



**MASINDE MULIRO UNIVERSITY OF  
SCIENCE AND TECHNOLOGY  
(MMUST)**

**MAIN CAMPUS**

**UNIVERSITY REGULAR EXAMINATIONS  
2021/2022 ACADEMIC YEAR**

**SECOND YEAR SECOND SEMESTER EXAMINATIONS**

**FOR THE DEGREE  
OF:**

**BACHELOR OF SCIENCE IN CIVIL AND STRUCTURAL  
ENGINEERING**

**BACHELOR OF TECHNOLOGY IN BUILDING CONSTRUCTION**

**COURSE CODE: CSE 212**

**COURSE TITLE: THEORY OF STRUCTURES II**

**DATE: WEDNESDAY 20<sup>TH</sup> APRIL 2022 TIME: 3.00 – 5.00 PM**

---

**INSTRUCTIONS:**

1. This paper contains **FIVE** questions
2. Answer **QUESTION ONE** and any other **TWO** Questions
3. Marks for each question are indicated in the parenthesis.
4. Relevant Table for analysis is provided.
5. Examination duration is **2 Hours**

MMUST observes **ZERO** tolerance to examination cheating

This Paper Consists of 4 Printed Pages. Please Turn Over.

---

**QUESTION ONE (30 MARKS)**

- a) Discuss any FOUR (4) differences between statically determinate structures and statically indeterminate structures. **(4Mks)**
- b) Several methods exist for analysis of statically indeterminate structures. Discuss the TWO broad categories of such methods of analysis. **(4Mks)**
- c) State Castigliano's second theorem. **(2Mks)**
- d) Given a truss with loading as shown in Figure Q1, calculate the member forces and reactions using Castigliano's second theorem. For all members,  $E = 200 \text{ GPa}$  and  $A = 7.36 \times 10^{-4} \text{ m}^2$ . **(20Mks)**

**QUESTION TWO (20 Marks)**

Moment-area method is one of the analysis methods which can be used for both statically determinate and statically indeterminate structures. A propped cantilever beam subjected to a point load of 150kN, as shown in Figure Q2 is to be analysed using moment-area method. Carryout the following:

- a) State the two moment-area theorems. **(2Mks)**
- b) Determine the moment at support A. **(9Mks)**
- c) Using the moment determined in (b) above, determine the vertical support reactions. **(3Mks)**
- d) Draw the shear force and bending moment diagrams with all the peak values. **(6Mks)**

**QUESTION THREE (20 Marks)**

A three-span continuous beam with relative moment of inertia is loaded as shown in Figure Q3. Using three-moment method, carry out the following:

- a) Write the general expression for three-moment equation. **(2Mks)**
- b) Determine the moments at supports A, B, C and D. **(12Mks)**
- c) Determine the reactions at each support. **(6Mks)**

**QUESTION FOUR (20 Marks)**

A rigid-jointed frame with the relative  $EI$  values and the applied loading shown in Figure Q4 is to be analyzed using moment distribution method.

- a) Determine the bending moments at the supports. **(11Mks)**
- b) Sketch the bending moment diagram indicating the critical values. **(9Mks)**

**QUESTION FIVE (20 Marks)**

- a) Influence lines are based on Müller-Breslau principle. State this principle as used in structural analysis. **(2Mks)**
- b) A beam shown in Figure Q5 is to be analysed using influence lines. Draw the quantitative influence line for the shear at *D* for the beam. Take *EI* to be constant. Plot numerical values at every 9 m. **(18Mks)**

