MACHAKOS UNIVERSITY

University examinations 2018/2019

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

SECOND YEAR SECOND SEMESTER EXAMINATION FOR BACHELOR IN CIVIL ENGINEERING

ECV 209: THEORY OF STRUCTURES II

Date **time**

INSTRUCTIONS

- *This paper comprises of five questions. Answer **three** questions*
- *Question one is **compulsory** and carry 30 marks*
- *Answer any other **two** questions*

1 (a) State four classes of arches (4mks)

(b) Figure 1 illustrates a cable structure carrying two loads. Assume that the deformed structure has the maximum depth as shown under the first load. The deformed structure has another critical depth under the second load. The latter depth is not precisely known beforehand, but it must be a value that is directly dependent on the maximum depth of the other point which is given. Analyse the structure (10mks)

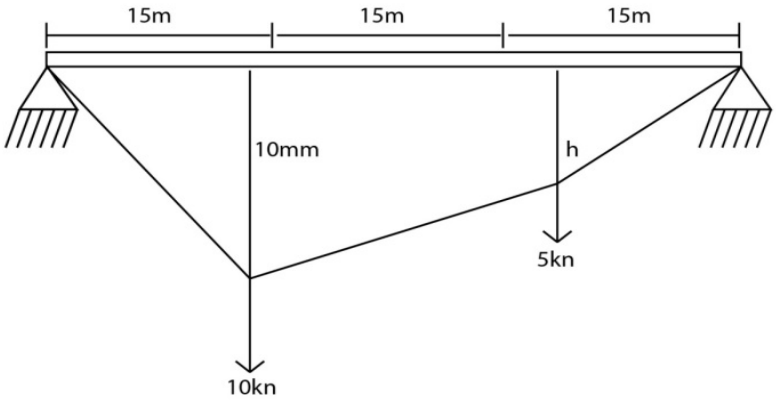


Figure 1

(c) Draw the influence lines for vertical reactions at A and C, shear at B and bending moment at B of the beam shown in figure 2 (10mks)

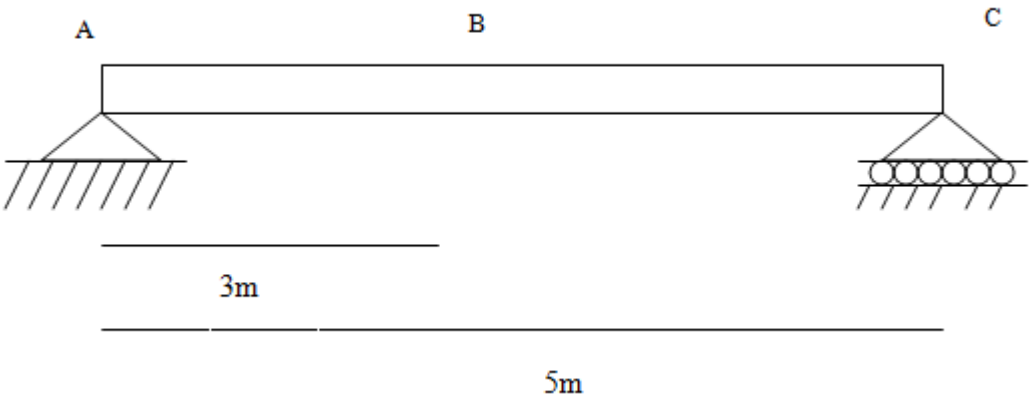


Figure 2

(d) Determine the equations for the slope and deflection the beam shown in figure 3 by the direct integration method. Also, compute the slope at each end and the deflection at the midspan of the beam. EI is constant (6mks)

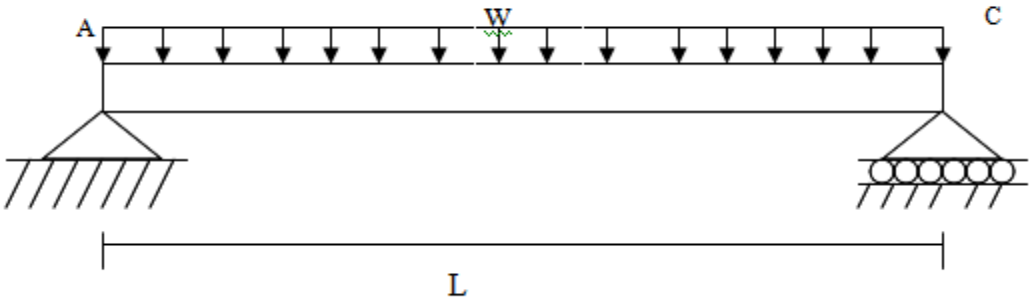


Figure 3

2. Determine the reactions and draw the shear and bending moment diagrams for the beam shown in figure 4 using 3-moment equation (20mks)

