Registration No: | | | | | | | | | | |

Total Number of Pages: 03

B.TECH
PCI3I001

3rd Semester Regular Examination 2016-17
MECHANICS OF SOLIDS
BRANCH: CIVIL
Time: 3 Hours
Max Marks: 100
Q.CODE: Y495

Answer Part-A which is compulsory and any four from Part-B.
The figures in the right hand margin indicate marks.

Part – A (Answer all the questions)

Q1 **Answer the following questions:** **(2 x 10)**

a) A steel bar of 40 mm diameter is subjected to an axial compressive load of 250 kN. If the length of the bar is 2 m and E = 200 GPa, the elongation of the bar will be _____.

b) A 100 mm diameter steel bar free to expand is heated from 15°C to 40°C. It develops _____ stress.

c) Poisson's ratio is the ratio between _____ and _____

d) Section modulus is the ratio between _____ and _____

e) A concentrated load of P acts on a simply supported beam of span L at a distance *L/2* from the left support. The bending moment at the point of application of the load is _____

f) A simply supported beam of span length 6m and 50mm diameter carries a uniformly distributed load of 1.0 kN/m. The maximum value of bending moment is _____

g) The point· of contraflexure is a point where_____ changes sign.

h) For a circular shaft of diameter d subjected to torque T, the maximum value of the shear stress is _____ .

i) The ratio of circumferential stress to longitudinal stress in a thin cylinder subjected to internal hydrostatic pressure is_____.

j) The expression for the crippling load for a column of length „l" with one end fixed and other end free is _____.

Q2 **Answer the following questions:** **(2 x 10)**

a) Define the term factor of safety and its importance.

b) What is Complementary shear stresses.

c) What are the types of stresses developed in thin cylinders subjected to internal pressure?

d) What are principal planes?

e) What is Mohr's stress circle ? Explain its significance.

f) When Macaulay's method is preferred?

g) State the relation between shear force and bending moment.

h) What is a Strut ? How does it differ from a column ?

i) Write the equation for strain energy stored in a shaft due to torsion.

j) What is the value of shear stress at the centre of a circular shaft under torsion?

Part – B (Answer any four questions)

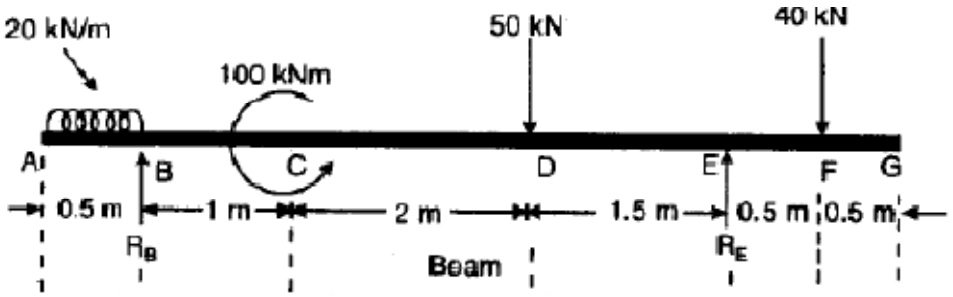
Q3 **a)** Draw stress - strain curve for a mild steel rod subjected to tension and explain about the salient points on it. **(7)**

b) A cylindrical vessel, whose ends are closed by means of rigid flange plates, is made up of steel plate 3 mm thick. The length and internal diameter of the vessel are 50 cm and 25 cm respectively. Determine the longitudinal and hoop stresses in the cylindrical shell due to an internal fluid pressure of 3 N/mm^2. Also calculate the increase in length, diameter and volume of vessel. Take E = 2×105 N/mm^2 and poisson's ratio =0.3. **(8)**

Q4 **a)** Direct tensile stresses of 120 MPa and 70 MPa act on a body on mutually perpendicular planes. What is the magnitude of shearing stress that can be applied so that the major principal stress at the point does not exceed 135 MPa? Determine the value of minor principal stress and the maximum shear stress. **(10)**

b) The principal tensile stresses at a point across two perpendicular planes are 100 MPa and 50 MPa. Find the normal and tangential stresses and the resultant stress and its obliquity on a plane at 200 with the major principal plane. **(5)**

Q5 A loaded beam is as shown below. Draw its S.F and B.M diagram. **(15)**



Q6 A cantilever of length 2.5m is loaded with an udl of 10 kN/m over a length 1.5m from the fixed end. Determine the slope and deflection at the free end. Determine the slope and deflection at the free end of the cantilever. Given I = 9500cm^4, E = 210 GN / m^2 Using Moment area method. **(15)**

Q7 **a)** Derive the relation $\frac{\sigma}{y}=\frac{M}{I}=\frac{E}{R}$, Symbols has their usual meaning. **(8)**

b) A simply supported beam of span 4m carries a udl of 6kN/m over the entire span. If the maximum allowable stress due to bending is restricted to 150 N/mm_2, determine the cross sectional dimensions if the section is; **(7)**
(i) Rectangular with depth twice the breadth
(ii) Solid circular section
(iii) Hollow circular section having a diameter ratio of 0.6

Q8 **a)** A solid shaft transmits 100 kW at 60 rpm. Determine the diameter of the shaft if the shear stress is not to exceed 75MPa. If the shaft is replaced by a hollow shaft whose internal diameter is 0.6 times external diameter, while length, material and the maximum shear stress are the same, find the percentage saving in weight. **(7)**

b) Two shafts are made of same material and transmits the same power. The first rotates at 50 rpm while the second rotates at 1000 rpm. Determine the ratio of diameters of the two shafts for the same maximum shear stress in each shaft. **(8)**

Q9 **a)** Derive the Euler crippling load for a vertical strut with both ends are hinged, acted upon by an axial load P. **(8)**

b) Using Euler's formula, determine the critical stress for a strut of slenderness ratio 80 under the condition of (i) both the ends are hinged and (ii) both the ends are fixed. Take E=210Ga. **(7)**

If the slenderness ratio is 120 what will be the critical stress in both the cases.