Roll No. .....

Total No. of Questions : 09] **[Total No. of Pages : 02**

B. Tech. (Sem. – 3rd)
MECHANICS OF MATERIALS
SUBJECT CODE : AE – 201

Paper ID : [A0701]

[Note : Please fill subject code and paper ID on OMR]

Time : 03 Hours **Maximum Marks : 60**

Instruction to Candidates:

1) Section - A is **Compulsory**.
2) Attempt any **Four** questions from Section - B.
3) Attempt any **Two** questions from Section - C.

Section - A

Q1) ***(10 × 2 = 20)***

a) Giving the mathematical formula, define the modulus of rigidity.

b) What is the ratio of maximum shear stress to hoop stress in a thin cylindrical pressure vessel?

c) Define ‘Neutral’ axis of a beam.

d) Write the expression for Castigiliano’s theorem.

e) List different types of helical springs.

f) Define ‘Spring Index’.

g) List the two limitations of Euler's Formula.

h) Differentiate between beam and column.

i) Define ‘strain energy’.

j) What do ‘torsional rigidity’ of a shaft mean?

Section - B

(4 × 5 = 20)

Q2) Draw and explain the stress-strain curve for brittle materials.

Q3) Assuming all the parameters, derive an expression for strain energy due to torsion on a beam of length *l*.

Q4) A thin spherical shell 60 cm in diameter, with a thickness 4 mm, is full of water at atmospheric pressure. Find the intensity of radial pressure exerted on the wall of the shell if 35 c. c. of water at atmospheric pressure is pumped into the shell. Calculate the resulting hoop stress and the change in volume of sphere if E=210 GPA, v=0.3 and bulk modulus of water is 3.1 GPa.

Q5) The internal diameter of a hollow shaft is two-third of its external diameter. Compare its resistance to torsion with that of a solid shaft of the same weight and material.

Q6) Derive an expression of buckling load for column with one end fixed and the other end free.

Section - C

(2 × 10 = 20)

Q7) A beam of 10 m length is simply supported at its ends. It carries a uniformly distributed load of 25 kN/m run over the length of left half of its span, together with concentrated load 25, 35 and 20 kN situated at 1.5,2.5 and 5m respectively from right hand support. Draw the BM and SF diagrams for this beam and find out the magnitude and position of the maximum BM taking place in the beam.

Q8) Two closed helical springs in parallel supports a load F. They both are of same material and same length. One spring consists of 20 turns of mean coil diameter 15cm and the other has 14 turns of mean coil diameter 12cm. They both are made of same wire. Calculate the maximum stress produced in each spring, if wire diameter, d= 3cm and F= 150kg.

Q9) A vertical tie rod rigidly fixed at the top end consists of a steel rod 3 m long and 21 mm diameter is encased throughout in a brass tube 21 mm internal diameter and 30 mm external diameter. The rod and the casing are fixed together at both ends. The compound bar is suddenly loaded in tension by a weight of l0kN falling freely through 3 mm before being arrested by the tie. Calculate the maximum stresses in steel and brass. Take the Young Modulus for steel and brass as 200 GPa and 100 GPa respectively.