End Semester Examination, 2022
Semester: 3rd
Subject Code: CT-303
Subject: Strength of Materials
Full Marks: 70
Time: 3 Hours

The Question Paper consists of two parts: Part-A and Part-B. Both are compulsory.

Part-A (Marks = 25)
All questions are compulsory

1Q: Choose the correct answer: **(15)**

(i)   The unit of strain is
   (a) Nmm
   (b) N/mm
   (c) mm
   (d) no unit

(ii)   The bending moment on a section is maximum where shear force is
   (a) Minimum
   (b) Maximum
   (c) Changing sign
   (d) Zero

(iii)   The polar moment of inertia of a circular shaft of diameter (d) is
   (a) $\pi d^4/8$
   (b) $\pi d^4/16$
   (c) $\pi d^4/32$
   (d) $\pi d^4/64$

(iv) The bending moment at the free end of a cantilever beam is
   (a) Zero
   (b) Maximum
   (c) Increasing
   (d) Decreasing

(v) A point of contraflexure is a point where
   (a) Shear force is zero
   (b) Shear force is maximum
   (c) Bending moment is zero
   (d) Bending moment is maximum

(vi) The resistance per unit area to deformation is called
  (a) Strain
  (b) Stress
  (c) Pressure
  (d) Modulus of elasticity
(vii) The unit of stress is
  (a) Nmm
  (b) N/mm^2
  (c) mm
  (d) no unit
(viii) Hook's law holds good up to
  (a) Yield point
  (b) Elastic limit
  (c) Plastic limit
  (d) Breaking point
(ix) Whenever a material is loaded within elastic limit stress is
  (a) Equal to strain
  (b) Directly proportional to strain
  (c) Inversely proportional to strain
(x) The ratio of linear stress to linear strain is called
  (a) Modulus of rigidity
  (b) Modulus of elasticity
  (c) Bulk modulus
  (d) Poissons ratio
(xi) When a change in length takes place, the strain is known as
  (a) Linear strain
  (b) Lateral strain
  (c) Volumetric strain
  (d) Shear strain
(xii) Young's modulus is the ratio of
  (a) Linear stress to lateral strain
  (b) Lateral strain to linear strain
  (c) Linear stress to linear strain
  (d) Shear stress to shear strain
(xiii) Modulus of rigidity may be defined as the ratio of
  (a) Linear stress to lateral strain
  (b) Lateral strain to linear strain
  (c) Linear stress to linear strain
  (d) Shear stress to shear strain
(xvi) The deformation per unit length in the direction of the force is known as
  (a) Linear strain
  (b) Lateral strain
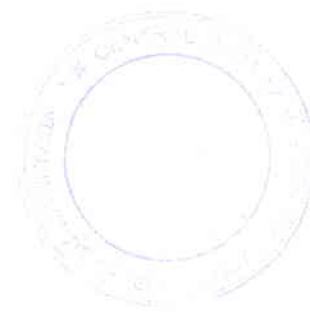
(c) Volumetric strain

(d) Shear strain

(xv) A beam which is fixed at one end and free at the other is called

(a) Simply supported beam

(b) Fixed beam

(c) Over hanged beam

(d) Cantilever beam

2Q: Read the following statements. Write TRUE or FALSE against each.　　　　**(5)**

(a) A continuous beam has only two supports at the ends.

(b) The unit of Young's modulus is same as that of stress.

(c) The maximum bending moment of a simply supported beam of length l with a central point load W is Wl/8.

(d) A beam supported at its both ends is not a simply supported beam.

(e) A load which acts at a point on a beam is called uniformly distributed load.

3Q: Match the following.　　　　**(5)**

Group A	Group B
The shear force at the free end of a cantilever beam carrying uniformly distributed load	Maximum and minimum normal stress.
The bending moment at the fixed end of a beam is	$Wl^2/8$
The maximum bending moment of a simply supported beam carrying a uniformly distributed load of w per unit length.	Two principal stresses.
The maximum shear stress is ½ of the algebraic difference of	zero
The radius of the Mohrs circle is equal to ½ of the difference of	maximum

Part-B (Marks = 45)
Answer any five (5) questions

4Q: (a) A bar ABCD 950mm long is made up of three parts AB,BC and CD of lengths 250mm, 450mm and 250mm respectively. AB and CD are cylindrical having diameters 25mm and 15mm respectively. The rod BC is square section 30mm x 30mm. the rod is subjected to a pull of 26000N. find, stresses in the three parts of the rod, extension of the rod. Given $E=2x10^5 N/mm^2$.　　**(6)**

(b) An elastic rod 25mm in diameter, 200mm long extends by 0.25mm under a tensile load of 40 kN. Find the intensity of stress, the strain and the elastic modulus for the material of the rod. **(3)**

5Q: A cast iron bracket subjected to bending has a cross section of I form with unequal flanges. The total depth of the section is 280mm and the metal is 40mm thick throughout. The top flange is 200mm wide and the bottom flange is 120mm wide. Find the position of the neutral axis and the moment of inertia of the section about the neutral axis and determine the maximum bending moment that should be imposed on this section if the tensile stress in the top flange is not to exceed 20N/mm². What is the value of maximum compressive stress in the bottom flange?   **(9)**

6Q: (a) For a given material the Young's modulus is 1.1×10^5 N/mm² and modulus of rigidity is 0.43×10^5 N/mm². Find the bulk modulus and lateral contraction of a round bar of 40mm diameter and 2.5m length when stretched by 2.5mm.   **(5)**
(b) Describe the theory of simple bending with respect to neutral layer.   **(4)**

7Q: At a certain point in a strained material the principal stresses are 100 N/mm² and 40 N/mm² both tensile. Find the normal, tangential and resultant stresses across a plan through the point at 48° to the major principal plane, using Mohr's circle of stress.   **(9)**

8Q: (a) Derive a relationship for section modulus of rectangular and circular section.   **(4)**
(b) A cast iron beam 20mmx20mm in section and 1m long and supported at the ends fails when a central load of 640 N is applied. What UDL will break a cantilever of the same material 50mm wide, 100mm deep and 2m long?   **(5)**

9Q: Draw the shear force and bending moment diagram for the given beam as below. Also indicate the location and magnitude of maximum bending moment.   **(9)**

8kN

2kN/m

3m   7m   3m
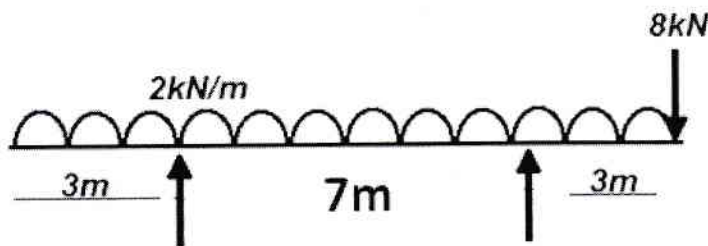
10Q: Draw the shear force and bending moment diagram for the given beam as below. Also   find   the magnitude of maximum bending moment.   **(9)**

4kN   10kN

1.5m   2.5m   4 kN/m

4m