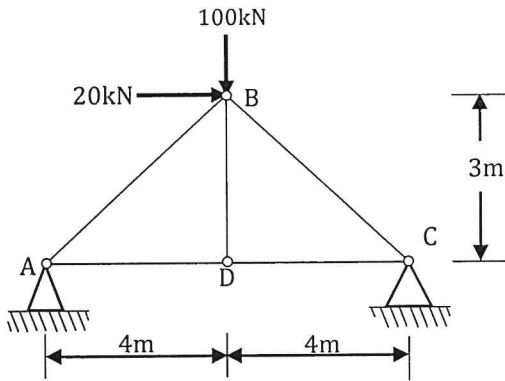


Figure Q1

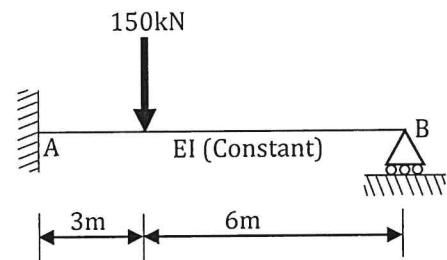


Figure Q2

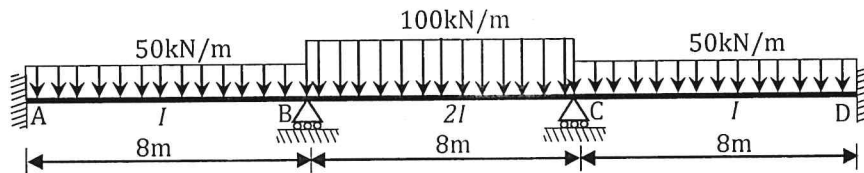


Figure Q3

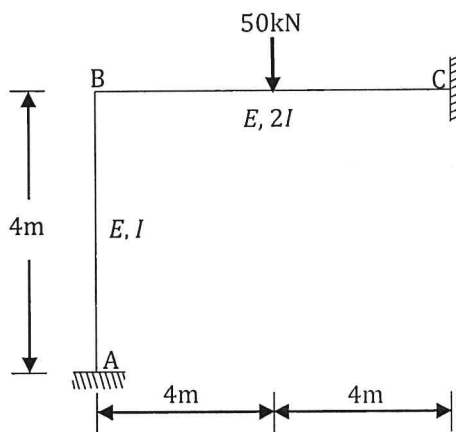


Figure Q4

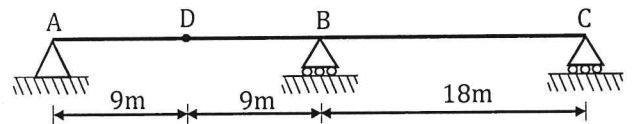
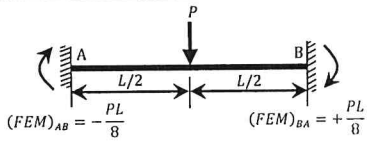
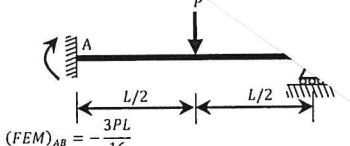
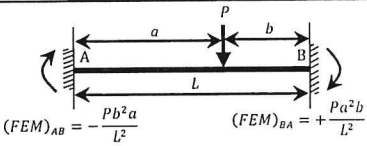
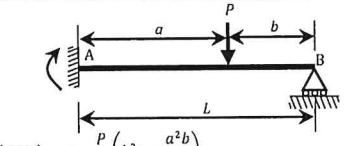
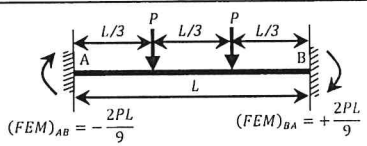
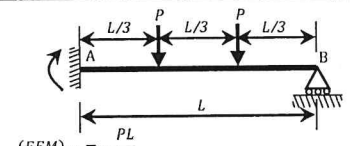
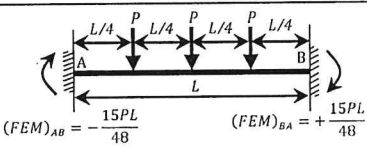
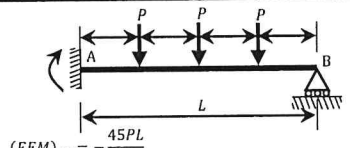
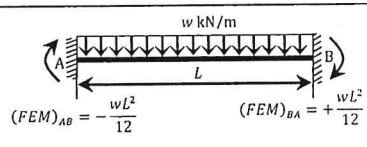
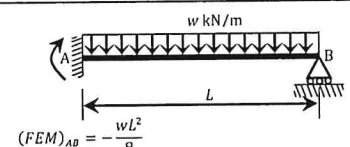
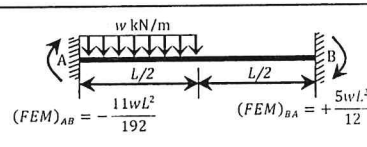
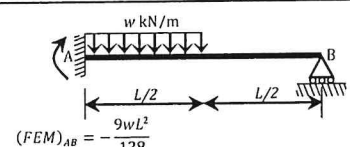
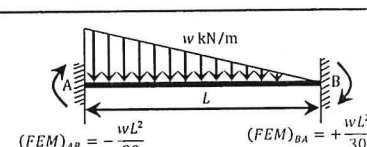
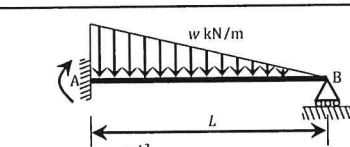
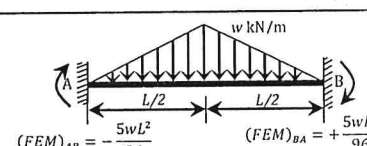
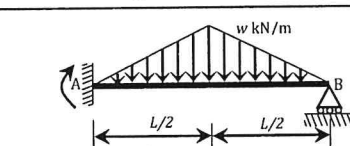


