Reg. No. :

Question Paper Code : 91294

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2019

Fourth Semester

Civil Engineering

CE 6402 – STRENGTH OF MATERIALS

(Regulations 2013)

(Common to Petrochemical Engineering, Plastic Technology, Polymer Technology)

(Also Common to PTCE 6402 – Strength of Materials for B.E. (Part-Time) for Second Semester – Civil Engineering – Regulations 2014)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions.

PART – A **(10×2=20 Marks)**

1. Define strain energy.
2. Write the expression for strain energy due to shear.
3. Determine the prop reaction for a cantilever beam with udl over entire span.
4. Write the three moment equation, stating all the variables used.
5. What are the causes of failure of a column ?
6. What are the methods of reducing hoop stress in cylindrical shells ?
7. Define stress tensor at a point.
8. State the limitations of Distortion energy theory.
9. Define Unsymmetrical bending. State the two reasons for unsymmetrical bending.
10. Why do we find shear centre of a section ?

PART – B (5×13=65 Marks)

11. a) Determine the maximum deflection of a simply supported beam with udl over entire span using principle of virtual work method. (13)

(OR)

b) A crane is shown in fig. Q. 11(b). The cross sectional area of the member AC is 3000 mm^2 and that of member BC is 7000 mm^2. Determine the vertical deflection of the joint C. Take E = 2.0 $\times 10^5$ N/mm^2. Use Williot diagram method

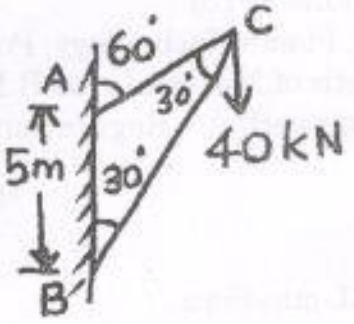

Fig. 11 (b) (13)

12. a) A fixed beam AB of length 6 m carries point loads of 160 kN and 120 kN at a distance of 2 m and 4 m from the left end A. Find the fixed end moments, support reaction and also draw B.M. and S.F. diagrams. (13)

(OR)

b) Draw the S.F. and B.M. diagram of a continuous beam ABC of length 10 m which is fixed at A and is supported on B and C. The beam carries a uniformly distributed load of 2 kN/m length over the entire length. The spans AB and BC are equal to 5 m each. (13)

13. a) 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 factors of safety of 5. Take the internal diameter as 0.8 times the external diameter. Take f_c = 550 N/mm^2 and $\alpha = \frac{1}{1600}$ in Rankine's formula. (13)

(OR)

b) Determine the maximum and minimum hoop stress across the section of a pipe of 500 mm internal diameter and 100 mm thickness, when the pipe contains fluid at a pressure of 10 N/mm^2. (13)

14. a) The principal stresses at a point across two perpendicular planes are 75 MN/m^2 (tensile) and 35 MN/m^2 (tensile). Find the normal, tangential stress and the resultant stress and its obliquity on a plane at 20° with major principal plane. (13)

(OR)

b) A steel shaft is subjected to an end thrust producing a stress of 90 MPa and the minimum shearing stress on the surface arising from torsion is 60 MPa The yield point of the material in simple tension was found to be 300 MPa. Calculate the factor of safety according to the following theories : (i) Maximum shear stress theory ; (ii) Maximum distortion theory. (13)

15. a) A curved bar is formed of a tube of 120 mm outside diameter and 7.5 mm thickness. The centre line of this is a circular arc of radius 225 mm. The bending moment of 3 kNm tending to increase curvature of the bar is applied. Calculate the maximum tensile and compressive stresses setup in the bar. (13)

(OR)

b) Derive the equation of Shear centre for channel section. (13)

PART – C **(1×15=15 Marks)**

16. a) In an experimental determination of the buckling load for 1.2 cm diameter mild steel pin ended struts of various lengths, two of the values obtained were :

i) When length = 50 cm the load = 10 kN, and

ii) When length = 20 cm, the load = 30 kN.

Make the necessary calculations and then state whether either of the above values of loads conforms with the Eulers formula for the critical load. Take $E = 200\ GN/m^2$. (15)

(OR)

b) A solid circular shaft is subjected to a bending moment of 50 kN-m and a torque of 20 kN-m. Design the diameter of the shaft according to

i) The maximum principal stress theory

ii) The maximum shear stress theory

iii) The maximum distortion energy theory

Take $\mu = 0.3$, stress at elastic limit = 300 N/mm^2, factor of safety = 2.5. (15)
