# TECHNICAL UNIVERSITY OF MOMBASA

## FACULTY OF ENGINEERING AND TECHNOLOGY

## DEPARTMENT OF BUILDING & CIVIL ENGINEERING

## UNIVERSITY EXAMINATION FOR:

BACHELOR OF SCIENCE IN CIVIL ENGINEERING

### ECE 2317 : THEORY OF STRUCTURES IV

## END OF SEMESTER EXAMINATION

## SERIES: JULY 2017

## TIME: 2  HOURS

**Instructions to Candidates**
You should have the following for this examination
    *-Answer Booklet, examination pass and student ID*
    *-Drawing instruments.*
This paper consists of five questions.
Attempt question ONE (Compulsory) and any other TWO questions.
**Do not write on the question paper.**

## QUESTION 1 (COMPULSORY)

i) Figure Q.1 (a) is a bridge truss loaded at point C and D and resting freely at the two supports. Using Castagliano's $1^{st}$ theorem and taking the modulus of elasticity as $230KN/mm^2$.
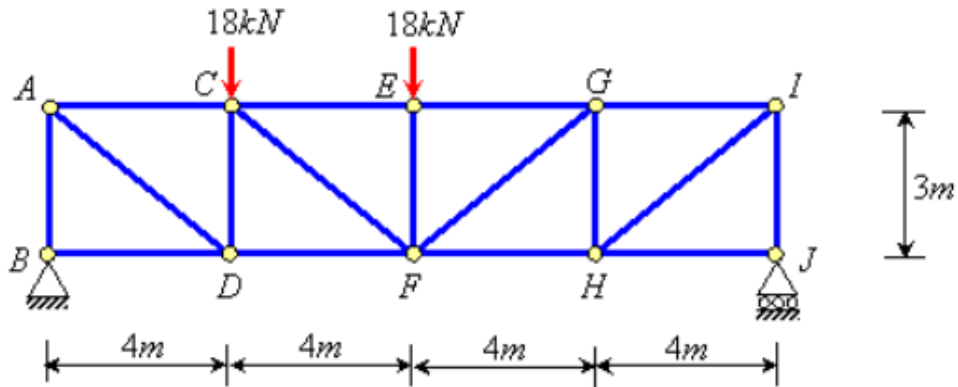
**Figure Q.1 (a)**

(20 marks)

ii) State Castagliano's 2nd theorem and show that the deflection of a frame using this principle is given by $[-\lambda = \dfrac{\delta U}{\delta R}]$

(10 marks)

## QUESTION 2

i) A braced span AB shown in figure Q.2(a) supports a vertical load of 100KN. find the maximum deflection in span AB and the deflection at C in terms of EI using **moment area method.**
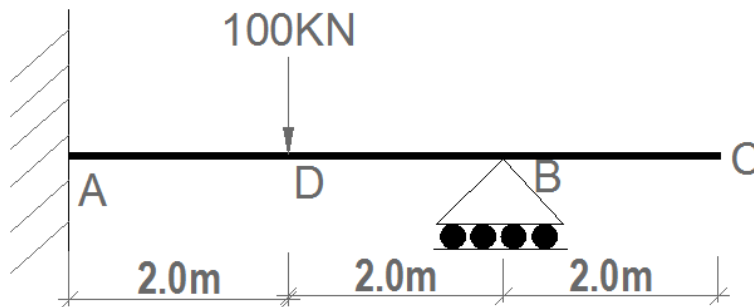


**Figure Q.2(a)**

(17 marks)

ii) State Castagliano's 1st theorem and show the equation associated with it.

(3 marks)

## QUESTION 3

Figure Q.3 shows a continuous beam loaded with a **udl** along the whole span. Using conjugate beam method, determine deflection at point **d** using **conjugate beam method.**
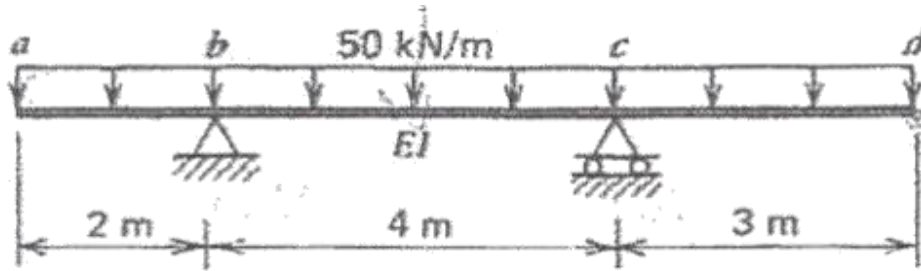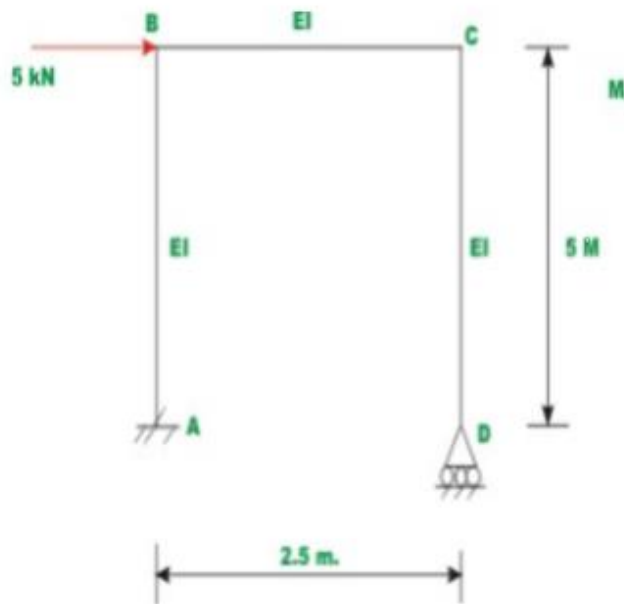
**Figure Q.3**

(18 marks)

## QUESTION 4

i) State the principle of virtual work and explain how it's applied in the analysis of trusses.

i. (3 marks)

ii) Find the horizontal displacement at joint B of the frame ABCD as shown in Figure Q.4 (b) by virtual work method. Assume EI to be constant for all members.



(17 marks)

**Figure Q.4 (b)**

## QUESTION 5

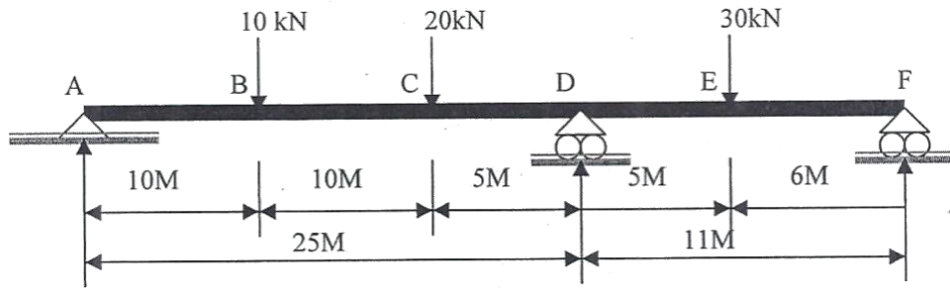Determine the value of reaction at support D for the beam shown in figure Q.5 using the method of least work.

**Figure Q.5**

(20 marks)