Strength of Materials-I
(ME-201, Dec 2005)

Time: 3 Hours Max. Marks: 60

Note: Question No. 1 is compulsory. Attempt any four questions from section B and two questions from section C.

Section-A

1. (a) What is the utility of engineering stress-strain curve?
   (b) How is thermal stress different from ordinary stress?
   (c) How do you explain the negative sign with a shear stress?
   (d) What is the shape of bending moment diagram in case of a uniformly distributed load applied at any point of a beam?
   (e) State the rule to avoid reverse in circular sections.
   (f) Where does the maximum shear stress occur in an elliptical bar subjected to twisting?
   (g) Name various methods to determine slope and deflection in beams.
   (h) What is flexural rigidity?
   (i) Why is the longitudinal stress in a thin cylinder zero?
   (j) What is the effect of lateral load on the buckling of columns?

Section-B

2. A brass bar having cross sectional area of 1000 mm^2 is subjected to axial forces as shown in figures. Find the total elongation of the bar. Take $E=1.05 \times 10^5$ N/mm^2.

Figure.

3. Define a composite bar. How will you find the stresses and load carried by each member of a composite bar?
4. A cast iron cantilever of length 1.5 meter fails when a point load W is applied at the free end. If the section of the beam is 40 mm x 60 mm and the stress at the failure is 120 N/mm^2. Find the point load applied.
5. Derive an expression for circumferential stress and longitudinal stress for a thin shell subjected to an internal pressure.
6. Derive an expression for the Euler's crippling load for a long column with both its ends fixed.

Section-C

7. At a certain point in a strained material, the stresses on the two planes are at right angles to each other are 40 N/mm^2 and 20 N/mm^2 both tensile. They are accompanied by a shear stress of magnitude 20 N/mm^2. Find graphically or otherwise the location of principal planes and evaluate the principal stresses.
8. A simply supported beam of length 8 m rests on supports 6 m apart, the right hand end is overhanging by 2 m. The beam carries a uniformly distributed load of 1500 N/m over the entire length. Draw S.F. and B.M. diagram and find the point of contra flexure, if any.
9. (a) Prove that the strain energy stored in a body due to torsion is given by

$$u = (q^2/4c) \times v$$

   Where q = shear stress at the surface
   C = Modulus of rigidity
   V = Volume of the body
   (b) Explain Macaulay's method for finding out slope and deflection in case of statically determinate beams.