320411 (20)

BE (4th Semester)

Examination, April-May, 2021

Branch : Civil

STRUCTURAL ANALYSIS - I

Time Allowed : Three Hours

Maximum Marks : 80

Minimum Pass Marks : 28

Note : All the questions are compulsory. Solve questions worth 16 marks from each unit. Choice is clearly marked. Assume any data (if missing) and mention it clearly.

Unit-I

Q. 1. (a) Define degree of redundancy. What is the
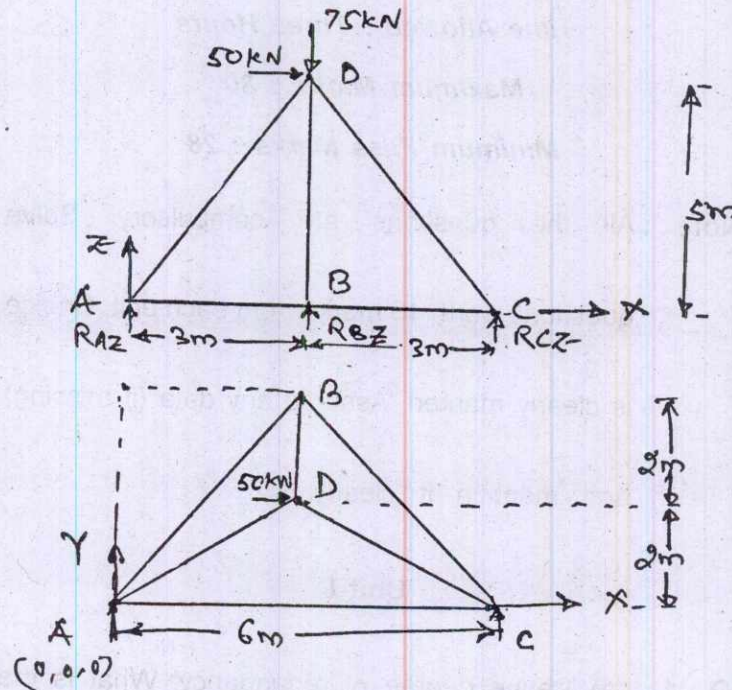
difference between external and internal

redundancy ?   4

(b) Using method of tension coefficients analyse

the space truss shown and find the forces
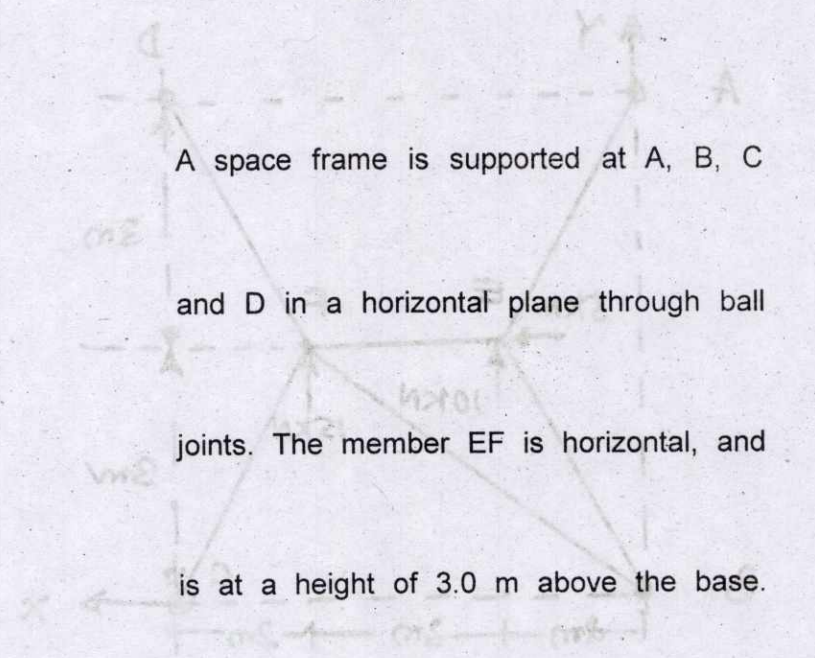
acting in the members of truss.   12

(3)

