

<b>Indian Maritime University</b>				
<b>Supplementary Examinations – March/April 2024</b>				
<b>B.TECH (MARINE ENGINEERING)</b>				
<b>STRENGTH OF MATERIALS</b>				
<b>UG11T4401</b>				
Date: 15.03.2024		Duration: 03 hours		
Max Marks : 70		Pass Marks : 35		
Part A (Part A is Compulsory)				
Q1 [10 x 1 = 10 Marks] Multiple Choice Questions	Options			
(1) A vertical column has two moments of inertia (i.e. $I_{xx}$ and $I_{yy}$ ). The column will tend to buckle in the direction of the	A) axis of load	B) perpendicular to the axis of load	C) maximum moment of inertia	D) minimum moment of inertia
(2) The neutral axis of the cross-section a beam is that axis at which the bending stress is	A) minimum	B) zero	C) maximum	D) infinity
(3) Euler's formula holds good only for	A) short columns	B) weak columns	C) long columns	D) both short and long columns
(4) When a rectangular beam is loaded transversely, the maximum compressive stress is developed on the	A) bottom layer	B) top layer	C) neutral axis	D) every cross-section
(5) When shear force at a point is zero, then bending moment is _____ at that point.	A) translatory	B) rotary	C) circular	D) translatory as well as rotatry
(6) In a simple bending of	A) parabolically	B) linearly	C) hyperbolically	D) elliptically

beams, the stress in the beam varies rough horizontal plane is				
(7) A concentrated load is one which	A) spreads uniformly over the whole length of a beam	B) spreads non-uniformly over the whole length of a beam	C) acts at a point on a beam	D) varies uniformly over the whole length of a beam
(8) A fixed beam is a beam whose end supports are such that the end slopes are	A) maximum	B) minimum	C) zero	D) none of the above
(9) The ratio of moment of inertia about the neutral axis to the distance of the most distant point of the section from the neutral axis is called	A) moment of inertia	B) section modulus	C) polar moment of inertia	D) modulus of rigidity
(10) Strut is defined as	A) member of a structure which carries a tensile load	B) member of a structure which carries an axial compressive load	C) vertical member of a structure which carries a tensile load	D) none of the above.

**Q2 [2 x 5 = 10 Marks] - Short Answer Type Questions**

- (11) What is the value of maximum bending moment of a cantilever beam having a point load  $W$  at free end in a span of length  $L$  of the beam.
- (12) Define the Section modulus of a beam.
- (13) What is Contra flexure point?.
- (14) Define Castigliano's first theorem.
- (15) Differentiate between long and short column.

**Part B (Answer any Five out of Seven) Each Question is for 10 Marks**

16. A hollow mild steel tube of 6m long and 4cm internal diameter and 6mm thick is used as a strut with both ends hinged. Find the crippling load and safe load taking factor of safety as 3. Take  $E = 2 \times 10^5 \text{ N/mm}^2$ .
17. Draw the shear force and bending moment diagram of the beam shown below figure 17.

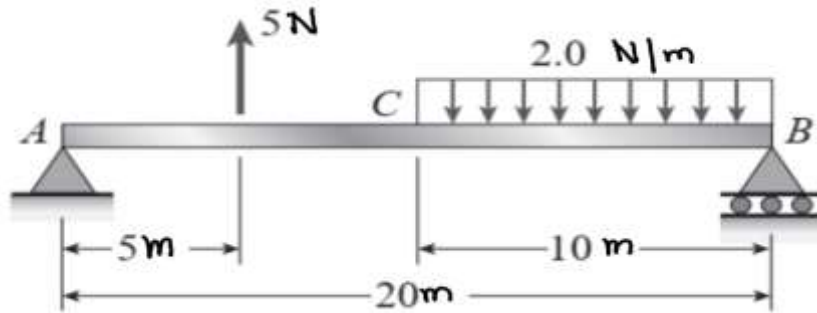


Figure 17

18. A cantilever 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  $E = 2 \times 10^5 \text{ N/mm}^2$  and  $I = 10^8 \text{ mm}^4$ .

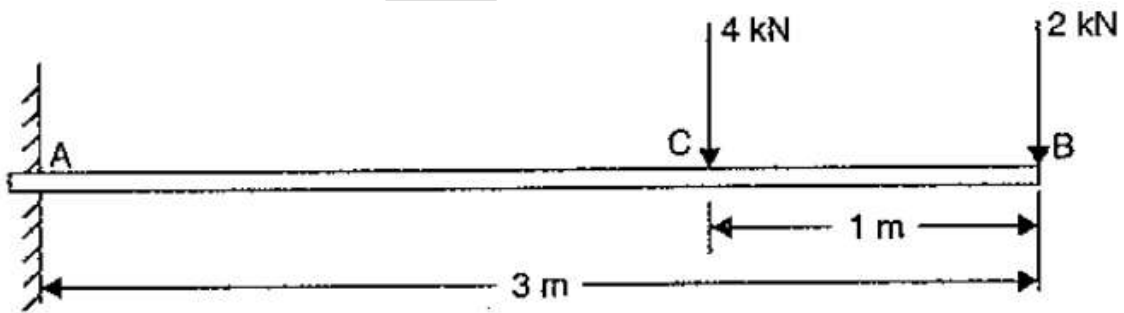


Figure 18

19. A rolled steel joist of I-section has the dimensions as shown in figure 19. This beam of I-section carries a uniformly distributed load of 40 kN/m run on a span of 10 m. Calculate the maximum stress produced due to bending.

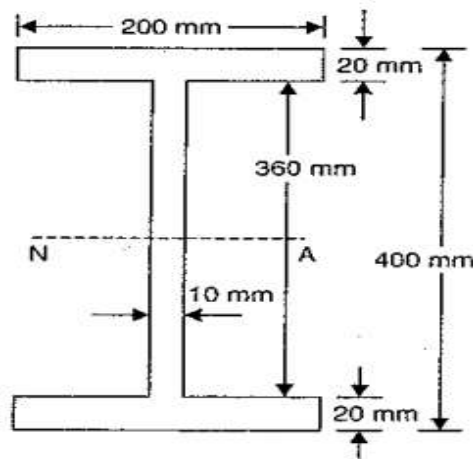


Figure 19.

20. Derive pure bending equation of a beam.

21. The frame ABC supports a concentrated load  $P$  at point  $C$  as shown in the figure. Members  $AB$  and  $BC$  have lengths  $h$  and  $b$  respectively. Determine the vertical deflection at point  $C$  using Castiglino's theorem.

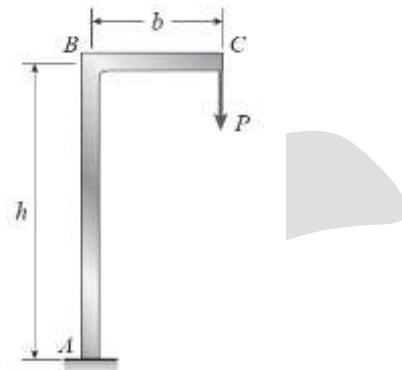


Figure . 21

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