P.E.S. COLLEGE OF ENGINEERING

(AN AUTONOMOUS INSTITUTE)

CHH. SAMBHAJINAGAR-431002

Summer Examination – 2026

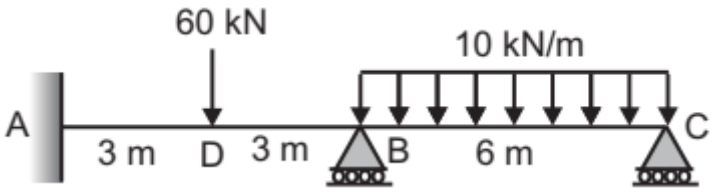
Course: F.Y.M. Tech. **Branch : Structural Engineering** **Semester : II**
Subject Code & Name: MTPESSEPE204CT, Matrix Method of Structural Analysis

Max Marks: 60 **Date:06/07/2026** **Duration: 3 Hr.**

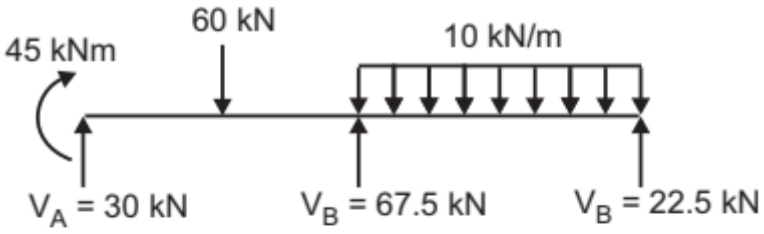
Instructions to the Students:

1. *All the questions are compulsory.*
2. *The level of question/expected answer as per OBE or the Course Outcome (CO) on which the question is based is mentioned in ( ) in front of the question.*
3. *Use of non-programmable scientific calculators is allowed.*
4. *Assume suitable data wherever necessary and mention it clearly.*

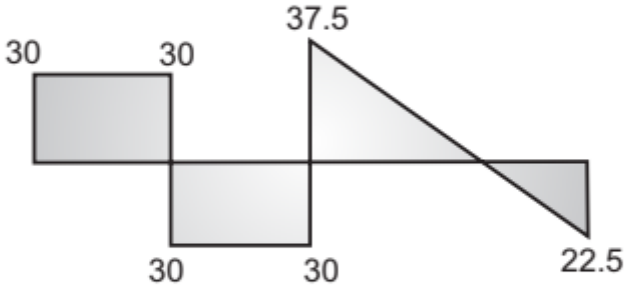
		(Level/CO)	Marks
Q. 1	**Solve Any one of the following.**		
A)	Analyse the continuous beam ABC as shown in figure by Direct Flexibility method.	**K3**	**12**



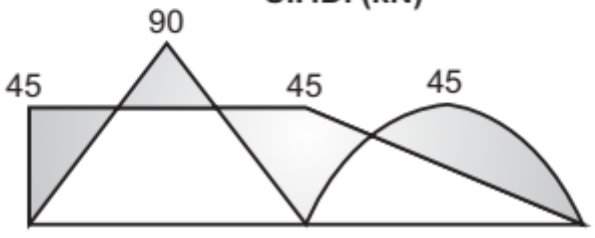
Solution:-



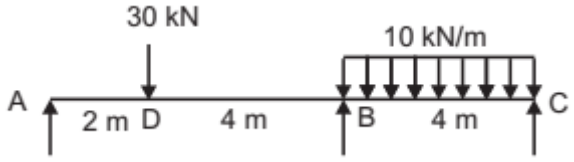
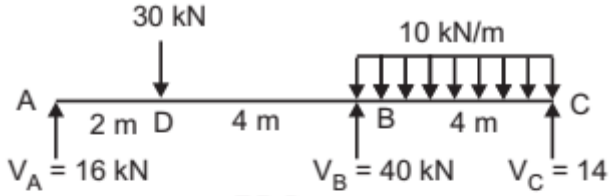
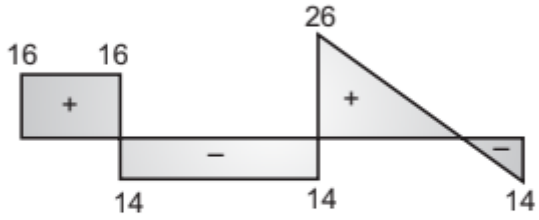
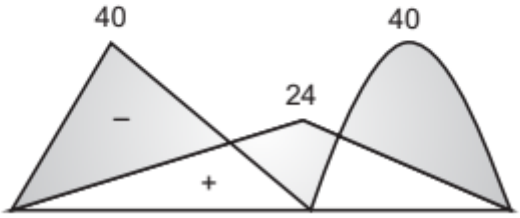
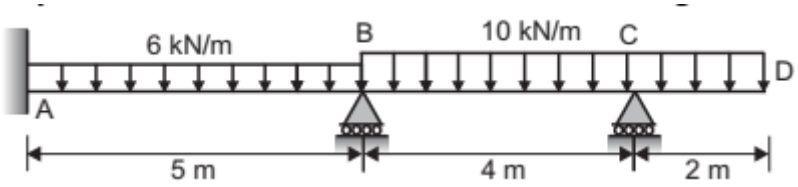
F.B.D. of structure

