University of Mumbai
Examination First Half 2022

Program: BE **Civil** Curriculum Scheme**: Rev2019**
Examination: **SE Semester IV** Course Code: **CEC402**
Course Name: **Structural Analysis**

Question Bank

Multiple Choice Questions

Q1.	**Choose the correct option for following questions.**
1.	Method of joints of analysis of pin-jointed plane truss is suitable when
Option A:	Three unknown forces are at a joint
Option B:	Four unknown forces are at a joint
Option C:	One or two unknown forces are at a joint
Option D:	Only one unknown force is at a joint
2.	A right-angled triangle pin-jointed truss CAB has AC as a vertical member. Left end A is hinged & right end B is roller-supported. Member AC is perpendicular to horizontal member AB. Angle B is 30 degrees. A downward point load (W) acts at joint C. The forces in horizontal member AB & diagonal member BC are, respectively
Option A:	Zero & zero
Option B:	[W/cos60] & [Wtan60]
Option C:	[Wsin60] & [Wcos60]
Option D:	[W/sin60] & [W/tan60]
3.	A 3-hinged symmetrical parabolic arch is subjected to a UDL of (w/unit run) over the entire span. The bending moment at quarter span is
Option A:	$wl^2/8$
Option B:	$wl^2/12$
Option C:	Zero
Option D:	$wl^2/24$
4.	A symmetrical 3-hinged parabolic arch has a central rise of (h), span of (l) & it carries a UDL of (w/unit run) over its entire span. The value of horizontal thrust at the lower hinges is
Option A:	$wl^2/16h$
Option B:	$wl^2/8h$
Option C:	$wl/16h$
Option D:	$wl^2/4h$
5.	For a simply supported beam AB, Influence Line Diagram for reaction at B is
Option A:	A triangle having zero ordinate at A & unit ordinate at B
Option B:	A rectangle

Option C:	A triangle having zero ordinate at B & unit ordinate at A
Option D:	A triangle having zero ordinates at A & B & unit ordinate at mid-span.
6.	For a simply supported beam of span 10 m., Influence Line Diagram is drawn for a Bending Moment at a section 3 m from the left support. The maximum bending moment at the section due to a moving point load of 150 kN, is
Option A:	115 kNm
Option B:	215 kNm
Option C:	315 kNm
Option D:	415 kNm
7.	A simply supported beam has a span of 16 m. It is traversed by two point loads of 10 kN & 20 kN from left to right, with 10 kN load leading. The distance between the two loads is 3 m. Using Influence Line Theory, the maximum Bending Moment at the centre of the beam is
Option A:	95 kNm
Option B:	105 kNm
Option C:	125 kNm
Option D:	155 kNm
8.	The Unit Load Method is
Option A:	Applicable only to statically indeterminate structures
Option B:	Another name for stiffness method
Option C:	An extension of Maxwell's reciprocal theorem
Option D:	Derived from Castigliano's theorem
9.	A cantilever beam has a length of (l) & it is subjected to a downward point load of (W) at the free end. The strain energy due to bending is
Option A:	Wl/2EI
Option B:	WL/3EI
Option C:	$W^2l^3/6EI$
Option D:	$W^2l^3/12EI$
10.	A simple portal frame ABCD has left support A as hinged support & right support D as roller support. AB & CD are two vertical columns & BC is a horizontal beam at top. At C, there is an internal hinge. The frame is
Option A:	Unstable
Option B:	Determinate & stable
Option C:	Indeterminate & stable
Option D:	Determinate
11.	A pin-jointed plane truss has left end as hinged support & right end as roller support. It is a rectangular frame with two diagonal members (i.e. totally there are 6 members). The degree of internal static indeterminacy is
Option A:	Zero
Option B:	3
Option C:	2
Option D:	1
12.	A single-bay portal frame is fixed at both the supports at the base. Neglecting the axial deformation, the degree of kinematic indeterminacy is

