

Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
SEVENTH SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2018

Course Code: CE403
Course Name: STRUCTURAL ANALYSIS - III

Max. Marks: 100

Duration: 3 Hours

PART A*Answer any two full questions, each carries 15 marks.*

Marks

- 1 a) What are the assumptions in cantilever method of analysis? (2)
- b) Analyse the frame shown in figure 1 using cantilever method. Cross-sectional area of members are shown in figure. (13)

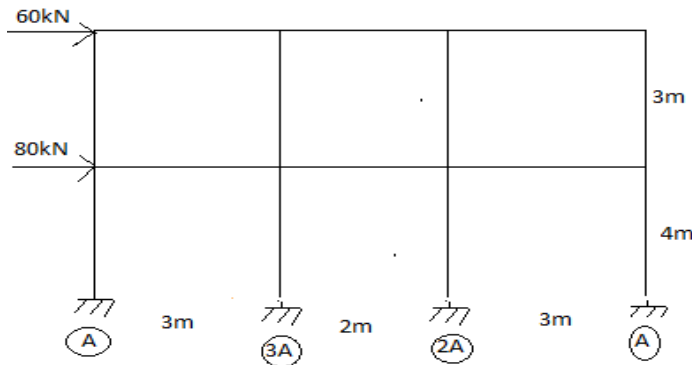


Fig 1

- 2 a) Explain the formulae to find out the kinematic indeterminacy of pin-jointed and rigid-jointed frames. (5)
- b) What is the relationship between stiffness and flexibility matrix (5)
- c) Compare nodal degrees of freedom and joint degrees of freedom. (5)
- 3 a) Define stiffness influence coefficients. Illustrate with suitable examples. (5)
- b) Explain the general procedure followed in displacement method of analysis (7)
- c) Define equilibrium and compatibility. (3)

PART B*Answer any two full questions, each carries 15 marks.*

- 4 a) Discuss the formation of flexibility matrix for frame element (10)
- b) Discuss basic concepts of flexibility method (5)

- 5 a) Derive the stiffness matrix for the structure with coordinates as shown in Fig.2. (5)



Fig. 2

- b) Analyse the rigid frame loaded as shown in Fig.3. using stiffness method (10)
 $E = 200 \times 10^6 \text{ kN / m}^2$; $I = 500 \times 10^{-6} \text{ m}^4$

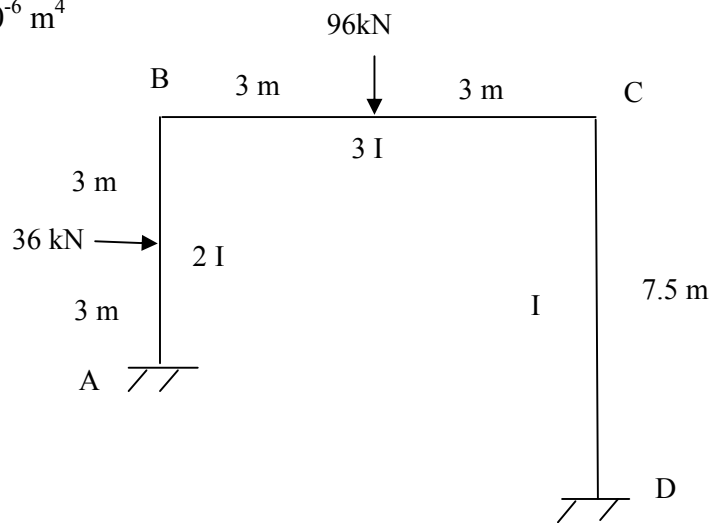


Fig.3

- 6 a) Explain how the effect of calibration error or temperature changes is considered in the analysis of trusses by matrix displacement method (5)
 b) Find the forces in the members of the truss loaded as shown in Fig.4. using stiffness method. Take axial rigidity $AE = \text{unity}$ for all members. (10)

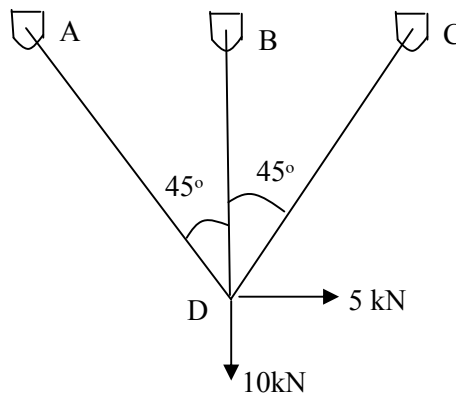


Fig. 4.

PART C

Answer any two full questions, each carries 20 marks.