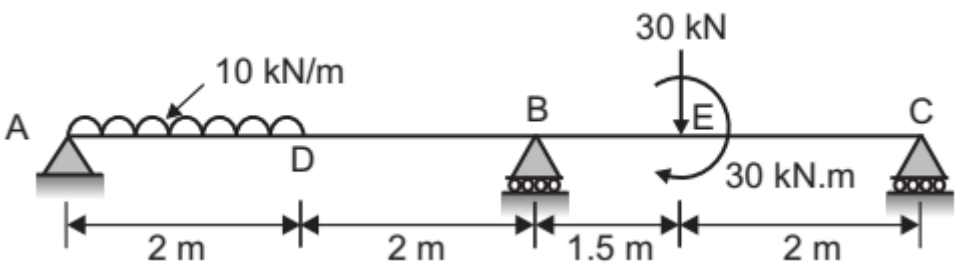
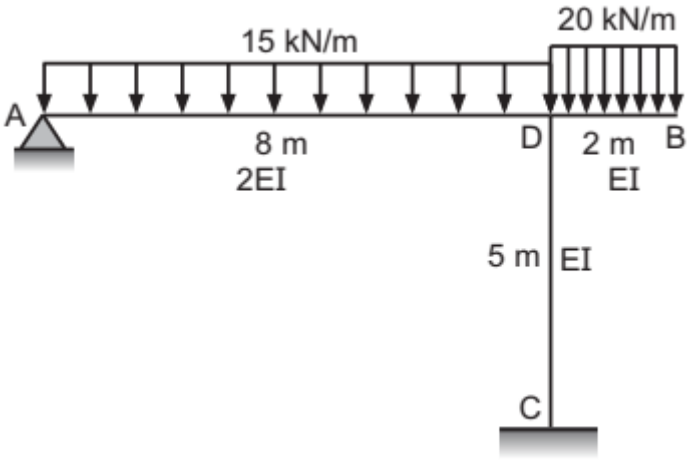
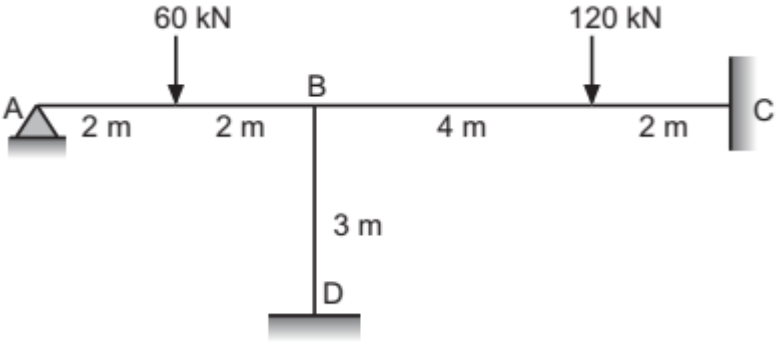


