Register Number: ……

B.E. DEGREE EXAMINATIONS: APRIL/MAY 2012

Fourth Semester

MEC109: STRENGTH OF MATERIALS

(Common to Mechanical Engineering and Mechatronics Engineering)

Time: Three Hours **Maximum Marks: 100**

Answer ALL Questions:-

PART A (10 x 1 = 10 Marks)

1. Within the elastic limit in loaded material, stress is

   (a) inversely proportional to strain (b) directly proportional to strain

   (c) equal to strain (d) none of the above

2. Hooke's law holds good with in

   (a) Proportional limits (b) yield point (c) elastic limits (d) plastic limits

3. If a beam is supported on more than two supports, it is called a

   (a) built-in beam (b) continuous beam (c) simply supported beam (d) encastered beam

4. The shear force and bending moment are zero at the free end of a cantilever, if it carries a

   (a) point load at the free end (b) uniformly distributed load over the whole length

   (c) point load in the middle of its length (d) none of the above

5. Every cross-section of a shaft, which is subjected to a twisting moment, is under

   (a) compressive stress (b) shear stress (c) tensile stress (d) bending stress

6. A fixed beam is a beam whose end supports are such that the end slopes

   (a) are maximum (b) are minimum (c) are zero (d) none of the above

7. The assumption made, while determining the shear stress in a circular shaft subjected to torsion, is that

   (a) the material of the shaft is uniform

   (b) the twist along the shaft is uniform

   (c) cross-sections of the shaft is plane and circular before and after the twist

   (d) all of the above

8. A cylindrical vessel is said to be thin if the ratio of its internal diameter to the wall thickness is

   (a) less than 20 (b) equal to 20 (c) more than 20 (d) none of the above

9. The circumferential strain in case of thin cylindrical shell, when subjected to internal pressure (p), is

(a) more than diametral strain (b) less than diametral strain

(c) equal to diametral strain (d) none of the above

10. A coil is having stiffness k. It is cut into two halves, then the stiffness of the cut coils will be

(a) same (b) half (c) double (d) one-fourth

PART B (10 x 2 = 20 Marks)

11. Define tensile stress.
12. Define modulus of resilience.
13. Define bending moment diagram.
14. Define bending stress in a beam.
15. Define polar modulus.
16. What is a spring? Name the two important types of spring.
17. What is a Macaulay's method? Where it is used?
18. Define the terms: principal planes and principal stresses.
19. Define the term 'obliquity' and how it is determined.
20. Define thin cylinder.

PART C (5 x 14 = 70 Marks)

21. a) A load of 2 MN is applied on a short concrete column 500 mm x 500 mm. The column is reinforced with four steel bars of 10 mm diameter, one in each corner. Find the stresses in the concrete and steel bars. Take E for steel as 2.1×10^5 N/mm^2 and for concrete as 1.4×10^4 N/mm^2.

(OR)

b) A load of 100 N falls through a height of 2 cm onto a collar rigidly attached to the lower end of a vertical bar 1.5 m long and of 1.5 cm^2 cross-sectional area. The upper end of the vertical bar is fixed. Determine: (i) maximum instantaneous stress induced in the vertical bar, (ii) maximum instantaneous elongation, and (iii) strain energy stored in the vertical rod. Take E = 2×10^5 N/mm^2

22. a) A cantilever 1.5 m long is loaded with a uniformly distributed load of 2 kN/m run over a length of 1.25 m from the free end. It also carries a point load of 3 kN at a distance of 0.25 m from the free end. Draw the shear force and bending moment diagrams of the cantilever.

(OR)

b) A steel plate of width 120 mm and of thickness 20 mm is bent into a circular arc of radius 10 m. Determine the maximum stress induced and the bending moment which will produce the maximum stress. Take $E = 2 \times 10^5$ N/mm^2

23. a) A solid circular shaft transmits 75 kW power at 200 r.p.m. Calculate the shaft diameter, if the twist in the shaft is not to exceed 1^0 in 2 meters length of shaft, and shear stress is limited to 50 N/mm^2. Take $C = 1 \times 10^5$ N/mm^2

(OR)

b) A closely coiled helical spring of mean diameter 20 cm is made of 3 cm diameter rod and has 16 turns. A weight of 3 kN is dropped on this spring. Find the height by which the weight should be dropped before striking the spring so that the spring may be compressed by 18 cm. Take $C = 8 \times 10^4$ N/mm^2

24. a) A beam 3m long, simply supported at its ends, is carrying a point load W at the centre. If the slope at the ends of the beam should not exceed 1^0, find the deflection at the centre of the beam

(OR)

b) A beam of uniform rectangular section 200 mm wide and 300 mm deep is simply supported at it ends. It carries a uniformly distributed load of 9 kN/m run over the entire span of 5 m. If the value of E for the beam material is 1×10^4 N/mm^2, find: (i) the slope at the supports and (ii) maximum deflection

25. a) The stresses at a point in a bar are 200 N/mm^2 (tensile) and 100 N/mm^2 (compressive). Determine the resultant stress in magnitude and direction on a plane inclined at 60^0 to the axis of the major stress. Also determine the maximum intensity of shear stress in the material at the point.

(OR)

b) A closed cylindrical vessel made of steel plates 4 mm thick with plane ends, carries fluid under a pressure of 3 N/mm^2. The dia. of cylinder is 25 cm and length is 75 cm, calculate the longitudinal and hoop stresses in the cylinder wall and determine the change in diameter, length and volume of the cylinder. Take $E = 2.1 \times 10^5 N/mm^2$ and $\mu = 0.286$.

****