- 7 a) Describe the stiffness matrix of elements in global coordinates from element coordinates (5)
 b) Analyse the beam shown in figure 5 using direct stiffness method and draw the BMD (15)

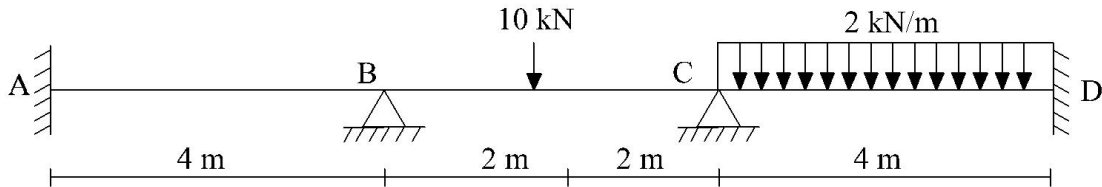


Fig 5

- 8 a) Explain the rotation of axes in 2 Dimensions (5)
 b) An overhanging beam is shown in figure 6. Analyse the structure using Direct Stiffness Method and draw BMD (15)

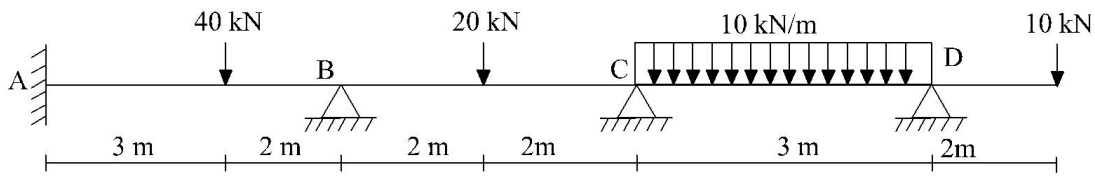


Fig 6

- 9 a) Explain logarithmic decrement. Derive the equation for logarithmic decrement. (5)
 b) Derive the response of the free vibration system with damped case and calculate the free vibration response of a SDOF system at time $t=0.20$ sec. for the following data (15)
 Natural frequency $\omega = 12$ rad/sec
 Damping coefficient $\xi = 0.15$
 Initial velocity = 10 cm/sec
 Initial displacement = 5 cm

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
SEVENTH SEMESTER B.TECH DEGREE EXAMINATION(S), MAY 2019

Course Code: CE403
Course Name: STRUCTURAL ANALYSIS - III

Max. Marks: 100

Duration: 3 Hours

PART A

Answer any two full questions, each carries 15 marks.

- | | | Marks |
|------|---|--------|
| 1 a) | What are the assumptions in portal method of analysis? | (2) |
| b) | Analyse the frame shown in figure 1 using portal method | (13) |

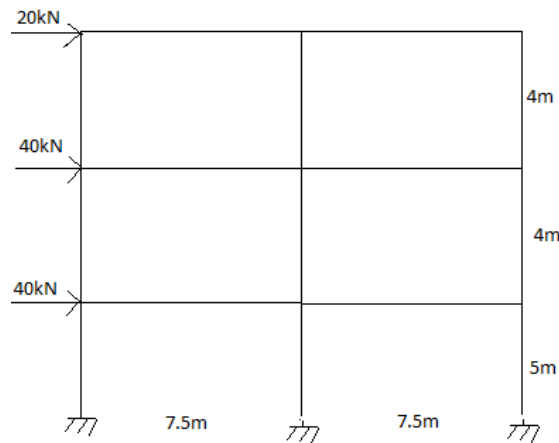


Fig 1

- | | | |
|------|---|--------|
| 2 a) | Explain static, external and internal indeterminacy with examples. | (5) |
| b) | Explain the concept of physical approach | (5) |
| c) | Define kinematic indeterminacy. Compute the kinematic indeterminacy of a rigid jointed frame of column height 'h' and beam span 'l' with one end fixed and other end hinged, if only the beam axial deformations are neglected. | (5) |
| 3 a) | Compare the analysis by flexibility and stiffness matrix | (10) |
| b) | Explain the formulae to find out the static indeterminacy of pin-jointed and rigid-jointed frames | (5) |

PART B

Answer any two full questions, each carries 15 marks.

- | | | |
|------|---|--------|
| 4 a) | Explain the load transformation matrix approach in flexibility method | (8) |
| b) | Explain analysis of plane trusses by flexibility method | (7) |
| 5 a) | Analyse the plane frame shown in figure 2 by flexibility matrix method and draw | (15) |

the SFD and BMD. The bottom support is fixed and top support is roller.

