Indian Maritime University

(A Central University, Govt of India)

End Semester Examinations – June 2023

Programme Name: B Tech (ME)

Semester: II

Subject Code: UG11T3204

Subject Name: STRENGTH OF MATERIALS I

Date: 19.06.2023 Max Marks: 70

Duration: 03 Hrs Pass Marks: 35

General Instructions

(i) All Sections (A, B & C) are to be attempted.
(ii) Options, if any, are specified in respective section.

Section A

Ten MCQs/Fill in the Blanks of 01 Mark each – Choose the correct answer as applicable.

1. The bending moment at the free end of a cantilever beam carrying any type of load is
(a) zero
(b) minimum
(c) maximum
(d) equal to the load
2. The maximum stress produced in a bar of tapering sections is at
(a) larger end
(b) smaller end
(c) middle
(d) anywhere
3. When shear force at a point is zero, then bending moment at that point will be
(a) zero
(b) minimum
(c) maximum
(d) infinity.
4. The section modulus of a circular section of diameter (d) is
(a) $\pi (d)^2/ 32$
(b) $\pi (d)^3/ 32$
(c) $\pi (d)^3/ 64$
(d) $\pi (d)^4/ 64$

5. The stress in a body if suddenly loaded is ..... the stress induced, when the same load is applied gradually.
(a) One-half
(b) euqal to
(c) twice
(d) four times

6. A circular bar of length (l) uniformly tapers from diameter (d1) at one end to diameter (d2) at the other. If the bar is subjected to an axial tensile load (P), then its elongation is equal to
(a) Pl/AE
(b) Pl/A_1A_2E
(c) $4Pl/\pi Ed_1d_2$
(d) $Pl/4\pi Ed_1d_2$

7. When a rectangular section of a beam is subjected to a shearing force, the ratio of maximum shear stress to the average shear stress is
(a) 2.0
(b) 1.75
(c) 1.25
(d) 1.5

8. Torque transmitted by a solid shaft of diameter (D), when subjected to a shear stress (τ) is equal to
(a) $\pi \times \tau \times D^2/32$
(b) $\pi \times \tau \times D^3/32$
(c) $\pi \times \tau \times D^2/16$
(d) $\pi \times \tau \times D^3/16$

9. The strength of a welded joint is equal to
(a) $l\, t\, \sigma$
(b) $l\, t/\sigma$
(c) $l\, \sigma/\, t$
(d) $t\, \sigma/\, l$

10. A thin cylindrical shell of diameter (d), length (l) is subjected to an internal pressure (p). The circumferential stress in the shell is
(a) pd/4t
(b) pd/2t
(c) pd/8t
(d) $pd/6t$

Section B

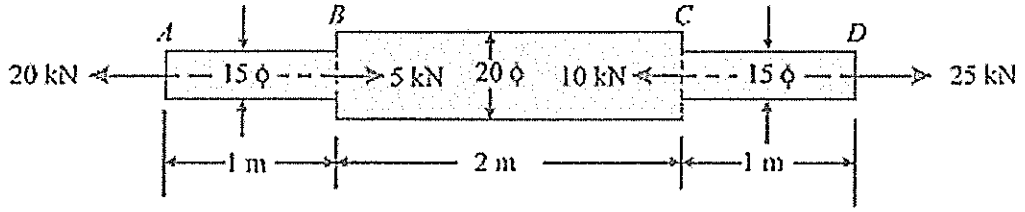
Five Questions of 02 Marks each

11. What is Hooke's Law?
12. Define Proof Resilience and Modulus of Resilience.
13. How to calculate strength of a fillet welded joint?
14. What is Poisson's ratio? Write down the relation between bulk modulus and Young's modulus.
15. Distinguish between circumferential stress and longitudinal stress in a cylindrical shell, when subjected to an internal pressure.

Section C

Seven Questions of 10 Marks each of which any 05 questions to be answered.

16. A steel bar ABCD 4 m long is subjected to forces as shown in Figure. Find the elongation of the bar. Take E for the steel as 200 GPa. 10



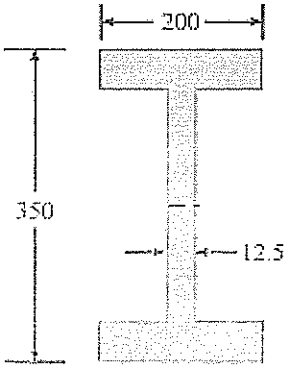
17. (a) Prove $\frac{\tau}{R} = \frac{C.\theta}{l}$ in case of torsion of a circular shaft. (5)
(b) A solid steel shaft has to transmit 100 kW at 160 r.p.m. Taking allowable shear stress as 70 MPa, find the suitable diameter of the shaft. The maximum torque transmitted in each revolution exceeds the mean by 20% (5)

18. (a) Write down the relation between three Elastic Constants. (4)
(b) An axial pull of 20 kN is suddenly applied on a steel rod 2.5 m long and 1000 mm^2 in cross-section. Calculate the strain energy, which can be absorbed in the rod. Take E = 200 GPa (6)

19. A copper tube 1.2 m long has 80 mm internal diameter and 2 mm wall thickness. It has closed ends, and is filled with water under pressure. What will be the alternation of pressure if an additional 10 cube centimetre of water is pumped into the tube. Neglect the distortion of the plates. Take E for copper=$1.02 \times 10^5 N/mm^2$ and μ=0.3 and bulk modulus for water=2.1×10^3 N/mm^2

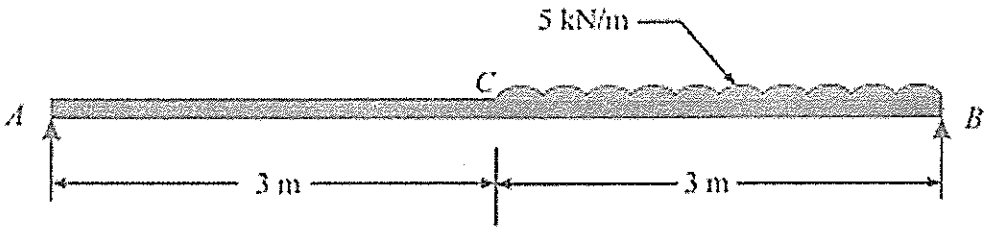
10

20. An I-section beam 350 mm × 200 mm has a web thickness of 12.5 mm and a flange thickness of 25 mm. It carries a shearing force of 200 kN at a section. Sketch the shear stress distribution across the section. 10



21. A simply supported beam 6 m long is carrying a uniformly distributed load of 5 kN/m over a length of 3 m from the right end. Draw the S.F. and B.M. diagrams for the beam and also calculate the maximum B.M. on the section.

10



22. A timber beam of rectangular section supports a load of 20 kN uniformly distributed over a span of 3.6 m. If depth of the beam section is twice the width and maximum stress is not to exceed 7 MPa, find the dimensions of the beam section. 10