

PARUL UNIVERSITY
FACULTY OF ENGINEERING & TECHNOLOGY
B.Tech. Summer 2022 - 23 Examination

Semester: 4th
Subject Code: 203142251
Subject Name: Strength of Materials

Date: 20-03-2023
Time: 2:00pm to 4:30pm
Total Marks: 60

Instructions:

1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Make suitable assumptions wherever necessary.
4. Start new question on new page.

Q.1 Objective Type Questions - (Fill in the blanks, one word answer, MCQ-not more than Five in case of MCQ) (All are compulsory) (Each of one mark) (15)

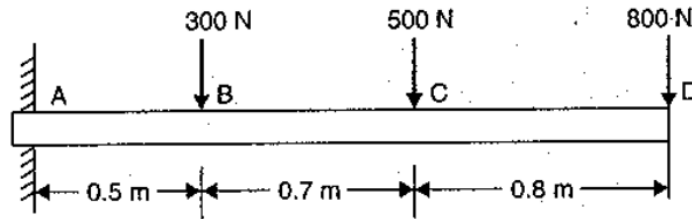
1. Bending moment M and torque T is applied on a solid circular shaft. If the maximum bending stress equals to maximum shear stress developed, then M is equal to
a. $T/2$. b. T c. $2T$ d. $4T$
2. The expression $EI(d^4y / dx^4)$ at a section of a member represents
(a) Shearing force
(b) Rate of loading
(c) Bending moment
(d) slope
3. Within elastic limit in a loaded material, stress is
(a) inversely proportional to strain
(b) directly proportional to strain
(c) equal to strain
(d) none of the above.
4. The ratio of linear stress to linear strain is known as
(a) Poisson's ratio
(b) bulk modulus
(c) modulus of rigidity
(d) modulus of elasticity
5. The ratio of lateral strain to longitudinal strain is called
(a) Poisson's ratio
(b) bulk modulus
(c) modulus of rigidity
(d) modulus of elasticity.
6. A tensile force (P) is acting on a body of length (L) and area of cross-section (A). The change in length would be _____
7. The normal stress on an oblique plane at an angle θ to the cross-section of a body which is subjected to a direct tensile stress (g) is equal to _____
8. The relation between modulus of elasticity (E), modulus of rigidity (C) and bulk modulus (K) is given by _____
9. A simply supported beam carries a uniformly distributed load of w N per unit length over the whole span (l). The shear force at the centre is _____
10. When bending moment M and torque T is applied on a shaft then equivalent torque is _____
11. The property by virtue of which a metal can be beaten into plates is called?
12. If a member is subjected to a uniform bending moment (M), the radius of curvature of the deflected form of the member is given by?
13. A cantilever of length (l) carries a uniformly distributed load w per unit length over the whole length. The downward deflection at the free end will be?
14. A fixed beam of length (l) carries a point load (W) at the centre. The deflection at the centre will be?
15. The relation between maximum stress (σ) offered by a section, moment of resistance (M) and section modulus (Z) is given by?

Q.2 Answer the following questions. (Attempt any three) (15)

- A) Derive the expression for torque transmitted by hollow circular shaft.
- B) A rectangular bar of cross-sectional area 10000 mm^2 is subjected to an axial load of 20 kN. Determine the normal and shear stress on a section which is inclined at an angle of 30 degree with normal cross section of the bar.
- C) The principal stresses at a point in an elastic material are 100 N/mm^2 (tensile), 80 N/mm^2 (tensile) and 50 N/mm^2 (compressive). If the stress at the elastic limit in simple tension is 200 N/mm^2 determine whether the failure of material will occur according at maximum principal stress theory. If not, then determine the factor of safety.
- C) Find the minimum diameter of a steel wire, which is used to raise a load of 4000N if the stress in the rod is not to exceed 95 MN/m^2 .

Q.3 A) Derive the expression for bending stress (07)

- B) A cantilever beam of length 2 m carries the point loads as shown in Fig. Draw the shear force and B.M. diagrams for the cantilever beam. (08)



OR

- B) A wooden beam 100 mm wide and 150 mm deep is simply supported over a span of 4 metres. If shear force at a section of the beam is 4500 N, find the shear stress at a distance of 25 mm above the N.A (08)

Q.4 A) Write the theories of failure for both brittle and ductile material. (07)

OR

- A) The tensile stresses at a point across two mutually perpendicular planes are 120 N/mm^2 and 60 N/mm^2 . Determine the normal, tangential and resultant stresses on a plane inclined at 30° to the axis of the minor stress. Solve using Mohr's circle. (07)

- B) A beam 6 m long, simply supported at its ends, is carrying a point load of 50 kN at its centre. The moment of inertia of the beam (i.e.I) is given as equal to $78 \times 10^6 \text{ mm}^4$. If E for the material of the beam = $2.1 \times 10^5 \text{ N/mm}^2$, calculate: (i) deflection at the centre of the beam and (ii) slope at the supports. (08)