# APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

## Scheme for Valuation/Answer Key

*Scheme of evaluation (marks in brackets) and answers of problems/key*

**SEVENTH SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2018**

**Course Code: CE403**

**Course Name: STRUCTURL ANALYSIS - III**

Max. Marks: 100 Duration: 3 Hours

### PART A

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

Marks

1 a) Two assumptions 2 mark (2)

b) Centroidal axis-2 (13)

Axial force-2

Beam shear-2

Beam moment-2

Column moment-2

Column shear -2

Bending moment diagram-1

2 a) Kinematic indeterminacy of pin-jointed frames – 2½ marks (5)

Kinematic indeterminacy of rigid-jointed frames – 2½ marks

b) Definition of stiffness and flexibility – 3 marks (5)

Inverse relation – 2 marks

c) Any 5 points – 1 mark each (5)

3 a) Stiffness influence coefficients – 3 marks (5)

Examples – 2 marks

b) Steps in displacement method of analysis – 7 marks (7)

c) Equilibrium – 1½ marks (3)

Compatibility – 1½ marks

### PART B

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

4 a) Flexibilty matrix for any member in rigid jointed frames and pin jointed frames (10)

For rigid jointed plane frames $[\delta]_{AB} = \frac{L}{6EI}\begin{bmatrix} 2 & -1 \\ -1 & 2 \end{bmatrix}$

in case of pin jointed frames flexibility matrix $[\delta]_{AB} = \left[\frac{L}{AE}\right]_{AB}$ (5)

Formation of flexibility matrix $[\delta^*]$for entire unassembled structure with element flexibility matrices along diagonal (3)

Form flexibility matrix with respect to system coordinates using $[f]^T[\delta^*][f] = [\delta]$ (2)

b) Removal of redundant forces to form basic determinate structure (1) (5)

Calculating displacement at each redundant location, due to applied loads (1)

Determination of displacement at redundant locations due to redundant (1)

Writing compatibility equation and solving for unknown forces I(2)

5 a) Formulation of displacement transformation matrix 3 marks (5)

Final answer 2 marks

b) DKI 1 mark (10)

FEM 2 mark

EJL 1 mark

Displacement transformation matrix 3 mark

K 1 mark

Last answer 2 mark

6 a) Full explanation with neat figure 5 mark (5)

b) Displacement transformation matrix 4 mark (10)

K 4 mark

Final answer 2 mark

## PART C

***Answer any two full questions, each carries 20 marks.***

7 a) Stiffness coefficients Kij and Element stiffness matrix $K_e$ - 2 (5)

Formation of Global stiffness matrix $K_G$ - 3

b) Writing global stiffness matrix in element coordinate system - 3x2 = 6 (15)

Assembly of global stiffness matrix 3

Modification of KG by applying BCs 2

Equivalent joint loads 2

Calculation of Δ using P=KG. Δ 1

Member forces 1

| | | | | |
|---|---|---|---|---|
| 8 | a) | Explanation with figure and rotation matrix (5 ) | | (5) |
| | b) | Writing global stiffness matrix in element coordinate system | - 3x2 = 6 | (15) |
| | | Assembly of global stiffness matrix | 3 | |
| | | Modification of KG by applying BCs | 2 | |
| | | Equivalent joint loads | 2 | |
| | | Calculation of Δ using P=KG. Δ | 1 | |
| | | Member forces | 1 | |

| | | | | |
|---|---|---|---|---|
| 9 | a) | Explanation with definition | 1.5 marks | (5) |
| | | Figure | 1.5 marks | |
| | | Derivation | 2 marks | |
| | | Total | 5 marks | |
| | b) | Derivation of equation | 9 marks | (15) |
| | | Substitution of the given data for the equation | 6 marks | |

***Equal credits shall be given for students choosing 0.15 value as damping ratio and damping coefficient.***

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