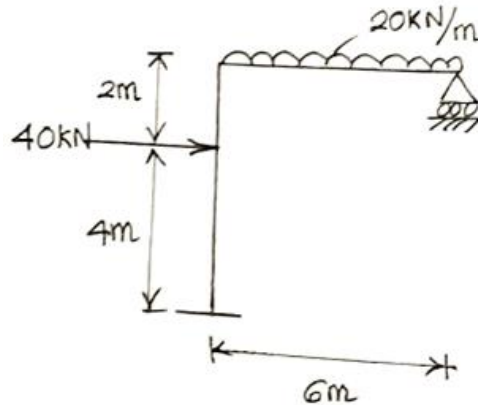


Fig 2

- 6 a) Define kinematic indeterminacy. Determine the kinematic indeterminacy of the following structures in Fig 3. (5)

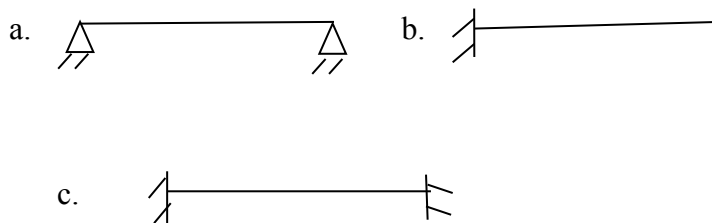


Fig.3

- b) Analyse the truss shown in Fig. 4 (with active global coordinates, as shown) and find the joint displacements, support reactions and bar forces. The truss is subjected to direct loads $F_1 = 50 \text{ kN}$; $F_2 = 30 \text{ kN}$, and a lack of fit due to bar AC being too long by 5 mm. Assume all bars to have same axial rigidity $AE = 6000 \text{ kN}$. Use stiffness matrix method. (10)

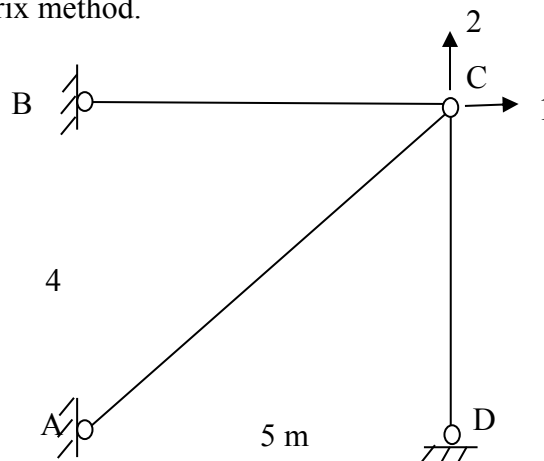


Fig 4

PART C

Answer any two full questions, each carries 20 marks.

- 7 a) Discuss the procedure of Direct Stiffness Method in the matrix analysis (5)
 b) Analyse the continuous beam shown in figure 5 using Direct Stiffness Method (15)
 shown in figure and develop the BMD

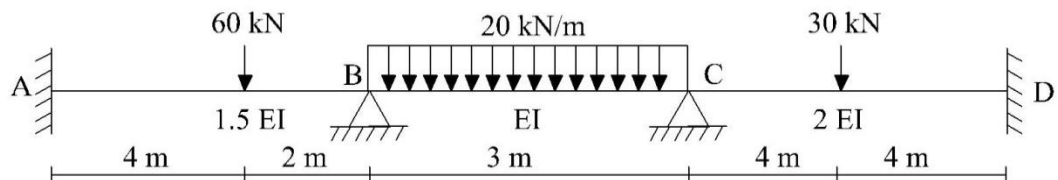


Fig 5

- 8 a) Explain Direct Stiffness Method in the matrix analysis (5)
 b) Analyse the beam shown in figure 6 using Direct Stiffness Method shown in figure (15)
 and determine the member forces and moments.

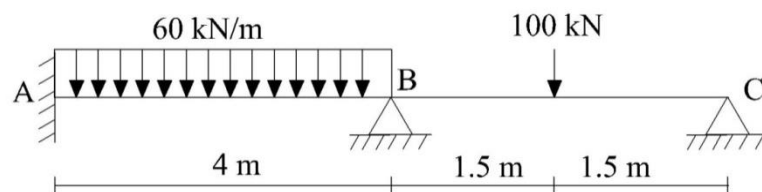


Fig 6

- 9 a) Write the equation of motions corresponding to the damped and undamped free and forced vibration. (5)
 b) Derive the equations for response of SDOF system subjected to damped free vibration in 'x' direction with inertia constant m , spring constant k and damping constant c . Draw the response diagram also. (15)

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
SEVENTH SEMESTER B.TECH DEGREE EXAMINATION(R&S), DECEMBER 2019

Course Code: CE403
Course Name: STRUCTURAL ANALYSIS - III

Max. Marks: 100

Duration: 3 Hours

Assume missing data if any and state it

PART A

Answer any two full questions, each carries 15 marks.

