Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Fourth Semester B.Tech Degree (S,FE) Examination June 2022 (2015 scheme)

Course Code: CE202

Course Name: STRUCTURAL ANALYSIS – I (CE)

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any two full questions. Each question carries 15 marks.

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1 a) List the basic assumptions in the analysis of trusses 3

b) Find the deflection at the middle point C of the simply supported beam, loaded as shown in Fig. 1, by unit load method. Assume the flexural rigidity $EI = 8\times10^4$ kNm^2.. 12

Figure 1

2 a) State whether the force in each of the bars labelled 1, 2, 3 and 4 in the truss in Figure 2, is tensile or compressive. 6

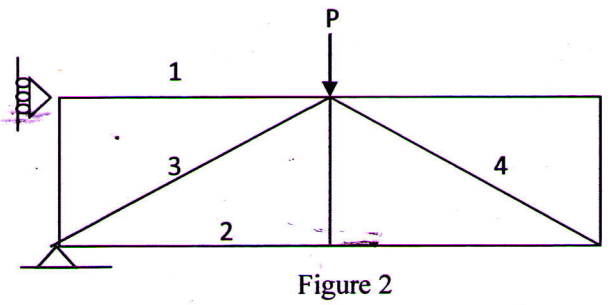

Figure 2

b) 6

The sign board of weight 2.2 kN is supported by a cantilevered steel pipe as shown in Figure 3. If the moment of inertia (I) and modulus of elasticity (E) of the pipe are 50 x $10^{-6}m^4$ and 200 x $10^6kN/m^2$ respectively, determine the vertical displacement of the centre of the sign board using strain energy method.

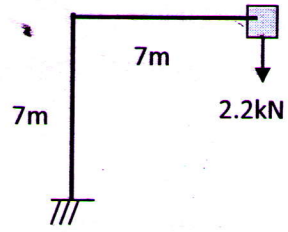

Figure 3

c) Explain Principle of virtual work as applicable to deformable bodies 3

3 a) Explain Castigliano's theorem for deflection 3

b) Analyse and determine the forces in the selected memebrs in the plane truss in Figure 4 by method of sections 12

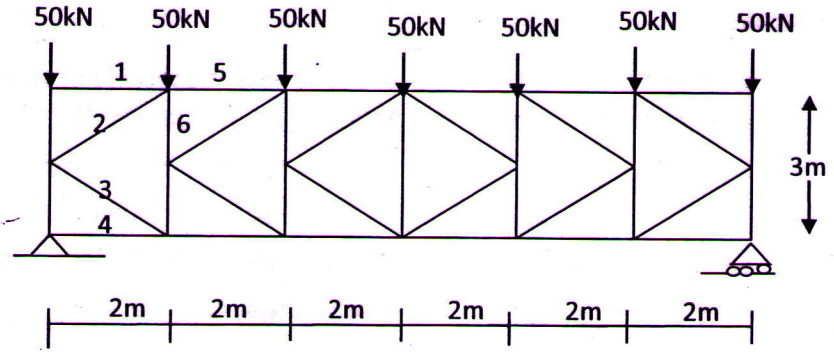

Figure 4

PART B

Answer any two full questions, each carries 15 marks.

4 a) Analyse the truss using consistent deformation method and tabulate the member forces. AE is constant for all the members. 15

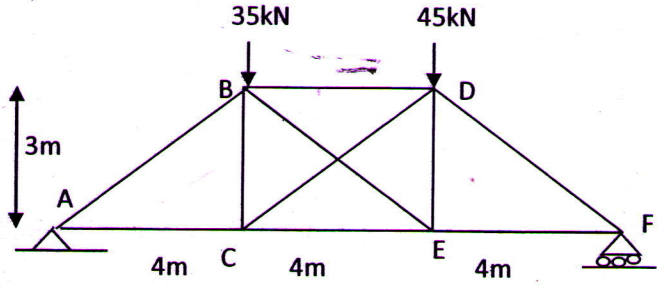

Figure 5

5 a) State the conditions of maximum bending moment at a section of a simply supported beam when 6

i) A train of concentrated load moves along the span

ii) A uniformly distributed load longer than the span moves along the span

iii) A uniformly distributed load shorter than the span moves along the span

b) Analyse the frame by consistent deformation method and draw bending moment diagram, shear force diagram and axial force diagram. The flexural rigidity is constant for all the members. 9

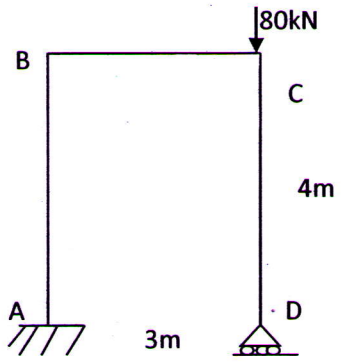

Figure 6

6 a) Distinguish between "bending moment at a section" and "influence line for bending moment at a section" for a simply supported beam 3

b) A train of five wheel loads (sequentially 20kN, 20kN, 10kN, 12.5kN and 10kN), with gaps of 2m between two successive wheel loads can traverse over a simply supported beam AB of span 18m, from right to left with 20kN load leading. Using influence lines, find the maximum shear force and bending moment at a section located 7m from the left end A. 12

PART C

Answer any two full questions, each carries 20 marks.

7 a) Derive the equation of the profile of the cable subjected to uniformly distributed load 5

b) A cable is suspended between two points A and B, 90m apart horizontally with its right end B lower than the left end A by 9m. The cable supports a uniformly distributed load of10 kN/m along the entire horizontal span. If the dip of the lowest point C below B is 3.675 m, determine the maximum cable tension and the length of the cable. 15

8 a) Explain Eddy's theorem 5

b) Analyse the parabolic three-hinged arch, loaded as shown in Figure 6, and determine the magnitude of the horizontal thrust. Sketch the bending moment diagram. Determine the magnitude and position of the maximum hogging and sagging BM. 15

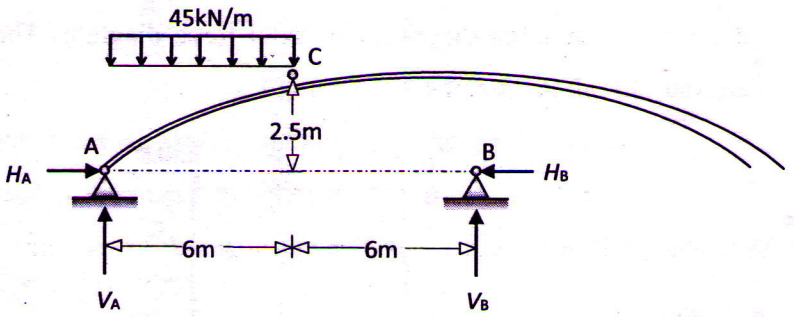

Figure 6

9 a) Determine the expression for influence line for the following forces of a 3 – hinged arch of span "l" and central rise "y_c" and plot ILD. 20

i) Horizontal thrust (H)

ii) Bending moment at a section (M)

iii) Radial shear at a section (V_r)

iv) Normal thrust at a section (N_r)

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