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ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)
B.E. (Full Time) - END-SEMESTER EXAMINATIONS, NOV-DEC 2024
CIVIL ENGINEERING
V Semester
CE5502 STRUCTURAL ANALYSIS - II
(Regulation 2019)

Time: 3 hours Max. Marks: 100

CO1	Draw influence lines for statically determinate structures and calculate critical stress resultants
CO2	Understand Muller Breslau principle and draw the influence lines for statically indeterminate beams
CO3	Analyse three hinged, two hinged and fixed arches
CO4	Analyse the suspension bridges with stiffening girders
CO5	Analyze rigid frames by approximate methods for gravity and horizontal loads

BL – Bloom's Taxonomy Levels
(L1-Remembering, L2-Understanding, L3-Applying, L4-Analysing, L5-Evaluating, L6-Creating)

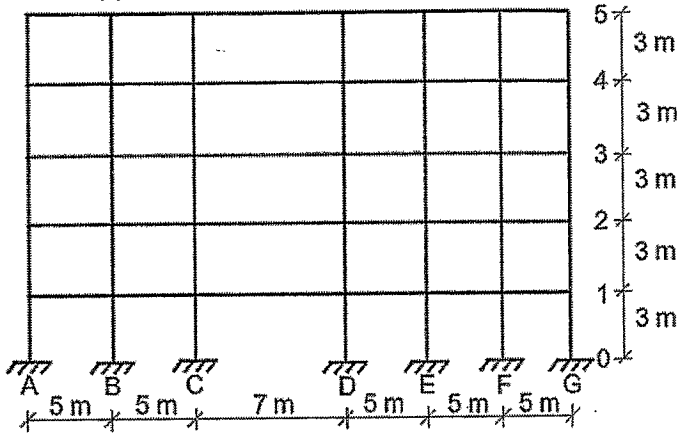
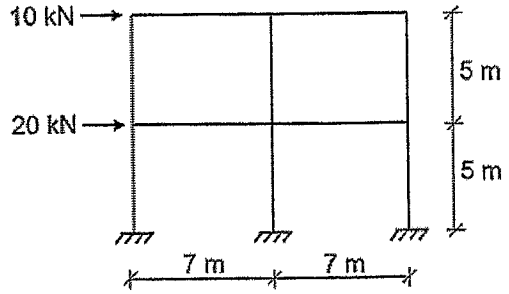
PART - A (10 x 2 = 20 Marks)

Q. No.	Questions	Marks	CO	BL
1	Calculate the bending moment at a section located at 4 m from the left support of a simply supported beam of span 10 m, when a concentrated load of 8 kN crosses the beam from left to right, using influence line diagram (ILD) concept.	2	1	L2
2	Draw the ILD qualitatively for the member forces in a top chord member and a bottom chord member of a simply supported Pratt truss. This Pratt truss has 6 bays, each of width '*a*' m and its height being '*h*'.	2	1	L2
3	State the Muller-Breslau principle used in the context of ILD for indeterminate beams.	2	2	L1
4	A continuous beam ABC, supported at A, B and C, has dimensions AB = 6 m and BC = 4 m. Draw the ILD for shear force at a section D qualitatively, which is located at 3 m from left support A.	2	2	L2
5	A three-hinged circular arch has a span of 15 m and a central rise of 3 m. Calculate the rise at a section located at 3 m from the left support.	2	3	L2
6	Mention the conditions applied for a fixed arch, to solve for the unknown reactions.	2	3	L1
7	A suspension bridge cable is supported by towers located 70 m apart. This cable has a central dip of 7 m and it supports a uniformly distributed load (UDL) of 20 kN/m. Find the tension in the cable.	2	4	L2
8	For a suspension cable with span '*l*' and central dip '*d*' stiffened by a stiffening girder, draw the ILD for horizontal pull and the equivalent UDL, when a concentrated load crosses the girder from left to right.	2	4	L1
9	Write the steps involved in the approximate analysis of frames using substitute frame method.	2	5	L2
10	State the assumptions and limitations of the cantilever method used in the approximate analysis of frames.	2	5	L1

