9/5/14

B.E / B.Tech (Full Time) DEGREE END SEMESTER EXAMINATIONS, APL /MAY 2014

CIVIL ENGINEERING

FOURTH SEMESTER

CN 281 / CE 9251 STRENGTH OF MATERIALS / STRENGTH OF MATERIALS II
(Regulations 2004 / 2008)

Time : 3 hr Max. Mark: 100

Instructions: 1. Assume suitable data if necessary

Answer ALL Questions

Part – A (10 x 2 = 20 Marks)

1. How is the strain energy related to the load deformation diagram of a bar?
2. State the Castigliano's first theorem.
3. Define the terms buckling and slenderness ratio?
4. What is a beam column? Give an example.
5. Define bending moment and shear force at a section of a beam?
6. Explain the term biaxial stress.
7. State the theories of failures that are suitable for ductile materials and brittle materials.
8. State the advantages and disadvantages of fixed beam?
9. Write the general three moment equation and explain the terms used in the equation.
10. State the assumptions made in the analysis of thin and thick cylindrical shells.

Part – B (5 x 16 = 80 Marks)

11. A simply supported beam of rectangular section 100 mm x 200 mm is of length l = 5m, and carries a uniformly distributed load of w=2kN/m run over its entire length. Find the deflection due to shear at a point at C distant l_1=3m and l_2=2m from the ends respectively. Also find the deflection at the mid section. Take C=80GN/m^2

(16 Mark)

12. (a) A continuous beam 10 m long is supported at the ends and at a point 6m from the left end. It carries a uniformly distributed load of 30 kN/m over the whole length. The support at the middle settles by 10 mm. Draw the shear force and bending moment diagram for the beam if E = 2 x 10^8 kN/m^2 and I = 1 x 10^{-4} m^4

(16 Marks)

(OR)

12. (b) A beam fixed at both ends carries a uniformly distributed load of 20kN/m in addition to a point load of 80kN at 1m from the left support. The left support sinks by 12 mm, Draw the shear force and bending moment diagrams for the beam. E = 2x10^{11} N/m^2 and I= 8000 cm^4

(16 Mark)

13. (a) A 1.5 m long cast iron column has a circular cross-section of 5 cm diameter. One end of the column is fixed in direction and position and the other is free, Taking factor of safety as 3., calculate the safe load, using (i) Rankine-Gordon formula, take yield stress 560 MN/m^2 and α= 1/1600 for pinned ends. (ii) Euler's formula, Young's modulus for cast iron = 120 GN/m^2.

(16 Marks)

(OR)

13. (b) A hollow cylindrical cast iron column is 4 m long with both ends fixed. Determine the minimum diameter of the column, if it has to carry a safe load of 250 kN with a factor of safety of 5. Take the internal diameter as 0.8 times the external diameter. Take α=1/1600 in Rankine's formula and σ_c = 550 MN/m^2.

(16 Marks)

14. (a) A circular steel shaft is subjected to combined bending and torsion, the bending moment being 20 kNm and torque 10kNm. If safe equivalent stress in simple tension is 200 N/mm^2 and Poisson's ratio is 0.25 find suitable diameter of the shaft based on the following theories. (i) Maximum Principal stress theory, (ii) Maximum shear stress theory and (iii) Shear strain energy theory.

(16 Marks)

(OR)

14. (b) At a point in a material under stress, the intensity of the resultant stress on a certain plane is 50 MN/m^2 (tensile) inclined at 30 degree to the normal of that plane. The stress on a plane at right angles to this has a normal tensile component of intensity of 30 MN/m^2. Find (i) The resultant stress on the second plane (ii) The principal planes and stresses. (iii) The plane of maximum shear and its intensity.

(16 Marks)

15. (a) A steel tube of 300 mm external diameter is to be shrunk on to another steel tube of 90 mm internal diameter. After shrinking the diameter at the junction is 180 mm. Before shrinking on the difference of diameter at the junction is 0.12mm. Find (i) The radial pressure at the junction; (ii) The circumferential stresses developed in the two tubes after shrinking on. Take E=200 GN/m^2

(16 Marks)

(OR)

15. (b) A curved bar is formed of a tube of 120 mm outside diameter and 7.5 mm thickness. The centerline of this beam is a circular arc of radius 225 mm. A bending moment of 3 kNm tending to increase curvature of the bar is applied. Calculate the maximum tensile and compressive stresses set up in the bar.

(16 Marks)