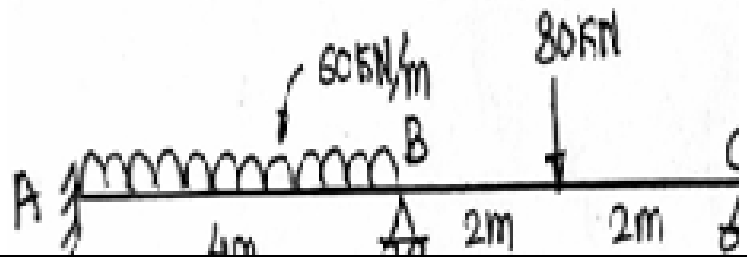
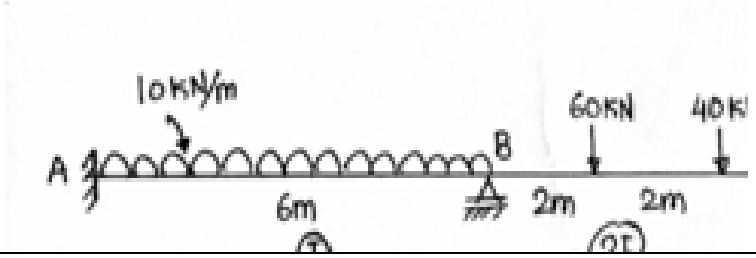
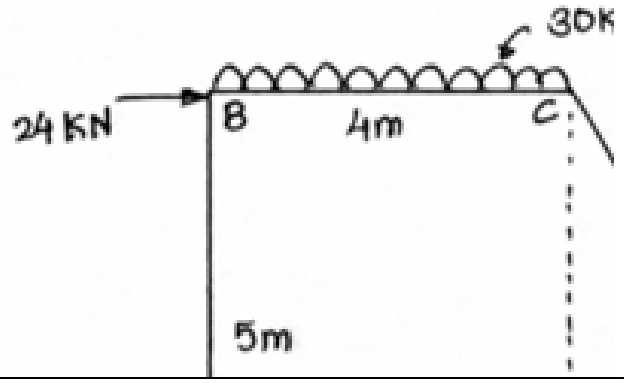
Option A:	1
Option B:	2
Option C:	3
Option D:	4
13.	For a rigid-jointed plane frame, one end is fixed & the other end is having hinged support. The size of the flexibility matrix is
Option A:	(1 X 1)
Option B:	(2 X 2)
Option C:	(3 X 3)
Option D:	(4 X 4)
14.	Which of the following is a force method of analysis?
Option A:	Moment Distribution Method
Option B:	Stiffness Matrix Method
Option C:	Clapeyron's Three Moment Theorem
Option D:	Plastic analysis of structures
15.	The stiffness coefficient K_{ij} means
Option A:	Force at (i) due to a unit deformation at (j)
Option B:	Deformation at (i) due to a unit force at (j)
Option C:	Deformation at (j) due to a unit force at (i)
Option D:	Force at (j) due to a unit deformation at (i)
16.	The stiffness of a spring having force (P) & deformation (Δ), is
Option A:	P / Δ
Option B:	$2P/ \Delta$
Option C:	$P \Delta$
Option D:	$P / 2 \Delta$
17.	A beam AB is fixed at left end A and roller-supported at right end B. An anticlockwise moment (M) is applied at B. The moment developed at A is
Option A:	M (Clockwise)
Option B:	M/2 (Clockwise)
Option C:	M/2 (Anticlockwise)
Option D:	M (Anticlockwise)
18.	In Moment Distribution Method, if distribution factor for one member at a joint is 0.25, what is the distribution factor for the other member at the same joint?
Option A:	0.25
Option B:	0.45
Option C:	0.65
Option D:	0.75
19.	Plastic analysis of structures is applicable for
Option A:	Ductile materials only
Option B:	Brittle materials only
Option C:	Both ductile & brittle materials
Option D:	Any structural material