OR

A space frame is supported at A, B, C

and D in a horizontal plane through ball
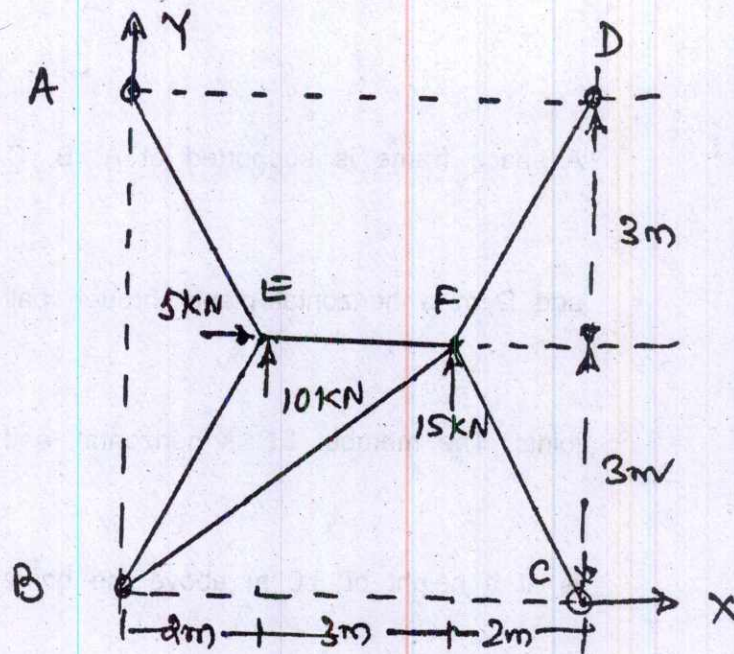
joints. The member EF is horizontal, and

is at a height of 3.0 m above the base.

The loads at the joints E and F, shown

act in horizontal plane. Find forces in

all the members of the frame.   12

Unit-II

Q. 2. (a) State the theorems used for confugate beam.

4

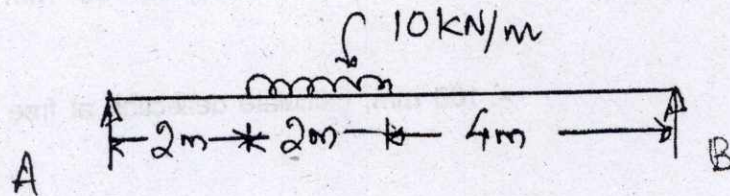(b) A beam of span 8.5 is simply supported

at the ends A and B and is loaded as

shown. $E = 200 \times 10^6$ kN/m^2 and $I = $

120×10^{-6} m^4. Determine :   12
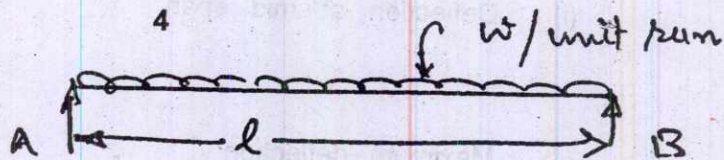
(i)   Deflection at mid span

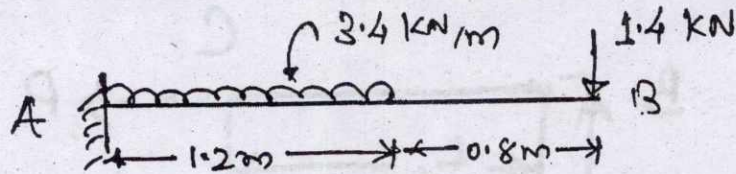(ii)   Maximum deflection

(iii) Slope at the end 'A'

OR

(i) Using Moment Area Method, find maximum slope and deflection for beam shown :

(ii) A cantilever is loaded as shown. If the section is rectangular 80 mm × 160 mm, calculate deflection at free end.

