# BRAINWARE UNIVERSITY

**Term End Examination 2022**
**Programme – B.Tech.(CE)]-2021**
**Course Name – Structural Mechanics I**
**Course Code - PCC-CE301**
**( Semester III )**

**Time : 2:30 Hours**

**Full Marks : 60**
[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

## Group-A
### (Multiple Choice Type Question)

1 x 15=15

1.  *Choose the correct alternative from the following :*

(i) The lateral strain is _____
   a) The ratio of axial deformation to the original length
   b) The ratio of deformation in area to the original area
   c) The strain at right angles to the direction of applied load
   d) The ratio of length of body to the tensile force applied on it

(ii) Which type of stress does in a reinforcement bar is taken by the concrete?
   a) Tensile stress
   b) Compressive stress
   c) Shear stress
   d) Bending stress

(iii) _____ positive/negative bending moments occur where shear force changes its sign.
   a) Minimum
   b) Zero
   c) Maximum
   d) Remains same

(iv) What is the factor of safety?
   a) The ratio of stress to strain
   b) The raio of permissible stress to the ultimate stress
   c) The ratio of ultimate stress to the permissible stress
   d) The ratio of longitudinal strain to stress

(v) In a body loaded under plane stress conditions, what is the number of independent stress components?
   a) 1
   b) 2
   c) 3
   d) 4

(vi) What is tensile strain?
   a) The ratio of change in length to the original length
   b) The ratio of original length to the change in length
   c) The ratio of tensile force to the change in length
   d) The ratio of change in length to the tensile force applied

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(vii) The stress which acts in a direction perpendicular to the area is called _____

a) Shear stress

b) Normal stress

c) Thermal stress

d) None of the mentioned

(viii) Find the elongation of an steel rod of 100mm length when it is subjected to a tensile strain of 0.005?

a) 0.5m

b) 0.5mm

c) 0.55mm

d) 0.55m

(ix) A diagram which shows the variations of the axial load for all sections of the pan of a beam is called _____

a) Bending moment diagram

b) Shear force diagram

c) Thrust diagram

d) Stress diagram

(x) SI units of shear force is _____

a) kN/m

b) kN-m

c) kN

d) m/N

(xi) Why is the strain the fundamental property but not the stress?

a) Because it is dimensionless

b) Because it is a ratio

c) Because it's value is calculated in the laboratory

d) No stress is the fundamental property

(xii) Which stress comes when there is an eccentric load applied?

a) Shear stress

b) Bending stress

c) Tensile stress

d) Thermal stress

(xiii) Which point on the stress strain curve occurs after the proportionality limit?

a) Upper yield point

b) Lower yield point

c) Elastic limit

d) Ultimate point

(xiv) SI units of Bending moment is _____

a) kN

b) kN2

c) kNm

d) km

(xv) A cantilever beam loaded with udl throughout, the maximum shear force occurs at_____

a) Free end

b) Fixed end

c) At centre

d) At point of contraflexure

## Group-B
### (Short Answer Type Questions)
3 x 5=15

2. A rectangular beam 60 mm wide and 150 mm deep is simply supported er a span of 4 metres. (3) If the bneam is subjected to a uniformly distributed load of 4.5 kN/m, find the maximum bending stress induced in the beam.

3. A steel rod 1 m long and 20 mm x 20 mm in cross-section is subjected to a tensile force of 40 (3) kN. Determine the elongation of the rod, if modulus of elasticity for the rod material is 200 GPa.

4. State clearly the Hooke's law. (3)

5. A hollow shaft of external and internal diameter of 80 mm and 50 mm is required to transmit (3) torque from one end to the other. What is the safe torque it can transmit, if the allowable shear stress is 45 MPa ?

OR

A stream boiler of 800 mm diameter is made up of 10 mm thick plates. If the boiler is (3) subjected to an internal pressure of 2.5 MPa, find the circumferential and longitudinal stresses induced in the boiler plates.

6. What is principle of the superposition? Explain its uses. (3)

OR

A copper wire of 2 mm diameter is required to be wound around a drum. Find the minimum (3)

radius of the drum, if the stress in the wire is not to exceed 80 MPa. Take modulus of elasticity for the copper as 100 GPa.

## Group-C
### (Long Answer Type Questions)

5 x 6=30

7. A cylindrical vessel 2 m long and 500 mm in diameter with 10 mm thick plates is subjected to (5) an internal pressure of 3 MPa. Calculate the change in volume of the vessel. Take E200 GPa and Poisson's ratio = 0.3 for the vessel material.

8. What is the relation between slope, deflection and radius of curvature of a simply suppor (5) beam?

9. Define principal planes and principal stresses and explain their uses. (5)

10. Explain the procedure adopted for analysing simply supported beam subjected to inclined (5) loads.

**OR**

A simply supported beam of 5 m span carries a triangular load of 30 kN.Draw S.F. and B.M. (5) diagrams for the beam.

11. A cantilever beam 4 m long carries a gradually varying load, zero at the free end to 3 kN/m at (5) the fixed end. Draw B.M. and S.F. diagrams for the beam.

**OR**

Explain bending stress. (5)

12. Describe the effect of a couple on the S.F. and B.M. diagram of a beam. (5)

**OR**

Explain equivalent length of a column using Euler's column theory. (5)

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