Figure Q5

**Table 1: Free-End Moments (Adopt specific sign convenu.**

 <p> <math>(FEM)_{AB} = -\frac{PL}{8}</math>      <math>(FEM)_{BA} = +\frac{PL}{8}</math> </p>	 <p> <math>(FEM)_{AB} = -\frac{3PL}{16}</math> </p>
 <p> <math>(FEM)_{AB} = -\frac{Pb^2a}{L^2}</math>      <math>(FEM)_{BA} = +\frac{Pa^2b}{L^2}</math> </p>	 <p> <math>(FEM)_{AB} = -\frac{P}{L^2} \left( b^2a + \frac{a^2b}{2} \right)</math> </p>
 <p> <math>(FEM)_{AB} = -\frac{2PL}{9}</math>      <math>(FEM)_{BA} = +\frac{2PL}{9}</math> </p>	 <p> <math>(FEM)_{AB} = -\frac{PL}{3}</math> </p>
 <p> <math>(FEM)_{AB} = -\frac{15PL}{48}</math>      <math>(FEM)_{BA} = +\frac{15PL}{48}</math> </p>	 <p> <math>(FEM)_{AB} = -\frac{45PL}{96}</math> </p>
 <p> <math>(FEM)_{AB} = -\frac{wL^2}{12}</math>      <math>(FEM)_{BA} = +\frac{wL^2}{12}</math> </p>	 <p> <math>(FEM)_{AB} = -\frac{wL^2}{8}</math> </p>
 <p> <math>(FEM)_{AB} = -\frac{11wL^2}{192}</math>      <math>(FEM)_{BA} = +\frac{5wL^2}{12}</math> </p>	 <p> <math>(FEM)_{AB} = -\frac{9wL^2}{128}</math> </p>
 <p> <math>(FEM)_{AB} = -\frac{wL^2}{20}</math>      <math>(FEM)_{BA} = +\frac{wL^2}{30}</math> </p>	 <p> <math>(FEM)_{AB} = -\frac{wL^2}{15}</math> </p>
 <p> <math>(FEM)_{AB} = -\frac{5wL^2}{96}</math>      <math>(FEM)_{BA} = +\frac{5wL^2}{96}</math> </p>	 <p> <math>(FEM)_{AB} = -\frac{5wL^2}{64}</math> </p>

=====END OF PAPER=====