



**TECHNICAL UNIVERSITY OF MOMBASA**

FACULTY OF ENGINEERING AND TECHNOLOGY  
DEPARTMENT OF BUILDING & CIVIL ENGINEERING  
**UNIVERSITY EXAMINATION FOR:**  
TECHNOLOGY IN CIVIL ENGINEERING

**ECE 2317 : THEORY OF STRUCTURES IV**  
END OF SEMESTER EXAMINATION  
**SERIES: JULY 2017**  
**TIME: 2 HOURS**  
**DATE:**

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of five questions.

Attempt question ONE (Compulsory) and any other TWO questions.

**Do not write on the question paper.**

**QUESTION ONE (COMPULSORY) 20 Marks**

(a) State the following:

- i. Principle of virtual work (2marks)
- ii. Castigliano's Second Theorem (2marks)
- iii. First moment of area theorem (2marks)
- iv. Complementary Work (2marks)
- v. Second Moment of Area Theorem (2marks)

(b) Using strain energy principle analyse the beam shown and draw the shear force and bending moment diagram (20marks)

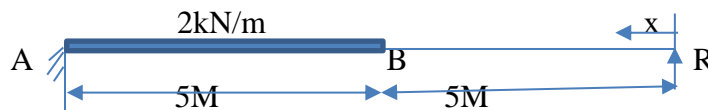


Figure Q1(b)

**ANSWER ANY TWO QUESTIONS FROM THIS SECTION**  
**QUESTION TWO (20 Marks)**



A rolled steel joist of 250mm x 125mm as shown below carries a single concentrated load of 20kN at the right third point over a simply supported span of 9m.

If the value of  $I_{xx}$  for the beam is  $51.316 \times 10^6 \text{mm}^4 (51.316 \times 10^{-6} \text{M}^4)$  and the value of  $E$  for the material is 200 GPa ( $200 \times 10^6 \text{kN/m}^2$ ) calculate by the use of conjugate beam method

- (i) Deflection under the load and
- (ii) Maximum deflection on the span.



(20marks)

Figure Q2

**QUESTION THREE (20 Marks)**

Analyze the continuous beam shown in Figure Q2 by the three moment equation. Draw the shear force and bending moment diagram.

Using moment area method determine the deflection at B and the slope for the figure shown below (20marks)

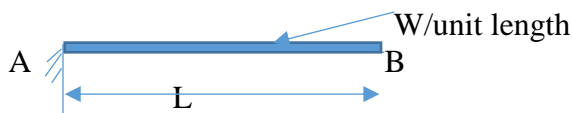
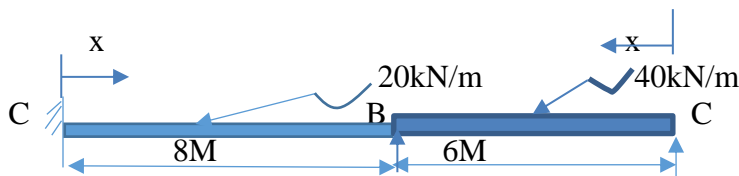


Figure Q3

**QUESTION FOUR (20 Marks)**

Using strain energy principle analyse the beam shown and obtain the reactions A,B and C ,SFD and BBD. (20marks)



EI Constant

Figure Q4

**QUESTION FIVE (20 Marks)**

Determine the vertical and deflection of joint D of the truss shown. Take  $E = 200 \text{kN/mm}^2$  and member areas,  $A = 1000 \text{mm}^2$  for all members except AE and BD where  $A = 1000\sqrt{2} \text{mm}^2$ .

(20marks)

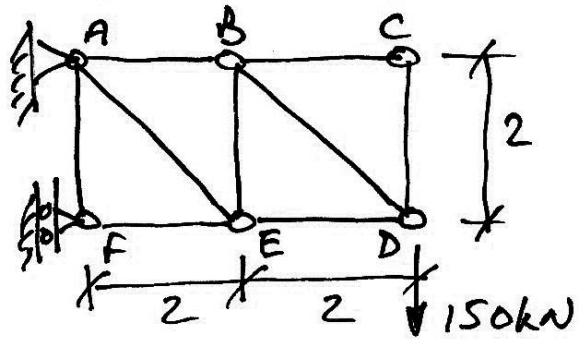


Figure Q5