Marks

- 1 a) What are the assumptions involved in cantilever method? 3
- b) Analyse the frame in Figure.1 using portal method. Beams and columns have same size.

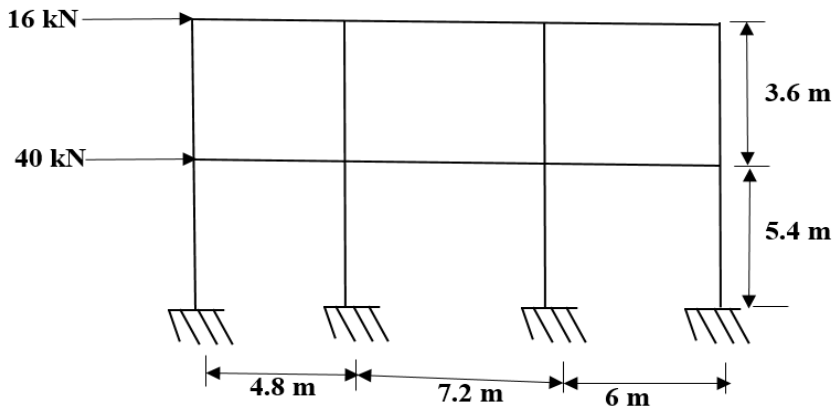


Figure. 1

12

- 2 a) Find the maximum hogging moment and shear force at the support due to gravity loading in the frame shown in Figure.2. Frames are spaced at 3.0 m c/c. Dead load = 3 kN/m², Live load = 2 kN/m², Weight of beam = 2 kN/m and storey height = 3 m.

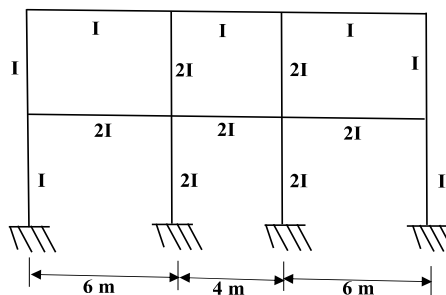


Figure. 2

10

- b) Derive Flexibility matrix for the following beam element in Figure.3.

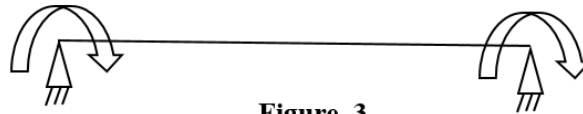


Figure. 3

5

- 3 a) Find the Kinematic indeterminacy and Static indeterminacy of the continuous beam (Figure.4) , pin jointed frame (Figure.5) and rigid frame (Figure.6)



Figure. 4- Discard axial forces

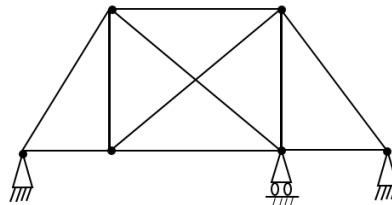


Figure. 5

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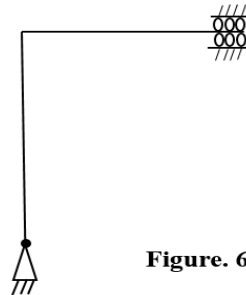


Figure. 6

- b) Derive Flexibility matrix for the truss element. 3
 c) Define flexibility coefficient and stiffness coefficient. 3

PART B

Answer any two full questions, each carries 15 marks.

- 4 a) Analyse the continuous beam shown in Figure.7, using flexibility matrix method and find the bending moments.

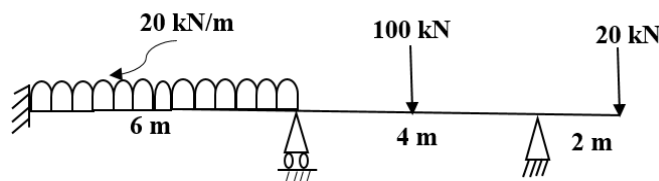
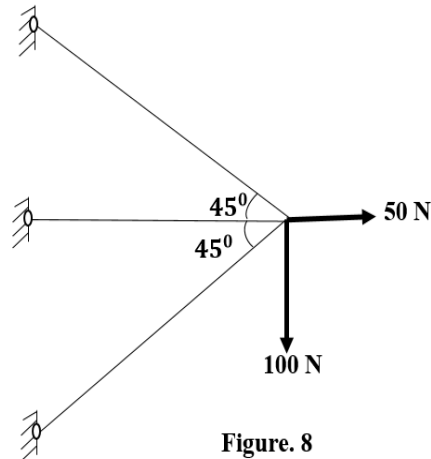


Figure. 7

15

- 5 a) Establish the relationship between flexibility matrix and stiffness matrix. 4
 b) What is displacement transformation matrix? 5
 c) What is lack of fit? Explain one method to estimate the member forces due to lack of fit using either flexibility or stiffness methods. 6
- 6 a) Find the member forces in the truss shown in Figure.8 using stiffness method. 15



PART C

Answer any two full questions, each carries 20 marks.

