mean by 'simple bending' or 'pure bending' ? What are the assumptions made in the theory of simple bending. **5+5=10**

   (b) What do you mean by section modulus ? Find an expression for section modulus for a circular section.

6. A closely coiled helical spring of round steel wire 10mm in diameter having 10 complete turns with a mean diameter of 12cm is subjected to an axial load of 200N. Determine **10**

   (a) the deflection of spring,

(b) maximum shear stress in the wire,

(c) stiffness of the spring.

Take $C=8x10^4 N/mm^2$

7. Derive an expression for strain energy stored in a body when the Load is applied with impact. 10

8. Explain with reasons which theory of failure is best suited for : 5+5=10

(a) Ductile materials

(b) Brittle materials

9 A timber beam 100mm wide and 200mm deep is to be reinforced by bolting on two steel flitches each 150mm by 12.5mm in section. Calculate the moment of resistance for flitches attached symmetrically at the top and bottom. Allowable stress in timber is $6N/mm^2$. Take $E_s=2x10^5 N/mm^2$ and $E_t=1x10^4 N/mm^2$. 10

10. Write short notes on *any four* of the following 2.5x4=10

(a) Castigliano's theorem

(b) Hooke's Law

(c) Fully restrained stepped bar

(d) Shear Centre

(e) Moment of resistance

(f) Factor of safety