Reg No.:_____ Name:_____

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**

B.Tech Degree S5 (R,S) (FT/WP),(S3 PT) Examination November 2025 (2019 Scheme)

**Course Code: CET 301**

**Course Name: STRUCTURAL ANALYSIS - I**

Max. Marks: 100 Duration: 3 Hours

**PART A**

***(Answer all questions; each question carries 3 marks)*** Marks

| | | |
|---|---|---|
| 1 | Write the conditions for perfect truss, deficient truss and redundant truss. | 3 |
| 2 | State and explain Castigliano's theorem. | 3 |
| 3 | Differentiate statically determinate and statically indeterminate structures. | 3 |
| 4 | State and explain Maxwell's law of reciprocal deflection. | 3 |
| 5 | Write the slope deflection equations for a span AB. | 3 |
| 6 | Define (i) Relative stiffness (ii) Distribution factor. | 3 |
| 7 | Write the expressions for the vertical load transmitted to the tower, horizontal load transmitted to the tower and the bending moment on tower when the supports of the cables are subjected to pulley supports. | 3 |
| 8 | Draw a neat diagram showing the different parts of a suspension bridge. | 3 |
| 9 | Differentiate 2 hinged and three hinged arches. | 3 |
| 10 | Define influence line diagram. What is the use of influence line diagrams. | 3 |

**PART B**

***(Answer one full question from each module, each question carries 14 marks)***

**Module -1**

11 a) Analyse the truss shown in fig.1 using method of joints and tabulate the force table. Units in m. 14

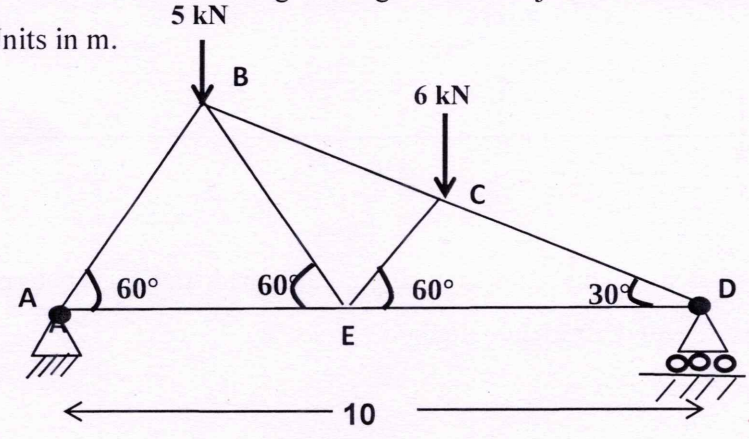


Fig.1

12 a) Determine the slope and Deflection at the free end and at point C for the beam shown in fig. 2 using moment area method. Take I = 2 x $10^8$ $mm^4$ and E = 2 x $10^5$ $N/mm^2$ 10

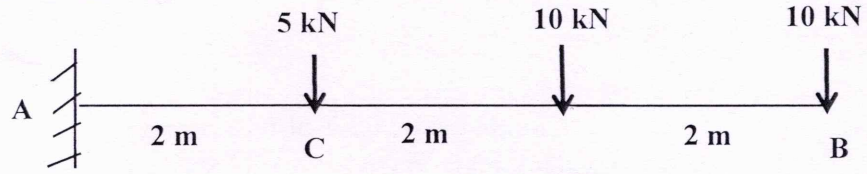


Fig.2

b) Determine the slope and deflection at the free end of a cantilever with a point load W at the free end using Moment Area method 4

**Module -2**

13 a) Determine the vertical deflection at point C in the truss shown in fig.3. The cross sectional area for members AD, DE is 1500 $mm^2$ and that for other members is 1000 $mm^2$. Modulus of elasticity E = 200 $kN/mm^2$. 14

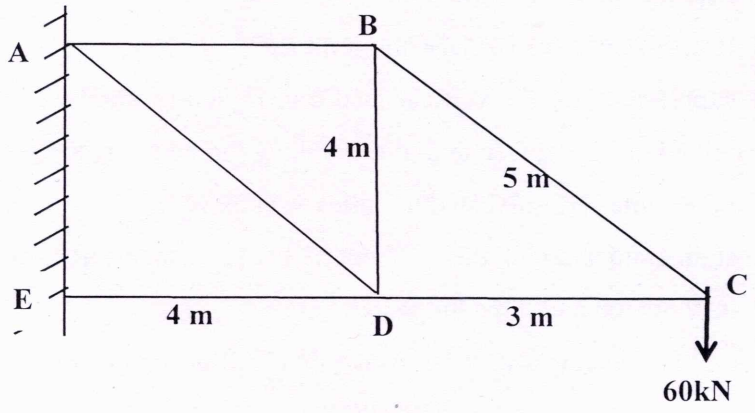


Fig.3

14 a) Analyse the propped cantilever beam shown in fig.4 using consistent deformation method (Choose the reaction at B as redundant) . 10

