Reg. No. ________

Karunya University

(Karunya Institute of Technology and Sciences)

(Declared as Deemed to be University under Sec.3 of the UGC Act, 1956)

End Semester Examination – April/May 2010

Subject Title: MECHANICS OF SOLIDS **Time: 3 hours**
Subject Code: CE203 **Maximum Marks: 100**

Answer ALL questions
PART – A (10 x 1 = 10 MARKS)

1. State the difference between elastic limit and proportionality limits.
2. Define factor of safety.
3. What is a propped cantilever beam?
4. Define point of contra-flexure.
5. The variation of bending stresses along the neutral axis to the extreme fiber is __________.
6. State the formula to find torsional stiffness.
7. The plane of maximum shear stress lies at __________degrees to the plane of principal axes.
8. What does the radius of Mohr's circle represent?
9. State the limitation of Euler's formula.
10. The maximum deflection of a cantilever beam with uniformly distributed load over the entire span is __________.

PART – B (5 x 3 = 15 MARKS)

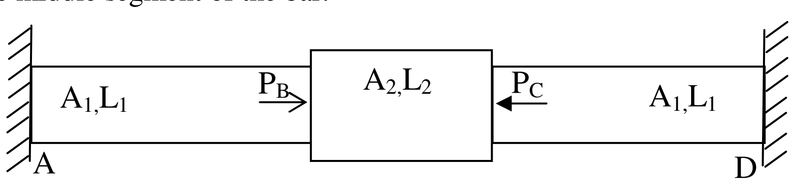
11. A rod uniformly tapers from 15mm to 45mm over a length of 250mm. Find the extension of the rod if it is subjected to an axial load of 5kN. Take E=200GPa.
12. Prove the relation $F = \frac{dM}{dx}$, i.e. the variation of bending moment is equal to the area under the shear force diagram.
13. A close coiled helical spring is designed to have a load of 200N and the mean diameter is 10 times the wire diameter. Find the dimensions of the spring if the maximum shear stress is limited to 80MPa.
14. Find the maximum shear stress for the state of stress consisting of two mutually perpendicular stresses 40 MPa and 30MPa.
15. Determine the ratio of strength of a solid steel column of internal diameter equal to ¾ of its external diameter. Both columns have the same cross sectional area, length and end conditions.

PART – C (5 x 15 = 75 MARKS)

16. A steel bar is placed between two copper bars each having same area and length as the steel bar at 20°C. At this stage they are rigidly connected together at both ends. When the temperature is raised to 320°C the length of the bar increases by 1.5mm. Find the original length and final stresses in the bar. Take E_{steel}=200GPa, E_{copper}=100GPa, α_{steel}=0.000012 per°C and α_{copper}=0.0000175 per°C.

(OR)

17. The fixed-end bar ABCD consists of three prismatic segments, as shown in the figure. The end segments have cross-sectional area A_1 = 840 mm^2 and length L_1= 200 mm. The middle segment has cross-sectional area A_2=260 mm^2 and length L_2=250 mm. Loads P_B and P_C are equal to 25.5 kN and 17.0 kN, respectively. (a) Determine the reactions at the fixed supports. (b) Determine the compressive axial force in the middle segment of the bar.

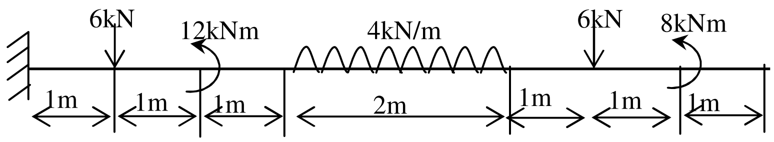


[P.T.O]

18. A simply supported beam of length 10m carries point load of 5kN and 6kN at distances of 4m and 6m from the left end. A uniformly distributed load of 2kN/m acts over the entire span. Draw the shear force and bending moment diagram. Find the maximum bending moment and point of contra-flexure if any.

(OR)

19. Draw the shear force and bending moment diagram of a cantilever beam with the following force system.

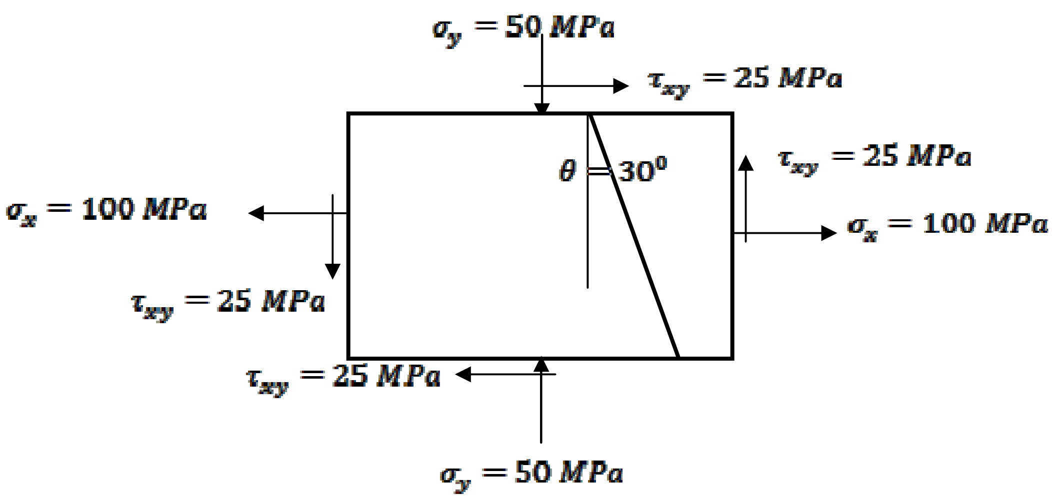


20. A hollow steel tube having external and internal diameter of 120mm and 100mm is simply supported over a span of 5m. The tube carries point load of W at a distance of 2m from one of the supports. Find W if the maximum bending stress is not to exceed 100MPa.

(OR)

21. A solid steel shaft is subjected to a torque of 45 kNm. If the angle of twist is 0.5° per meter length of the shaft and the shear stress is not allowed to exceed 90MPa, find (a) the suitable diameter for the shaft, (b) maximum shear stress and angle of twist and (c) maximum shear strain. Take C=80GN/m^2.

22. Find the principal stresses and their location. Also find the maximum shear stress and its location



(OR)

23. Find the principal stress and their location using Mohr's circle for the above problem.

24. A simply supported beam has its supports 8m apart at A and B. It carries a uniformly distributed load of 6kN/m between A and B starting from 1m and ending at 5m from A. The end B of the beam has an overhang of 1m and at the free end a concentrated load of 8kN is applied. Find the deflection of the free end and the maximum deflection between A and B. Take E=210GPa and I=20x$10^6$$mm^4$.

(OR)

25. Derive the equation to find Euler's critical load for a column with both ends fixed. Assume the length of the column to be '*l*' and subjected to axial load 'P'.