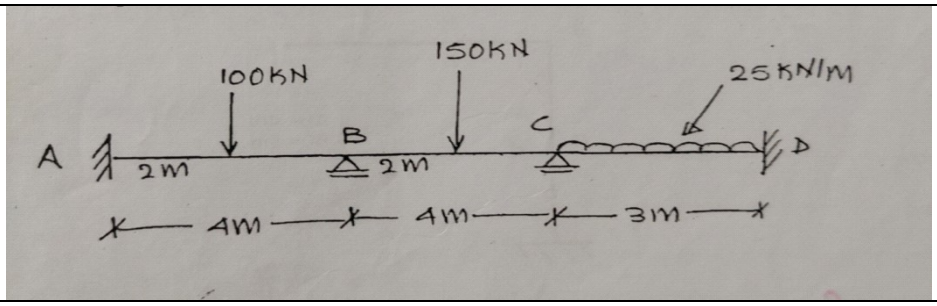
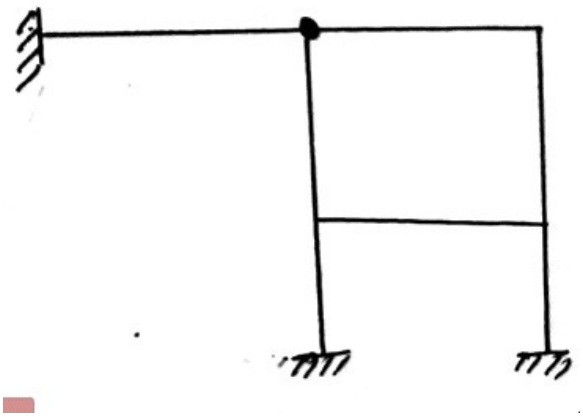
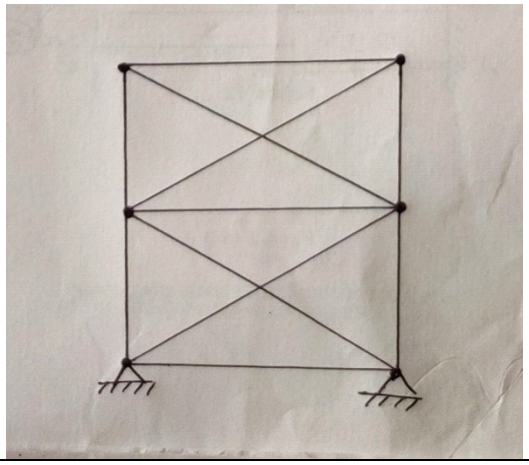
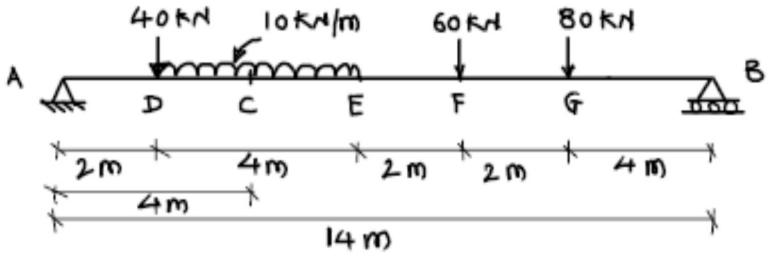
20.	A beam is fixed at one end & roller-supported at the other end. For mechanism to form, the minimum number of plastic hinges to be incorporated is
Option A:	4
Option B:	3
Option C:	2
Option D:	1
21.	In influence line diagrams (ILD)
Option A:	Points remain fixed, position of load changes
Option B:	Points change, position of load remains fixed
Option C:	Both point and position change
Option D:	Both are always fixed
22.	For stable structures, one of the important properties of flexibility and stiffness matrices is that the elements on the main diagonal i) of a stiffness matrix must be positive ii) of a stiffness matrix must be negative iii) of a flexibility matrix must be positive iv) of a flexibility matrix must be negative The correct answer is
Option A:	(ii) and (iii)
Option B:	(i) and (iii)
Option C:	(i) and (iv)
Option D:	(ii) and (iv)
23.	A rigid-jointed plane frame is stable and statically determinate if
Option A:	(m + r) = 2j
Option B:	(m + r) = 3j
Option C:	(3m + r) = 3j
Option D:	(m + 3r) = 3j
24.	A single rolling load of 8 kN rolls along a girder of 15 m span. The absolute maximum bending moment will be
Option A:	8 kN.m
Option B:	25 kN.m
Option C:	30 kN.m
Option D:	35 kN.m
25.	Shape factor for the triangular cross section of beam of base 'b' and height 'h' is
Option A:	3.34
Option B:	2.34
Option C:	1.69
Option D:	3.69
26.	What is B.M. diagram Area for Simply supported beam of span 5m and carrying UDL 12KN/m?
Option A:	125
Option B:	37.5
Option C:	150
Option D:	50

