Indian Maritime University

(A Centradl University, Govt of India)

Supplementary Examinations – March/April 2025

Programme Name: B Tech (ME)

Semester: IV

Subject Code: UG11T4401

Subject Name: STRENGTH OF MATERIALS

Date: 01.04.2025	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. A simply supported beam carries a couple at a point on its span, the shear force
    a. Varies by cubic law
    b. Varies by parabolic law
    c. Varies linearly
    d. Is uniform throughout
2. Variation of shear force in a cantilever carrying a load the intensity of which varies uniformly from zero at the free end to *w* per unit length at the fixed end is by
    a. Cubic law
    b. Parabolic law
    c. Linear law
    d. None of these
3. A beam is said to be loaded in pure bending if
    a. Shear force and bending moment are uniform throughout
    b. Shear force is zero and bending moment is uniform throughout
    c. Shear force can vary but bending moment is uniform throughout
    d. None of the above
4. In simple bending of beams, the stress in the beam
    a. Is constant
    b. Varies linearly
    c. Varies parabolically

d. None of the above

5. The flexural rigidity of a beam is
   a. E/I
   b. EI
   c. I/E
   d. E^2/I
6. A continuous beam has
   a. One support
   b. Two support
   c. More than two support
   d. Very long span
7. The first area-moment theorem states that the area of the M/EI diagram between two points 1 and 2 gives
   a. Slope at point 1
   b. Slope at point 2
   c. Angle between tangents at 1 and 2
   d. Vertical intercept at point 2 from the tangent at 1
8. The equivalent length of a column fixed at one end and hinged at other end is
   a. L
   b. 2L
   c. L/2
   d. 0.707L
9. In a long column with one end fixed and other free, if the slenderness ratio increases, the critical stress
   a. Increases
   b. Decreases
   c. Remains same
   d. None of the above
10. If the load on a column is increases to a value that on its removal the deflection remains, the load is known as
    a. Critical load
    b. Crippling load
    c. Buckling load
    d. All of these

Section B

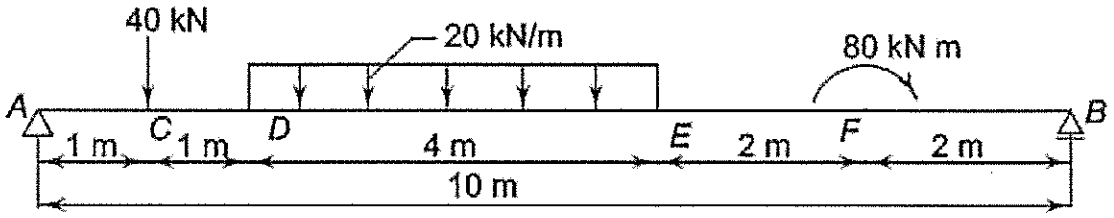
Five Questions of 02 Marks each

11. Define 2nd Area moment theorem.
12. What is statically indeterminate structure?
13. Explain the limitation of Euler's formula.
14. Define Castigliano's theorem.
15. Write and explain the differential relationship between Load intensity, Shear force and Bending moment.

Section C

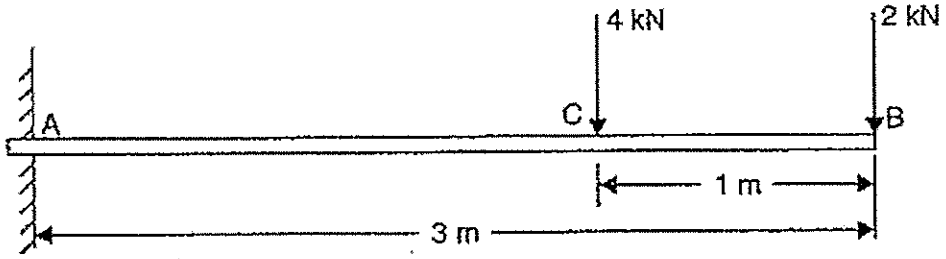
Seven Questions of 10 Marks each of which any 05 questions to be answered.

16. Draw the SF and BM diagrams for the beam loaded as shown in Fig. Also, find the value of maximum bending moment.

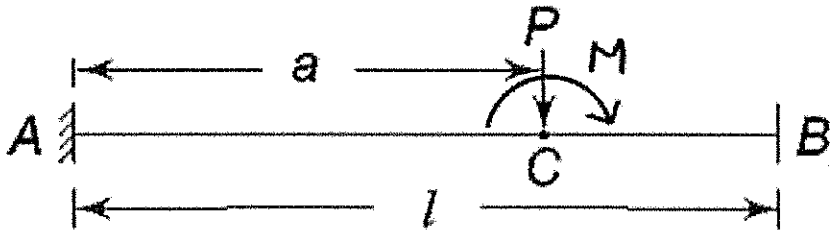


17. Derive pure bending equation of a beam. (10)

18. A ccantilever of length 3 m carries two point loads of 2 KN at the free end and 4 KN at a distance of 1 m from the free end as shown in figure 18. Find the deflection at the free end. Take E = 2X 10^5 N/mm^2 and I = 10^8 mm^4.



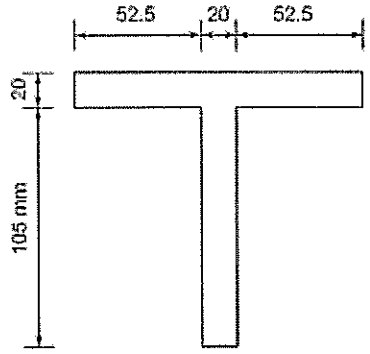
19. (a) A cantilever beam carrying a point load '*P*' and moment '*M*' as shown in Fig. Find slope and deflection at free end B, using Area-moment method. *EI* is constant. (7)



(b) A circular shaft is subjected to a BM of 20 kN-m and a torque of 12 kN-m at a section. Find equivalent BM and equivalent Torque. (3)

20. A fixed beam of 6 m span is subjected to a couple of 120 kN m at a point 2 m from the left support. Draw the SF and BM diagrams. (10)

21. Determine the Euler critical load for the column section shown in Fig. if its length is 3m and (a) If its ends are hinged and (b) if its ends are fixed. *E* = 200 GPa. All dimensions are in mm. (10)



22. Derive crippling load of a column when both ends are hinged. (10)