12

A — 3.4 kN/m ... 1.4 kN ... B
1.2m ... 0.8m

Unit-III

Q. 3. (a) Define strain energy.   2

(b) A vertical load W is applied to the rigid
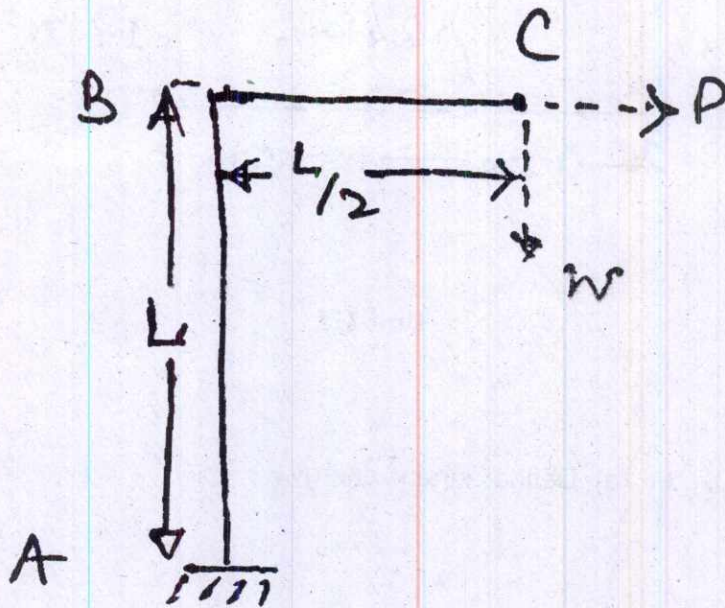
cantilever frame. Assuming EI to be constant

throughout frame, determine horizontal and

vertical deflection of point 'C'. Neglect axial

deformation.   14

OR

Write the following theorems : $3\frac{1}{2} \times 4 = 14$

(i) Maxwell's reciprocal theorem

(ii) Betti's theorem

(iii)   Castigliano's first theorem

(iv)   Castigliano's second theorem

Unit-IV

Q. 4. (a) Draw the influence line diagram for B.M.

and S.F. for a beam simply supported at

ends.   2

(b) Find the position of UDL shorter than

span for maximum B.M. at any

section x.   4

(c) A system of 5 wheel loads 80, 140, 160, 50, 40 kN crosses a beam of 15 m span with 80 kN load leading.

The distance between loads are 2.4 m, 3.0 m, 2.4 m and 1.6 m respectively.

Find the absolute maximum bending moment. 10

OR

Draw the influence line diagram for the

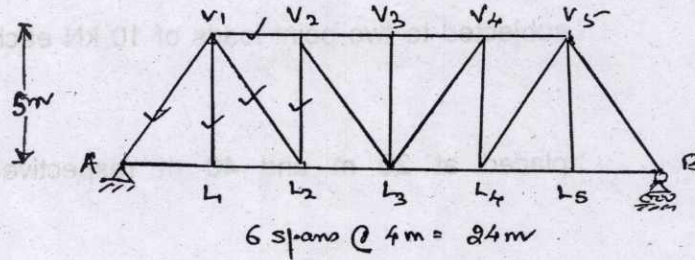members V_1V_2, V_2L_2, V_1L_2, L_1V_1, AV_1 for

truss shown. 10

6 spans @ 4m = 24m

Unit-V

Q. 5. (a) Explain what is theoretical arch ? 2

(b) What are functions of stiffening girders in

suspension bridge ? 2

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(c) The three hinged stiffening girder of a suspension bridge of 100 m span is subjected to two point loads of 10 kN each, placed at 20 m and 40 m respectively from the left hand hinge. Determine the B.M. and S.F. in girder at section 30 m from each end. Also determine the maximum tension in the cable which has a central dip of 10 m.   12

OR

A 3 hinged circular arch of span 16 m

and size 4.0 m is subjected to two point

loads of 100 kN and 80 kN at the left

and right quarter span points (i.e. 4 m).

Find reactions, also the bending moment,

radial shear and normal thrust at 6.0 from

left support. 12

Diagram: Three-hinged parabolic arch ABC with span 16 m. Horizontal load H_A and vertical reaction V_A at support A (left). A 100 kN vertical load at 4 m from left. Crown C at centre with $y_c = 4m$. A 30 kN vertical load at 4 m from right. Support B (right) with reactions H_B, R_B, V_B.