Indian Maritime University

(A Central University, Govt of India)

Supplementary Examinations – September/October 2024

Programme Name: B Tech (Marine Engineering)

Semester: IV

Subject Code: UG11T4401

Subject Name: STRENGTH OF MATERIALS

Date: 01.10.2024	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. Select the method of finding beam deflections that uses the considerations of Strain Energy of the Beam

   (a) Method of Double Integration

   (b) Area Moment Method

   (c) Castiglione's Method

   (d) Clapeyrons Theorem

2. 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

3. The strain energy stored by the body within elastic limit when loaded externally is called

   (a) Resilience

(b) Proof resilience

(c) Modulus of resilience

(d) None of these

4. The product of ..... is known as flexural rigidity.

(a) EL

(b) EG

(c) EI

(d) EC

5. 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

6. In case of a circular section the section modulus is given as

(a) $\frac{\pi d^2}{16}$

(b) $\frac{\pi d^3}{16}$

(c) $\frac{\pi d^3}{32}$

(d) $\frac{\pi d^4}{64}$

7. Select the correct statement

(a) Fixed –Fixed Beam is statically indeterminate and Propped Cantilever beam is statically determinate

(b) Fixed –Fixed beam and Propped Cantilever Beam are both statically indeterminate beam

(c) Fixed-Fixed beam and propped cantilever beam are both statically determinate

(d) Fixed-fixed beam is statically determinate and propped cantilever beam is statically indeterminate

8. The slope and deflection at the center of a simple beam carrying a central point load are

(a) Zero and zero

(b) Zero and maximum

(c) Maximum and minimum

(d) Maximum and zero

9. A continuous beam has

(a) One support

(b) Two support

(c) More than two support

(d) Very long span

10. The strength of a column depends on which of the following factors?

(a) Slenderness ratio

(b) End conditions

(c) Both (a) and (b)

(d) None of the above

Section B

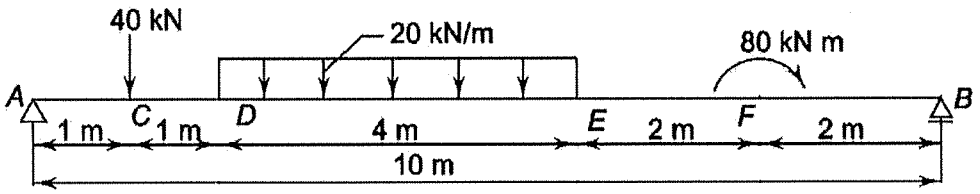
Five Questions of 02 Marks each

11. Define shear force and bending moment
12. Calculate the strain energy stored in a bar 2m long, 50mm wide and 40mm thick when it is subjected to a tensile load of 60kN. Take E as 200GPa.
13. State the assumptions in theory of bending
14. List and explain the different types of supports
15. What is the effective length of a column in terms of actual length at one end fixed and the other end free?

Section C

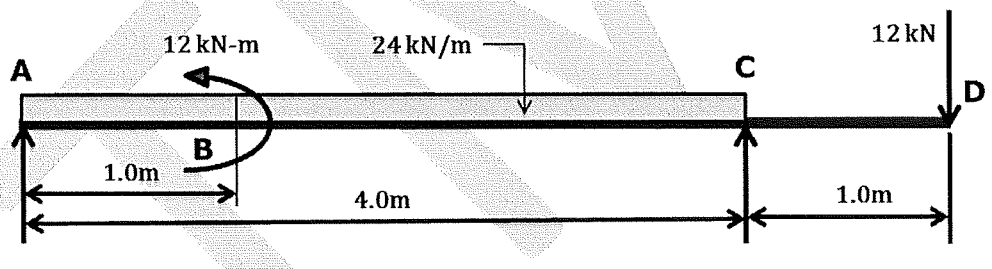
Seven Questions of 10 Marks each of which any 05 questions to be answered.

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



17. A rectangular beam 60mm Width and 150mm Depth is simple supported over a Span of 6m. If the beam is subjected to central point load of 12 KN. Find the maximum bending stress in the beam section.

18. Consider a Hinge supported beam along with the loads subjected on it as shown in the figure bellow. Using Macaulay's method obtain the slope at both support points and deflection at a point 3.0 meter from point A.



19. Derive the following deflection equation and also find the maximum deflection of a cantilever beam of length 'L' subjected to a point load 'P' at the free end by using deflection equation.

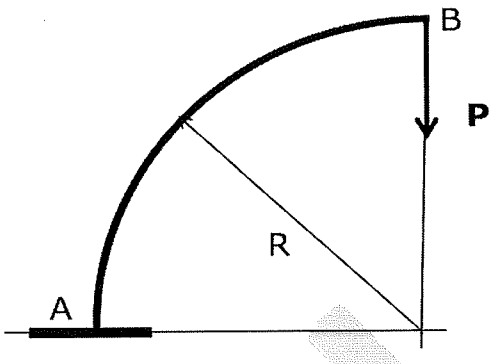
$$EI\frac{d^2y}{dx^2} = -M$$

where, M=Bending Moment, I= Moment of Inertia and E= Young's Modulus

20. Derive the expression for the Euler's Buckling load for the Strut supported by the hinged joints at the both ends.

21. Thin bar AB, curved in the form of a quadrant of a circle, and is fixed on the ground at point A to hold the total arc in the vertical plane and end B

is left free as shown in the figure bellow. A Vertical force in the plane of the arc of magnitude P Newton is applied at the point B. Obtain the vertical as well as horizontal displacement of the point B.



22. Derive the bending equation:

$$\frac{M}{I} = \frac{f}{y} = \frac{E}{R}$$

Where,

M=Bending Moment
I= Moment of Inertia
E= Young's Modulus
R= Radius of curvature and
f = Bending stress in a fiber, at a distance y from the neutral axis