- 7 a) Analyse and draw bending moment diagram for the frame shown in Figure.9 using direct stiffness method.

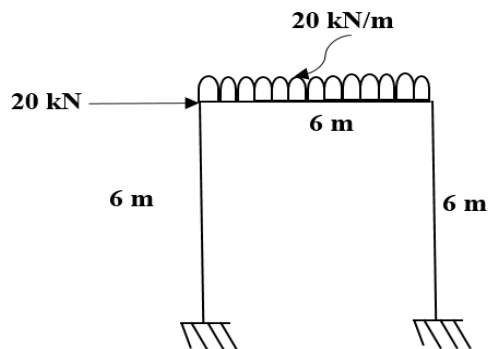


Figure. 9

- b) What is direct stiffness method? 3
- 8 a) Differentiate between local coordinates and global coordinates. 4
 b) How global stiffness matrix can be derived from the element stiffness matrix? 6
 c) Describe Vibration Isolation? What are the different types of vibration isolation? 10
- 9 a) What is critical damping? 3
 b) What is magnification factor? 3

- c) A person standing on a spring produces a deflection of 1.0 mm to the spring. Find the natural frequency and Time period. 4
- d) A vibrating system consists of mass of 10 kg, spring of stiffness 240 N/m and a damper with a damper coefficient of 10 N-s/m. Determine 10
- i) Damping factor
 - ii) Natural frequency of damped vibration
 - iii) Logarithmic decrement
 - iv) Ratio of successive amplitudes
 - v) Number of cycles after which initial amplitude reduced to 25%

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
Seventh semester B.Tech degree examinations (S), September 2020

Course Code: CE403

Course Name: STRUCTURAL ANALYSIS - III

Max. Marks: 100

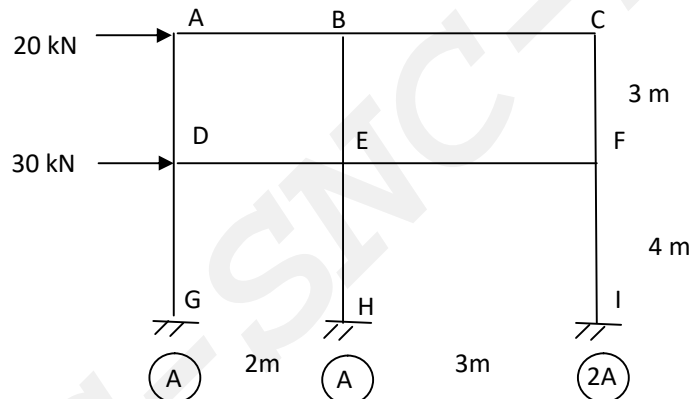
Duration: 3 Hours

PART A

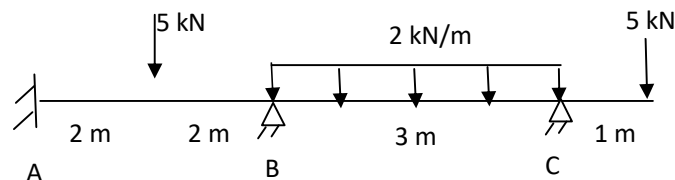
Answer any two full questions, each carries 15 marks.

Marks

- 1 a) What is a substitute frame? (2)
- b) Analyse the rigid frame loaded as shown in figure using cantilever method. (13)
- Cross section areas of columns are given as A, A and 2A.



