

**INDIAN MARITIME UNIVERSITY**  
(A Central University, Government of India)  
**END SEMESTER EXAMINATIONS –DECEMBER 2018**  
**B. Tech (Marine Engineering)**  
**Semester -III**  
**Strength of Materials -II (UG11T3304)**

Date:04-01-2019  
Time: 3Hrs

Max Marks: 100  
Pass Marks: 50

**PART A**

**Question-1 is compulsory.**

(10 X 3 = 30 Marks)

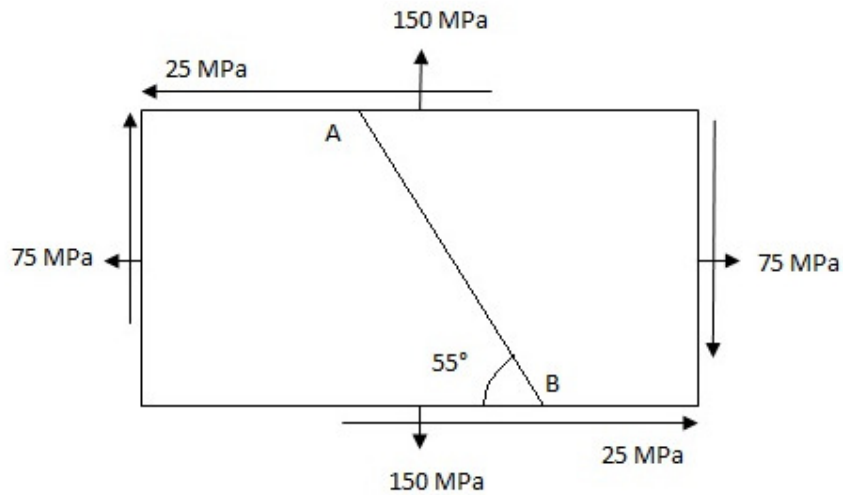
- Q1. a) What is Mohr's Circle? How it is Drawn?  
b) Define Principle Stresses and Planes.  
c) What are the methods of determining slope and deflection at a section in a loaded beam?  
d) Define Mohr's Theorem I and II  
e) Explain the difference between Fixed and continuous beams.  
f) State Claperyon's Three moment theorem.  
g) How you will determine hoop stress in a compound thick cylinder?  
h) What do you mean by Lamé's equation?  
i) State and explain Rankine-Gordan formula for columns.  
j) What is 'slenderness ratio'? Describe with mathematical expression.

**PART B**

**Answer any 5 questions from the following**

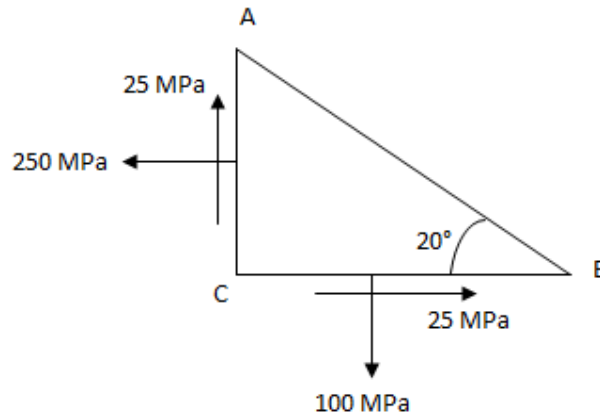
( 5 X 14 = 70 Marks)

- Q2. a. Derive the expression of normal stress and shear stress on an oblique plane inclined at an angle  $\theta$  of a rectangular body which is subjected to direct stresses in two mutually perpendicular directions accompanied by a shear stress. [7]
- b. A point in a strained material is subjected to stress shown in the figure below. Using Analytical method, determine the normal and tangential stresses and resultant stress across the oblique plane. [7]



Q3.

- a. A point in a strained material is subjected to stress shown in the figure below. Using Mohr's circle method, determine the normal and tangential stresses and resultant stress across the oblique plane. [8]



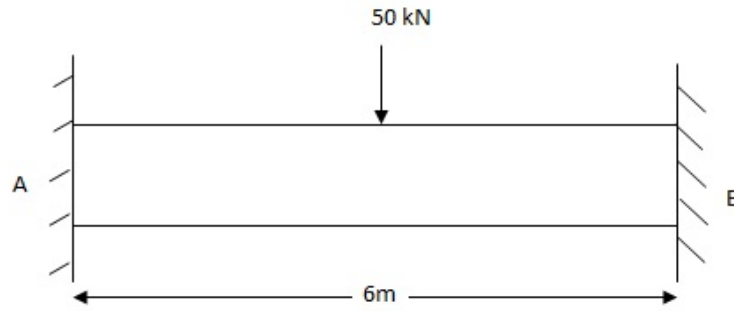
- b. Derive the maximum slope and deflection of a cantilever beam with a uniformly distributed load using moment area method. [6]

Q4.

A horizontal beam AB is simply supported at A and B, 8 m apart and carries a uniformly distributed load of 15 kN/m run (including its own weight). A clockwise moment of 160 kN-m is applied to the beam at a point C, 3 m from the left hand support. Calculate the slope of the beam at C, if  $EI = 40 \times 10^3 \text{ kN-m}^2$ . [14]

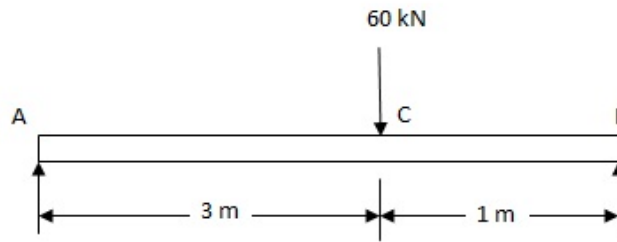
Q5.

A fixed beam AB, 6 m long, is carrying a point load of 50 kN at its centre. The moment of inertia of the beam is  $78 \times 10^6 \text{ mm}^4$  and value of E for the beam material is  $2.1 \times 10^5 \text{ N/mm}^2$ . Determine: [14]  
 a) Fixed end moments at A and B  
 b) Deflection under the beam.  
 (solve using BM diagram)



Q6.

Using the modified form of the Castigliano's theorem, obtain the deflection under a single concentration load applied to a simply supported beam shown in the figure. Take  $EI = 2.2 \text{ MN-m}^2$ .



[14]

Q7.

A compound thick cylinder is formed by shrinking a tube of 300 mm external diameter over another tube of 150 mm internal diameter. After shrinking, the diameter at the junction of the tubes is found to be 250 mm and radial compression as  $28 \text{ N/mm}^2$ . Find the original difference in radii at the junction. Take  $E$  for the cylinder metal as 200 GPa.

[14]

Q8.

a) Derive a relation for Euler's crippling load for a column for a column when one end fixed and the other end is free.

[7]

b) Find the Euler's crippling load for a hollow cylindrical steel column of 38 mm external diameter and 2.5 mm thick. Take length of the column as 2.3 m and hinged at its both ends. Take  $E = 205 \text{ GPa}$ .

[7]

Also determine crippling load by Rankine's formula using constants as 335 MPa and  $\frac{1}{7500}$

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