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BAS-008

B.TECH. (AEROSPACE ENGINEERING) (BTAE)

01473

Term-End Examination

December, 2012

BAS-008 : STRENGTH OF MATERIALS

Time : 3 Hours *Maximum Marks : 70*

Note : *(i) Answer **any five** questions.*

*(ii) **All** questions carry **equal** marks.*

*(iii) Use of Non-Programmable Scientific calculator is **permitted**. Assume any missing data if required.*

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1. A fixed beam is subjected to a point load at its mid span. Derive equation for : **14**

(a) Shear force.

(b) Bending moment.

(c) Slope and

(d) Deflection.

Draw corresponding diagrams.

2. A 10 mm diameter steel rod passes centrally through a copper tube 25 mm external diameter and 15 mm internal diameter and 2.5 m long. The tube is closed at each end by thick steel plates secured by nuts. The nuts are tightened until the copper tube is reduced in length by 0.6 mm. The whole assembly is then raised in temperature by **14**

20°C. Calculate the stresses in the steel rod and copper tube before and after the rise in temperature. The thickness of the end plates remains unchanged.

E steel = 208000 N/mm^2

E copper = 104000 N/mm^2

$\alpha_s = 12 \times 10^{-6}/°C$

$\alpha_{cu} = 17.5 \times 10^{-6}/°C$

3. (a) Derive the expression for maximum deflection of a cantilever beam subjected to uniformly distributed load. 7

(b) State Rankine theory and Tresca's theory of elastic failure. 7

4. A beam ACB, hinged at the ends A and B, carries a uniformly distributed load of intensity W_1 per unit length acting downwards from the end A upto its centre C. Rest of the portion of the beam is covered with an upward uniformly distributed load of intensity W_2 per unit length. 14

(a) Draw the SF and BM diagram if $W_2 = 2W_1$

(b) Locate the position of the point of contraflexure.

5. Construct and describe Mohr's stress circle. 14

6. A cantilever has a free length of 3m. It is of T section with the flange 100 mm by 20 mm, web 200 mm by 10 mm, the flange being in tension. 14

What load per meter run can be applied if the maximum tensile stress is 40 N/mm^2 ? What is the maximum compressive stress ?

7. Show that the strain energy U due to bending of a beam of rectangular section simply supported at ends with a concentrated load P at the centre **14**

can be expressed as $U = \frac{\sigma^2}{18E} \times$ (Volume of beam),

where σ is the maximum bending stress in the beam and E is the Young's modulus. Compare the strain energy when the beam is loaded axially by load P if the ratio of length of beam to depth is 6.

8. A shaft is subjected to a bending moment and a twisting moment simultaneously and at a particular section the bending moment is M and twisting moment is T. Show that the strain energy per unit volume is **14**

$$U = \frac{1}{2E}\left[2^{\sigma_b^2} + 2q^2\left(\frac{m+1}{m}\right)\right]$$

where σ_b is the maximum bending stress and q is the maximum shear stress and 1/m is the Poisson's ratio, and E is the Young's modulus.