- 2 a) Differentiate between force method and displacement method of analysis. (5)
- b) Define static indeterminacy and kinematic indeterminacy. Also determine the static and kinematic indeterminacy of a propped cantilever beam subjected to transverse loads. (5)
- c) Explain how the distributed loads are accounted for in matrix method of analysis (5)
- 3 a) Determine the equivalent joint load for the continuous beam loaded as shown in figure. (7)

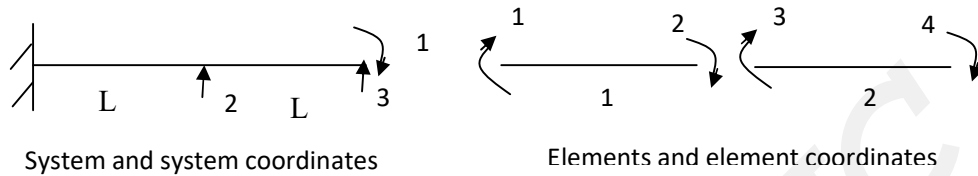


- b) Define flexibility influence coefficient. (3)
- c) Derive the relationship between flexibility influence coefficient and stiffness influence coefficient. (5)

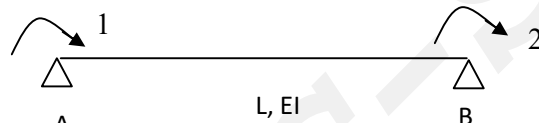
PART B

Answer any two full questions, each carries 15 marks.

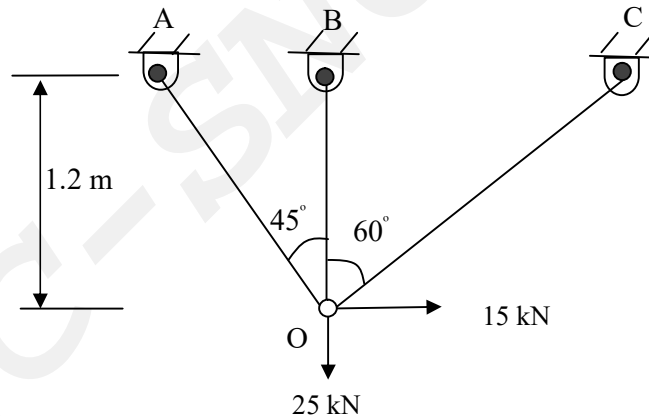
- 4 a) Write down the properties of flexibility matrix. (3)
 b) Generate the load transformation matrix and element flexibility matrix for the system coordinates and element coordinates given below. (6)



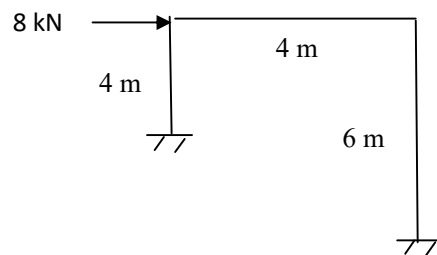
- c) Explain how the effect of lack of fit is considered in flexibility matrix method of analysis. (6)
 5 a) Derive the flexibility matrix for the beam element with coordinates as shown in figure. (5)



- b) Analyse the pin jointed frame loaded as shown in figure for the member forces, using flexibility method. Take constant AE for all members. (10)



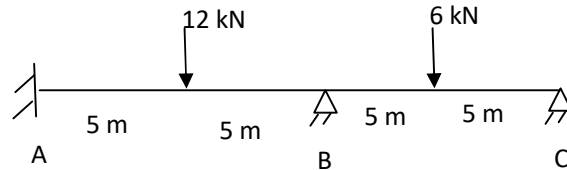
- 6 a) Derive the relationship between force transformation matrix and displacement transformation matrix. (5)
 b) Analyse the given portal frame using stiffness matrix method. Take EI constant. (10)



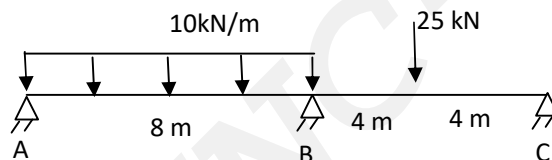
PART C

Answer any two full questions, each carries 20 marks.

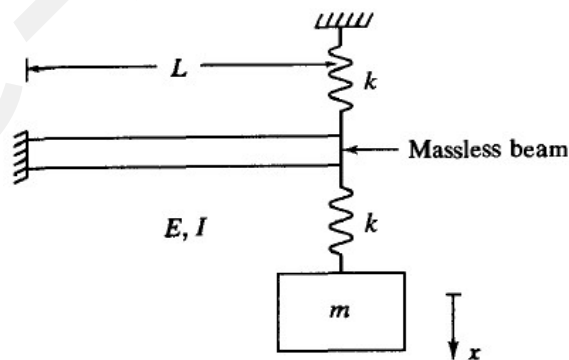
- 7 a) Discuss on the rotation of axis in two dimension. (5)
 b) Analyse the given continuous beam using direct stiffness method. EI constant. (15)



- 8 a) Discuss the global assembly procedure of element stiffness matrices in direct stiffness method. (5)
 b) Analyse the given continuous beam using direct stiffness method. Take EI constant for all members. (15)