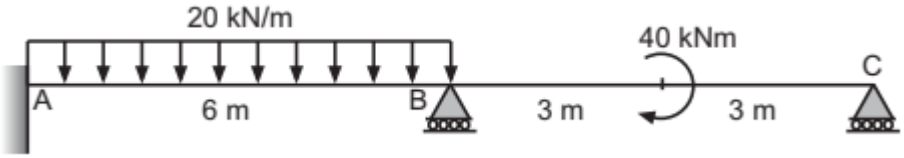
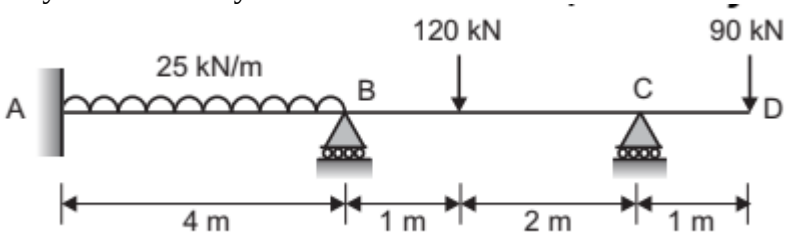
S.F.D. (kN)



B.M.D. by superposition

B)	Analyse the continuous beam shown in Figure by flexibility method. Take EI = constant.  Solution:-  **F.B.D. structure**  **S.F.D. (kN)**  **B.M.D. by superposition**	**K3**	**12**
Q.2	**Solve Any one of the following.**		
A)	Analyse the beam shown in Figure by Generalized flexibility method. Take EI = constant.  Solution: Va = 15.39KN, Vb = 32.42 KN, Vc = 42.19KN, Ma = 13.14KN-m, Mab max = 6.57 KN-m, Mcb max = 4.62KN-m, Mcd= 20 KN-m.	**K3**	**12**
B)	Analyse the continuous beam shown in Figure by Generalized flexibility method. Take EI = constant.	**K3**	**12**

	 Solution:- Va=14.85 KN, Vb=13.90KN, Vc=21.25 KN. Mab = 9.7 KN-m, Mmax=0.6 KN-m, Mbc=12.5 and 42.5 KN-m.		
Q. 3	**Solve Any one of the following.**		
A)	Analyse the portal frame as shown in figure by Direct Stiffness method.  Solution: Mad=0, Mda=100.65KN-m, Mdc= -20.65 KN-m, Mcd=-6.45 KN-m, Mdb=Mfdb=-80KN-m.	**K4**	**12**
B)	Analyse the portal frame as shown in figure by Direct Stiffness method.  Solution:- Mab=0, Mba=52.275KN-m, Mbc=-51.31 KN-m, Mcb=107.68KN-m, Mbd=4.04KN-m, Mdb=2.02KN-m.	**K4**	**12**
Q.4	**Solve Any one of the following.**		

A)	Analyse the continuous beam ABC as shown in figure by Generalized Stiffness method.  **Solution:-** Va=72.38KN, Vb1=47.62KN, Vb2=2.86KN, Vc=2.86 KN. Ma=97.14 KN-m, Mb=22.86 KN-m, Mc=0 KN-m. Mab= 90 KN-m, Mbc=20 KN-m.	**K4**	**12**
B)	Analyse the beam by Generalized Stiffness Matrix Method.  Solution: Va= 52.209 KN, Vb1=47.79 KN, Vb2=59.14KN, Vc1=60.85KN, Vc2 =90 KN. Ma=1.43 KN, Mb=37.13KN-m, Mc=40KN-m, Mab=20KN-m, Mbc=100KN-m.	**K4**	**12**
Q. 5	**Solve Any one of the following.**		
A)	Explain the concepts of material non-linearity and geometric non-linearity in structural analysis. Discuss their causes, characteristics, assumptions, and effects on the load–deformation behavior of structures. **Solution:-**	**K2**	**12**
B)	Describe the stiffness method for nonlinear structural analysis. Explain the formulation and solution procedure for structures exhibiting (a) material non-linearity and (b) geometric non-linearity. **Solution:-**	**K2**	**12**

Particulars	**Marks**
Definition of material non-linearity	3
Definition of geometric non-linearity	3
Causes and characteristics of material non-linearity (yielding, cracking, plasticity, etc.)	3
Causes and characteristics of geometric non-linearity (large displacement, P-Δ effect, etc.)	3
Total	**12**

Particulars	**Marks**
Introduction to nonlinear stiffness method	3
Formulation of stiffness method with material non-linearity	3
Formulation of stiffness method with geometric non-linearity	3
Explanation of tangent stiffness matrix	3
Total	**12**

***** End *****