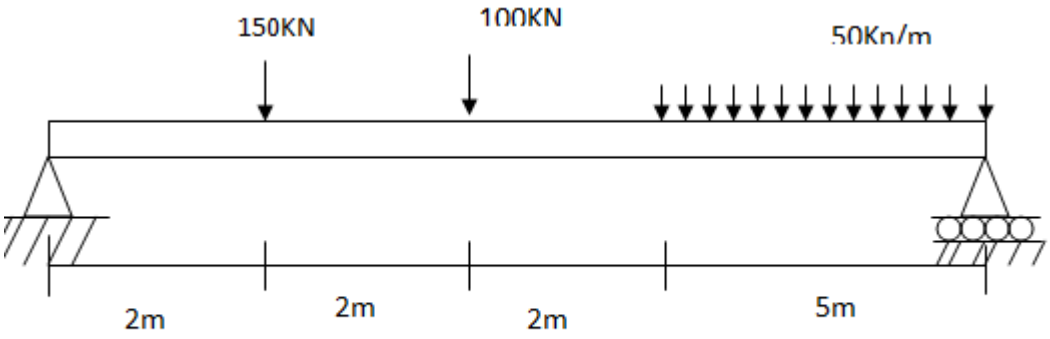


Figure 4

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

3. A parabolic arch hinged at the springing and crown has a span of 20m as shown in figure 5. The central rise of the arch is 4m. It is loaded with a uniformly distributed load of intensity 2 kN/m on the left 8m length. Calculate:

(a) The direction and magnitude of reactions at the hinges

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

(c) Maximum positive and negative bending moments (20mks)

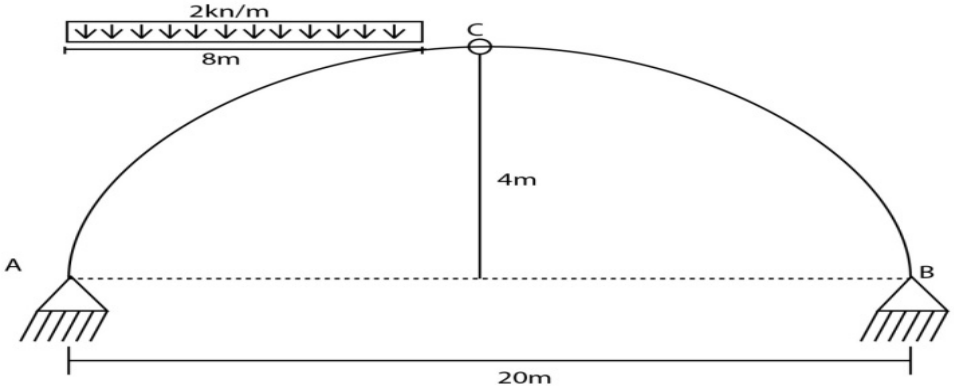
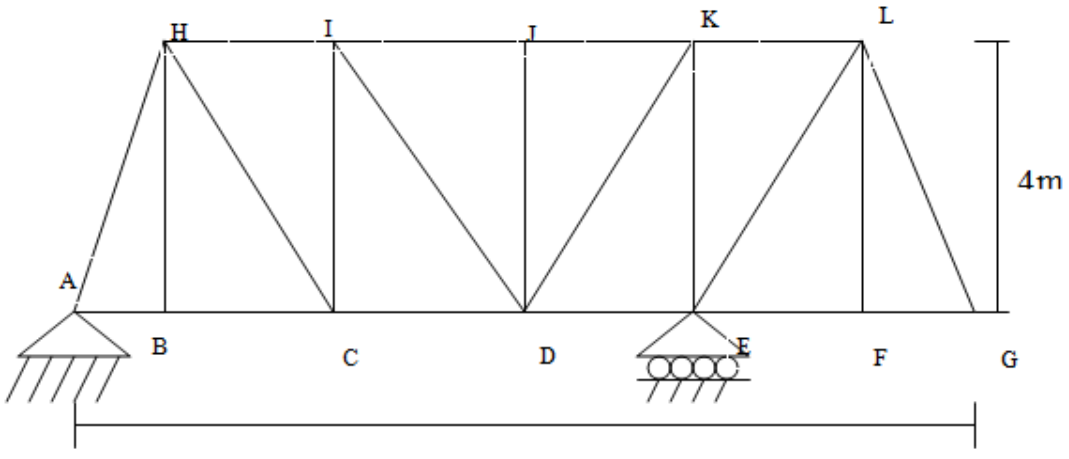


Figure 5

4. Draw the influence lines for vertical reactions at supports A,E and for the axial forces in members CI,CD, DI, IJ and FL of the truss shown in figure 6 (20mks)



6panels at 3m=18m

Figure 6

5. Determine the reactions and draw the shear and bending moment diagrams for the beam shown in figure 7 by the method of consistent deformations (20mks)

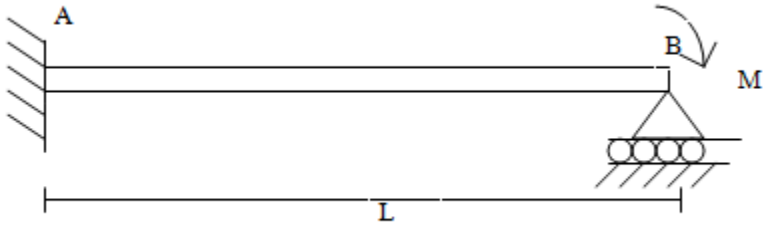


Figure 7