- 9 a) State and explain D'Alembert's principle. (4)
 b) Set up the equation of motion and hence determine the natural frequency for small vertical vibrations of the idealization shown in figure. (8)



Take $L = 3\text{ m}$. EI for beam = 27 Nm^2 , stiffness for each spring, $k = 3\text{ N/m}$ and mass $m = 3\text{ kg}$

- c) A 50 kg turbine is mounted on four parallel springs, each of stiffness $3 \times 10^5\text{ N/m}$. When the machine operates at 20 Hz, its steady-state amplitude is observed as 1.8 mm. Compute the magnitude of the excitation? (8)

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Seventh Semester B.Tech Degree Examination (Regular and Supplementary), December 2020

Course Code: CE403**Course Name: STRUCTURAL ANALYSIS - III**

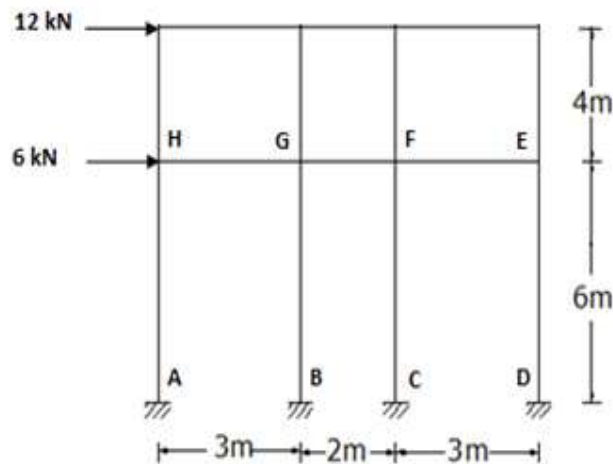
Max. Marks: 100

Duration: 3 Hours

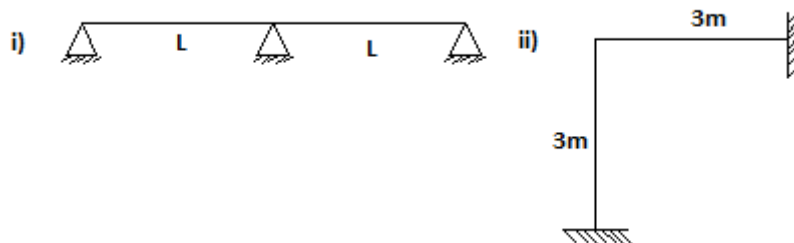
PART A*Answer any two full questions, each carries 15 marks.*

Marks

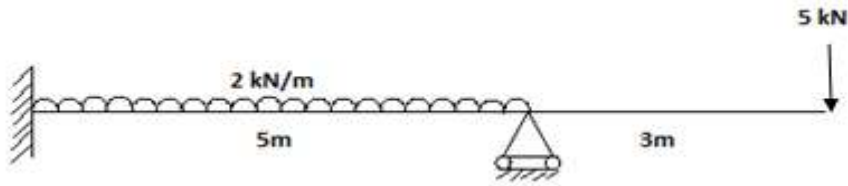
- 1 a) List the assumptions to analyse a frame by cantilever method. (3)
- b) Analyse using portal method and find the axial force in columns, shear force in beams and columns, bending moments in beams and columns. Draw the BMD of beams and columns. (12)



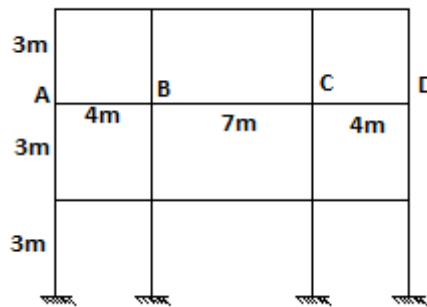
- 2 a) List the two methods in matrix method of analysis and explain each method. (5)
- b) Explain static, external and internal indeterminacy with examples. (5)
- c) Derive the stiffness matrix for the given structures. (5)



- 3 a) Find the equivalent joint load matrix for the beam given below. (5)



