MACHAKOS UNIVERSITY

University Examinations for 2019/2020Academic Year

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

SECOND YEAR SECOND SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE (CIVIL ENGINEERING)

ECV 209: THEORY OF STRUCTURES II

DATE: 15/12/2020 **TIME: 8.30-10.30 AM**

INSTRUCTIONS

Answer question **ONE** and any other **TWO** questions

QUESTION ONE (COMPULSORY) (30 MARKS)

a) Draw the influence lines for the vertical reaction and the reaction moment at support A and the shear and bending moment at point B of the cantilever beam shown in figure 1. (5 marks)

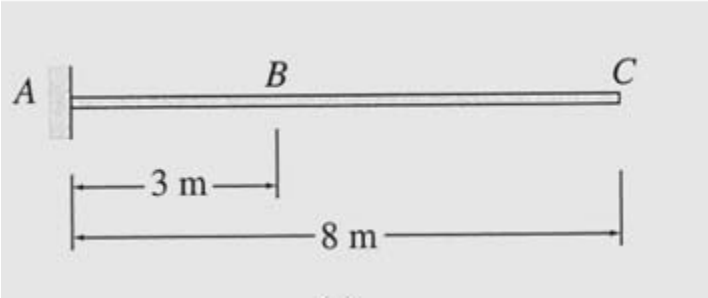

Figure 1

b) Determine the reactions and draw the shear and bending moment diagrams for the beam shown in figure 2 by the method of consistent deformations (7 marks)

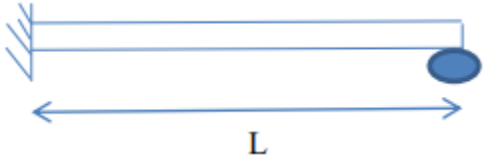

Figure 2

c) An overhanging beam ABC is loaded as shown in figure 3. Find the slopes over each support and at the right end. (8 marks)

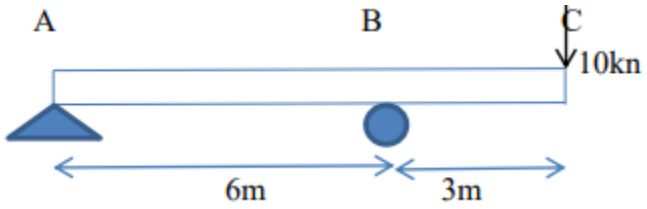

Figure 3

d) State four classes of arches (4 marks)

e) Determine the slope and deflection at point B of the cantilever beam shown in figure 4 by the direct integration method. EI is constant. E=200GPa and I= 315*106mm 4 (6 marks)

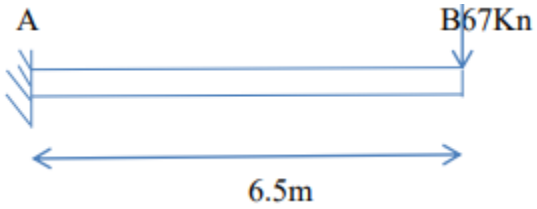

Figure 4

QUESTION TWO (20 MARKS)

Determine the reaction for the continuous beam shown in figure 5 due to the uniformly distributed load and due to the support settlements of 10mm at A , 50mm at B , 20mm at C and 40mm at D. Use the 3 moment equation. E=200GPa and I=700*106mm 4

$$\frac{M_\ell L_\ell}{I_\ell} + 2M_c\left(\frac{L_\ell}{I_\ell} + \frac{L_r}{I_r}\right) + \frac{M_r L_r}{I_r}$$
$$= -\sum \frac{P_\ell L_\ell^2 k_\ell}{I_\ell}(1 - k_\ell^2) - \sum \frac{P_r L_r^2 k_r}{I_r}(1 - k_r^2) - \frac{w_\ell L_\ell^3}{4I_\ell} - \frac{w_r L_r^3}{4I_r}$$
$$- 6E\left(\frac{\Delta_\ell - \Delta_c}{L_\ell} + \frac{\Delta_r - \Delta_c}{L_r}\right)$$

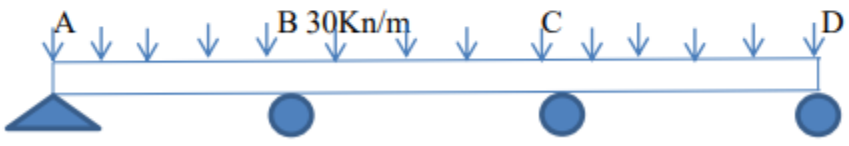

Figure 5

QUESTION THREE (20 MARKS)

A beam ABC of length 9 m has one support at the left end and the other support at a distance of 6m from the left end. The beam carries a point load of 1Kn at right end and also 4Kn/m over a length of 3m as shown in figure 6. Determine the slope and deflection at point C.

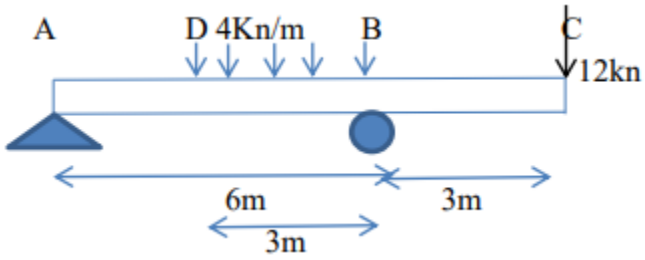

Figure 6

QUESTION FOUR (20 MARKS)

A parabolic arch hinged at the springing and crown has a span of 20m.The central rise of the arch is 4m. It is loaded with a uniformly distributed load of intensity 2Kn/m on the left 8m length. Calculate

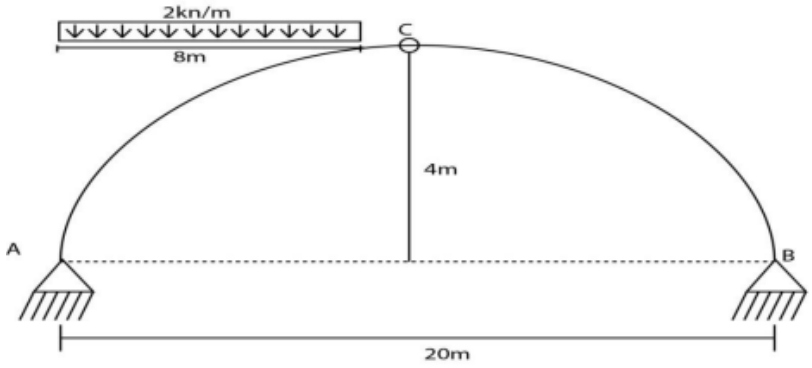

Figure 7

a) The direction and magnitude of reactions at the hinges

b) The bending moments, normal thrust and shear at 4m and 15m from the left end.

c) The maximum positive and negative bending moments

QUESTION FIVE (20 MARKS)

Draw the influence lines for the vertical reactions at support A , C and E, the shear just to the right of C and the bending moment at point B of the beam in figure 7.

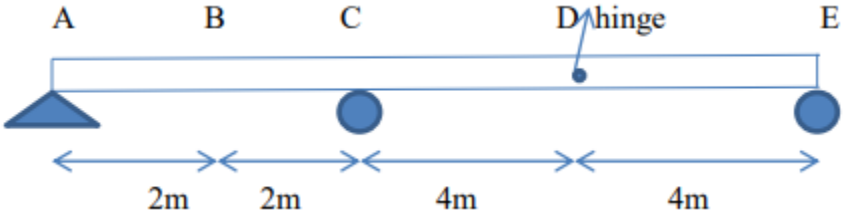

Figure 7