Reg. No. | | | | | | | | | | | |

# Question Paper Code : 60249

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2016.

Fourth Semester

Civil Engineering

CE 2252/CE 43/080100019/10111 CE 403 — STRENGTH OF MATERIALS

(Regulations 2008/2010)

(Common to 10111 CE 403 — Strength of Materials for B.E. (Part – Time) Second Semester – Civil Engineering – Regulations 2010)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define principle of virtual work.
2. State the Maxwell's reciprocal theorem
3. What is the value of prop reaction in a propped cantilever of span 'L', when it subjected to a U.D.L over the entire length?
4. What are the advantages and limitations of the theorem of three moments?
5. Define slenderness ratio of a column.
6. State any four assumptions made in Lame's theory.
7. Define 'stress tensor'.
8. What is principal strain?
9. Explain briefly about stress concentration.
10. What is meant by fatigue?

PART B — (5 × 16 = 80 marks)

11. (a) Using castigliano's first theorem, calculate the central deflection, and the slope at end of a simply supported beam carrying a UDL of intensity W per unit length over the whole span. (16)

Or

(b) A beam Simply supported over a span of 3.5 m carries a UDL of 25 kN/m over the entire span. Taking EI = 2.5 $MNm^2$ and using Castigliano's theorem, determine the deflection at the center of the beam. (16)

12. (a) A cantilever of length L carries a concentrated load W at the mid-span if the free end is supported on a rigid Prop, find the reaction at the prop. Also draw shear force and bending moment diagrams.

Or

(b) A beam ABCD 16 m long is continuous over three spans: AB = 6 m, BC = 5 m and CD = 5 m, the supports being at the same level. There is a uniformly distributed load of 20 kN/m over BC. On AB, there is a point load of 80 kN at 2 m from A. On CD there is a point load of 60 kN at 3 m from D. Calculate the moments and reactions at the supports using theorem of three moments.

13. (a) State the Euler's assumption in column theory. And derive a relation for the Euler's cripping load for a columns with both ends hinged.

Or

(b) A short length of tube having internal diameter and external diameter are 4 cm and 5 cm respectively, which failed in compression at a load of 250 KN. When a 1.8 m length of the same tube was tested as a strut with fixed ends, the load failure was 160 kN. Assuming that $\sigma_c$ in Rankine's formula is given by the first test, find the value of constant $\alpha$ in the same formula. What will be the crippling load of this tube if it is used as a strut 2.8 m long with one end fixed and the other hinged?

14. (a) The state of stress (Cartesian components of stress) at a point are:

$\sigma_{xx} = 7\text{Mpa}, \sigma_{yy} = 6\,\text{Mpa}, \sigma_{zz} = 5\,\text{Mpa}, \zeta_{xy} = 2\,\text{Mpa}, \zeta_{yz} = -2\,\text{Mpa},$
$\zeta_{xz} = 0\,\text{Mpa}$. Determine the values of Principal Stresses.

Or

(b) A cylindrical shaft made of steel of yield strength 350 MPa is subjected to static load consisting of bending moment of 10 kN-m and a torsional moment of 30 kN-m. Determine the diameter of the shaft using

(i) Maximum principal stress theory,

(ii) Maximum shear stress theory

(iii) Maximum Strain energy theory and

(iv) Maximum distortion energy theory. Take $E = 210\,\text{GPa}$, Poisson's ratio = 0.25 and factor of safety = 2.

15. (a) A 80 mm × 80 mm angle as shown in fig. Q 15 (a) having $I_{XX} = I_{YY} = 87.36 \times 10^{-8} m^4$. It is used as a freely supported beam with one leg vertical. On the application of the bending moment in the vertical Plane *YY*, the mid section of the beam deflects in the direction *AA'* at 30°15' to the vertical.

(i) Calculate the second moment of area of the section about its principal axis.

(ii) What is the bending stress at the corner *B* if the bending moment is 1.5 kN – m? (16)

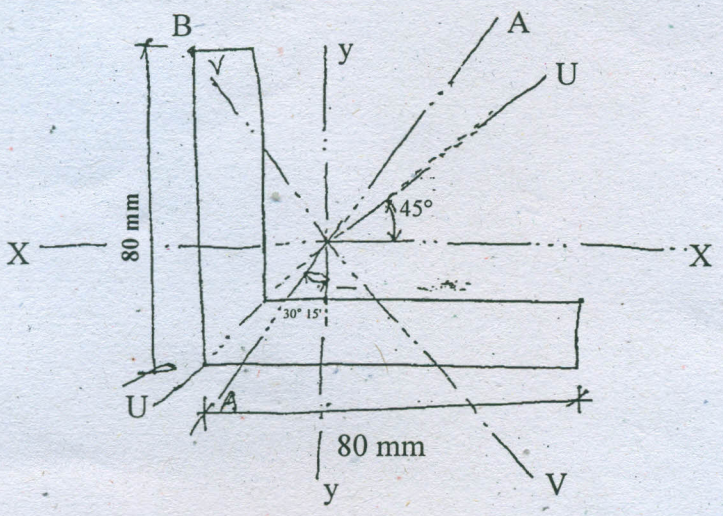


Figure – Q.15 (a)

Or

(b) A ring as shown in fig. Q. 15 (b) is carrying a load of 30 kN. Calculate the stresses at 1 and 2. (16)

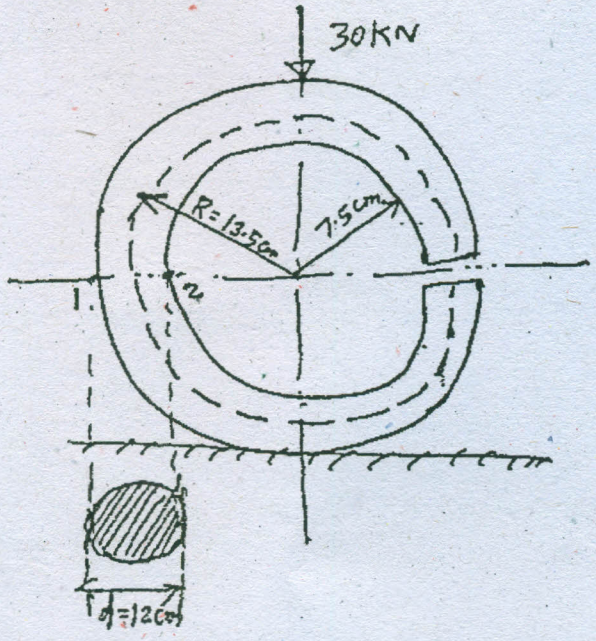


Figure – Q.15 (b)