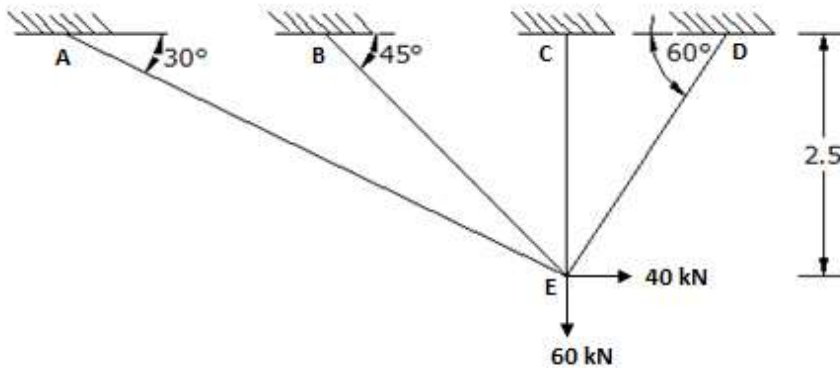
- b) In a multi-storey building frame spaced at 5.5m interval. The DL on the slab is 3kN/m^2 and LL is 6kN/m^2 . Analyse the second floor beam BC for maximum positive bending moment at the mid span. Self weight of the beam for 4m span is 4 kN/m and that of 7m span is 5kN/m. Use substitute frame method, Assume that I of the columns = $36 \times 10^4\text{cm}^4$ and I of all girder = $50 \times 10^4\text{cm}^4$ (10)



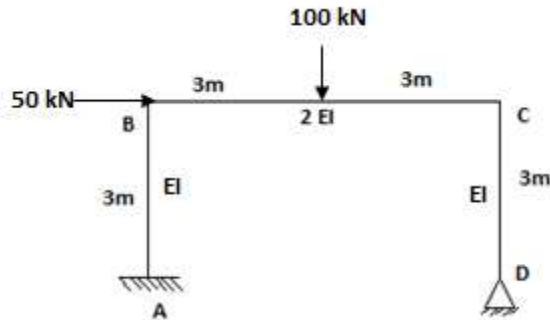
PART B

Answer any two full questions, each carries 15 marks.

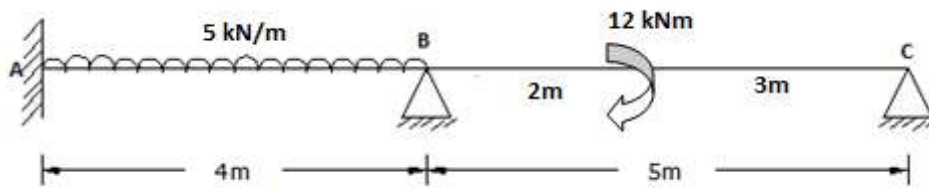
- 4 a) Develop flexibility influence coefficients of a simply supported beam. (5)
 b) Find the forces in the members of the truss loaded as shown in figure using stiffness method. (10)



- 5 a) Explain how the effect of lack of fit is considered in flexibility matrix method of Analysis. (3)
 b) Analyse the frame shown in figure by flexibility method. (12)



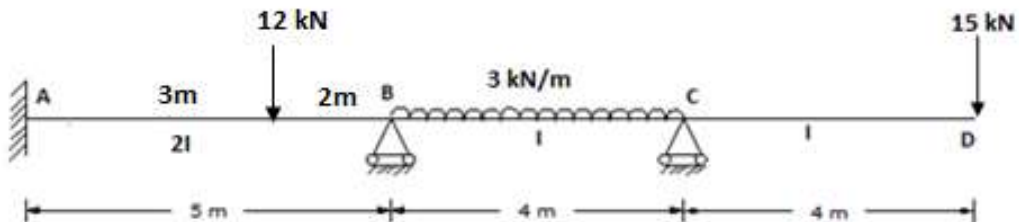
- 6 a) Derive the relationship between force transformation matrix and displacement transformation matrix. (5)
- b) Analyse the continuous beam shown in Figure, using flexibility matrix method and find the bending moments. (10)



PART C

Answer any two full questions, each carries 20 marks.

- 7 a) How global stiffness matrix can be derived from the element stiffness matrix? (5)
- b) Analyse the continuous beam shown in Figure, using direct stiffness method and find the bending moments. (15)



- 8 a) Discuss the concept of vibration isolation and its applications. (5)
- b) Analyse a continuous beam ABCD by direct stiffness method. Assume EI is constant for all the members. The three spans AB, BC and CD are 4 m long. The extreme ends A and D are fixed. At the continuous joints B and C, roller supports are provided. BC span carries a central concentrated load of 10kN and CD span carries a udl of 2kN/m. Draw the BMD. (15)
- 9 a) State and explain D'Alembert's principle. (4)
- b) Derive the equations for response of SDOF system subjected to damped free vibration in 'x' direction with inertia constant m, spring constant k and damping constant c. Draw the response diagram also. (8)
- c) A system vibrating with a natural frequency of 6Hz starts with an initial amplitude of 2cm and an initial velocity of 25 cm/s. Determine the natural period, amplitude, maximum velocity, maximum acceleration and phase angle. Also write the equation of motion of a vibrating system. (8)
