Strength of Materials-I
(ME-201, Dec 2006)

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) State Hooke's law.
   (b) If a bar is stretched in such a manner that all the lateral strain is prevented, what is the poison's ratio?
   (c) What is the maximum shear strain in an element where the principal strains are 3.6×10^{-4} and -6×10^{-5}?
   (d) Mention the position of maximum shear force in a cantilever beam.
   (e) Define pure bending in beams.
   (f) Sketch the shear stress distribution across a rectangular section with a central circular hole.
   (g) Shear stress in a shaft due to torque is maximum at the centre of cross section. State True or False.
   (h) A boiler shell 200 cm diameter and 1.5 cm thickness is subjected to an internal pressure of 1.5 MPa. What is the hoop stress induced in the shell?
   (i) Explain buckling of columns.
   (j) The maximum deflection in a cantilever beam is y. If the beam depth is doubled, what will be the corresponding deflection?

Section-B

2. Derive the relation between modulus of elasticity and modulus of rigidity.
3. An element in a strained material is subjected to normal stresses of 60 MPa and -40 MPa on two mutually perpendicular planes together with a shear stress of 40 MPa. Determine the principal stresses and maximum shear stress together with their planes.
4. A simply supported beam of 8m span is subjected to u.d.l. of 20 KN/m over the left half and a point load of 80 KN at 2m from the right end. Draw shear force and bending moment diagrams.
5. Determine the diameter of a solid shaft to transmit 150 HP at 200 r.p.m. The allowable shear stress is 75 N/mm^2 and the allowable twist is 1º in a length of 3m.
6. Determine the increase in volume of a thin walled spherical shell subjected to an internal pressure p.

Section-C

7. A 300 X 150 mm R.S.J. of flange thickness 20 mm and web thickness 13 mm is subjected to a shear force of 200 KN. Draw the shear stress distribution across the section and find the percentage of shear carried by web.
8. A column of 12 cm external diameter, 9 cm internal diameter, 3 m long, hinged at both ends carries a load of 80 KN at an eccentricity of 2 cm from the geometrical axis. Calculate the maximum and minimum stresses. Also calculate the maximum eccentricity for no tension. Assume E=205 GPa.
9. A simply supported beam of span 8 m is subjected to two concentrated loads of 60 KN and 80 KN at 3m and 5m from left end respectively. Determine
   (a) Slopes at the supporters
   (b) Deflection under the loads
   (c) Position and magnitude of maximum deflection.