

Roll No. 

Total No. of Pages : 02

Total No. of Questions : 09

B.Tech.(AE) (2011 Onwards) (Sem.-3)

**MECHANICS OF MATERIALS**

Subject Code : BTAE-301

Paper ID : [A1112]

Time : 3 Hrs.

Max. Marks : 60

**INSTRUCTION TO CANDIDATES :**

1. SECTION-A is **COMPULSORY** consisting of **TEN** questions carrying **TWO** marks each.
2. SECTION-B contains **FIVE** questions carrying **FIVE** marks each and students has to attempt any **FOUR** questions.
3. SECTION-C contains **THREE** questions carrying **TEN** marks each and students has to attempt any **TWO** questions.

**SECTION-A**1. **Write briefly :**

- (a) State Hook's law.
- (b) What is Poisson's ratio ?
- (c) What are Principal Stresses ?
- (d) What do you understand by a concentrated load ?
- (e) What is a Flitched Beam ?
- (f) Define total strain energy theory.
- (g) What is Modulus of rupture ?
- (h) Give any two limitations of Euler's formula.
- (i) What is Hoop Stress ?
- (j) What is the meaning of point of contraflexure?

**SECTION-B**

2. Derive an expression for a relationship between Young's modulus and modulus of rigidity.
3. The principal stresses at a point across two perpendicular planes are  $75 \text{ MN/m}^2$  tensile and  $35 \text{ MN/m}^2$  tensile. Using Mohr's circle method, find the normal, tangential and resultant stresses and its obliquity on a plane at  $20^\circ$  with the major principal plane.

4. What is the difference between a strut and a column ? Give the general classification of columns.
5. A horizontal cantilever 6m long carries loads of 2 KN and 3 KN at 2 m and 5 m respectively from fixed end and a UDL of 10 KN over its entire length. Draw the SF and BM diagrams.
6. State and explain Maximum Principal Strain Theory. Give its graphical representation.

### SECTION-C

7. A cylindrical shell 3 m long, which is closed at the ends, has an internal diameter of 1 m and wall thickness of 15 mm. Calculate the circumferential and longitudinal stresses induced and also change in dimensions of the shell if it is subjected to an internal pressure of  $1.5 \text{ MN/m}^2$ . Take  $E = 200 \text{ GN/m}^2$  and  $\nu = 0.3$ .
8. A flitched beam consists of a wooden joist 12 cm wide and 20 cm deep strengthened by two steel plates 1 cm thick and 18 cm deep, fixed one on each side of the vertical faces. If the stresses in wood and steel are not to exceed  $7 \text{ MN/m}^2$  and  $120 \text{ MN/m}^2$ , find the moment of resistance of the section of the beam. Take  $E_s = 20 E_w$ .
9. A hollow shaft, having an inside diameter 60% of its outer diameter is to replace a solid shaft transmitting the same power at the same speed. Calculate the percentage saving in material, if the material to be used is also the same.