PART - B (5 x 13 = 65 Marks)

Q. No.	Questions	Marks	CO	BL
11 (a)	A 4 m long UDL of magnitude 20 kN/m, crosses a simply supported beam AB of span 18 m from left to right. Find the maximum shear force and bending moment at a section located at 6 m from the left support A, and the absolute maximum bending moment in the beam, using ILD concept.	13	1	L3
	OR			
11 (b)	The following system of the wheel loads crosses a simply supported span of 28 m from left to right, with 10 kN load leading. Calculate the maximum shear force and bending moment at a section 10 m from the left support, using ILD concept.	13	1	L3
12 (a)	Draw the ILD for the reaction at the prop of a propped cantilever AB of span 10 m. Plot the coordinates at 1 m interval.	13	2	L4
	OR			
12 (b)	Draw the ILD for the support moment at the left support A of a fixed beam AB of span 'l'.	13	2	L4
13 (a)	A three-hinged parabolic arch, hinged at the supports A and B and at the crown C, has a span of 20 m and a central rise of 4 m. It carries a UDL of 25 kN/m over the left half portion (from A to C) and a concentrated load of 40 kN located at 3 m from the right support B. Find the bending moment, normal thrust and radial shear at a section located at 5 m from the left support A. Also draw the bending moment diagram.	13	3	L4
	OR			
13 (b)	A two-hinged parabolic arch has a span of 45 m and central rise of 5 m. It is subjected to a concentrated load of 50 kN at the centre. It has an elastic support which yields by 0.00012 mm/kN. Considering secant variation, calculate the horizontal thrust when there is a rise in temperature of 25 °C. Take E = 200 kN/mm^2; I = 5 × 10^9 mm^4; α = 12 × 10^{-6} /°C.	13	3	L4
14 (a)	The cables of a suspension bridge of span 90 m, are suspended from piers which are 10 m and 5 m respectively above the lowest point of the cable. The UDL carried by each cable is 2 kN/m. Using the data provided, calculate the following: (i) Length of the cable (ii) Horizontal pull in the cable (iii) Pressure on the piers considering smooth pulley support. The backstay at the lower pier makes an angle of 50° with the vertical and that at the taller pier makes an angle of 40° with the vertical.	13	4	L4
	OR			

Wheel load (kN)	7		14		12		10
Distance between the loads (m)		2		3		2	

14 (b)	A 100 m span suspension bridge, has 2 Nos. of three-hinged stiffening girders, with a 5 m wide roadway in-between. These are supported by two cables of parabolic profile, having a central dip of 9 m. The dead load is 5 kN/m^2 of the entire floor area. A live load of 12 kN/m^2, covers the left half of the bridge. Find the shear force and bending moment at 25 m from the left support. Determine also the maximum tension developed in the cable, for this position of live load.	**13**	4	L4
15 (a)	The frame shown in Fig. Q. 15(a) is spaced at 3 m centre-to-centre. The dead and live loads on all the floors are 3 kN/m^2 and 2 kN/m^2, respectively. The beams have a self-weight of 5 kN/m. Consider the *EI* for beams to be 1.5 times that for the columns. Determine the following using substitute frame method. (i) Maximum span moment in the beam C_3D_3 (ii) Maximum support moment at D_3  Fig. Q. 15(a)	**13**	5	L4
	OR			
15 (b)	Analyze the portal frame shown in Fig. Q. 15(b) and find the shear force, bending moment and axial force in all the members.  Fig. Q. 15(b)	**13**	5	L4

PART - C (1 x 15 = 15 Marks)
(Q. No.16 is compulsory)

Q. No.	Questions	Marks	CO	BL
16.	Draw the ILD for bending moment at a section D located at 4 m from the left support A of a continuous beam ABC, with span AB = 8 m and BC = 5 m. Plot the coordinates at 1 m interval.	**15**	2	L5