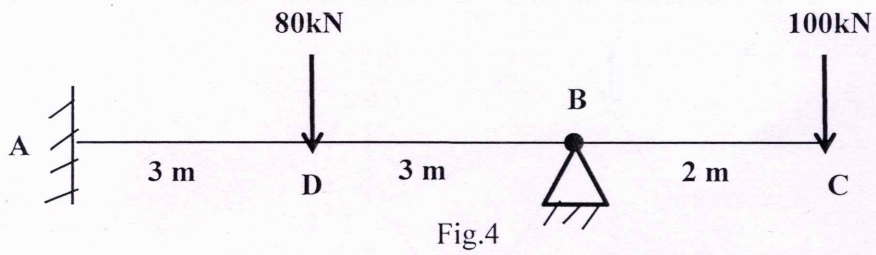


Fig.4

b) Write the steps involved in analysing a beam with statical indeterminancy = 2 using consistent deformation method 4

## Module -3

15 a) Analyse the continuous beam ABCD consisting of three spans and is loaded as shown in fig.5 Ends A is fixed and D is simply supported. Use slope deflection method and plot the bending moment diagram. 14

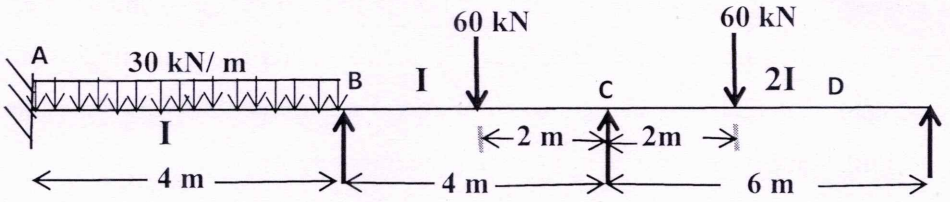


Fig.5

16 a) A continuous beam ABCD consists of three spans and is loaded as shown in fig.6. Ends A and D are fixed. Analyse the beam using moment distribution method and plot the bending moment diagram. 14

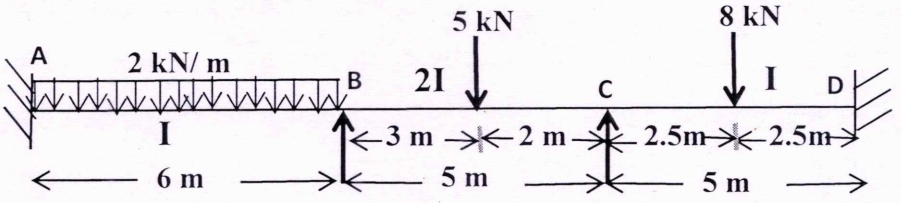


Fig.6

b)

## Module -4

17 a) A light flexible cable 18 m long is supported at the two ends at the same level. The supports are 16 m apart and the cable is subjected to a udl of 1 kN/m of horizontal length over the entire span. Determine maximum and minimum tension in cable. Also calculate inclination of cable at the support and dip of the cable. 8

b) Show that the shape or geometry of the cable when subjected to udl is a parabola 6

18 a) A cable of span 120 m and dip 10 m carries a load of 6 kN/m of horizontal span. Find the maximum tension in the cable and the inclination of the cable at the support. Find the forces transmitted to the supporting pier if the cable passes over smooth pulleys on top of the pier. The anchor cable is at 30° to the horizontal. Determine the maximum bending moment for the pier if the height of the pier is 15 m. 10

b) Write a note on anchor cable supports. 4

## Module -5

| | | | |
|---|---|---|---|
| 19 | a) | A three hinged parabolic arch has a span of 60 m and a central rise of 10 m. It carries a udl of 10 kN/m over the entire span. Show that the bending moment is zero at any cross section of the arch | 8 |
| | b) | A three hinged parabolic arch, has a horizontal span of 12 m and a central rise of 2.5 m. It carres a udl of 30 kN per horizontal meter run over the left half of the span. Calculate the vertical and horizontal reactions. Also calculate the normal thrust and shear force at 1.5 m from the left support. | 6 |
| 20 | a) | A simply supported girder has a span of 25 m. Draw the influence line for shearing force at a section 10 m from the left end, and using the diagram determine the maximum positive and negative shearing forces, and maximum bending moment due to the passage of a concentrated load of 5 kN, followed immediately by a uniformly distributed load of 2.4 kN per m extending over a length of 5 m. The loads may cross in either direction (i.e., concentrated load followed by udl or udl followed by concentrated load). Also determine the absolute maximum positive shear and absolute maximum negative shear at the supports. | 14 |

***