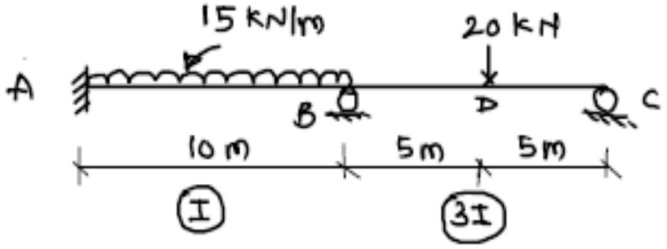
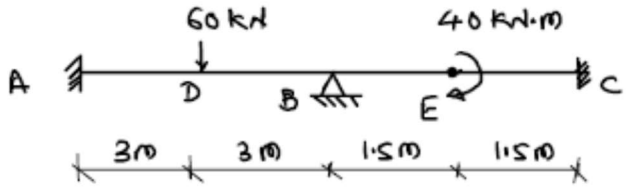
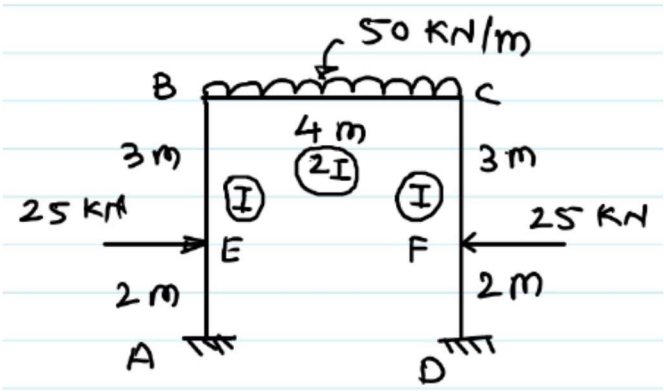
27.	Minimum number of members required in a perfect(stable) truss if number of joints = 6
Option A:	8
Option B:	9
Option C:	10
Option D:	11
28.	Any member of a pin jointed plane truss is subjected to
Option A:	shear force only
Option B:	bending moment only
Option C:	shear force and bending moment only
Option D:	axial force only
29.	Which of the following is formula to calculate shape factor, where Mp= plastic moment, My= Yield moment, Zp= plastic section modulus, Z= elastic modulus, fy= yield stress, Pu= collapse load, Pw= working load
Option A:	Mp / My
Option B:	My / Mp
Option C:	Z / Zp
Option D:	Pu / Pw
30.	The ratio of stiffness of any member to that of total stiffness of all members meeting at a joint is called
Option A:	stiffness factor
Option B:	distribution factor
Option C:	rotation factor
Option D:	carry over factor

Subjective questions (10 marks each) for Q No 2,3 and 4

A	A 3-hinged symmetrical parabolic arch ACB has a span of 40 m. It has a central rise of 6 m. Two hinges are at the left support A & right support B. At crown C, there is an internal hinge. Left part AC carries a UDL of 10 kN/m. At crown C, there is a downward point load of 20 kN. Calculate radial shear, normal thrust & bending moment at 3 m from the left hinge A.
B	A simply supported girder is of length 12 m. A vehicle having 3 wheel loads of 10 kN, 7 kN & 5 kN, is moving from left to right on the girder. 10 kN load is leading & 5 kN load is trailing. The distance between 10 kN load & 7 kN load is 1.5 m & the distance between 7 kN load & 5 kN load is 1 m. Using Influence Line Diagram, Find the maximum bending moment at the mid-span of the girder.
C	A portal frame ABCD has left end A hinged & right end D roller-supported. The height of the frame is 6 m. The left vertical column AB carries a point load of 20 kN (from left to right) at mid-point E. Beam BC of length 5 m. carries a UDL of 10 kN/m on its entire length. All the members have uniform flexural rigidity. Using

	Unit Load Method (Virtual Work Method), calculate the horizontal deflection of roller support D.
D	An inverted L-shaped rigid-jointed plane frame ABC has AB as a left vertical column of height 4 m & BC as a right horizontal beam of length 3 m at the top. Supports A & C are fixed. Column AB carries a point load of 15 kN (left to right) at mid-span D. Beam BC carries a UDL of 8 kN/m on its entire length. Using Flexibility Matrix Method or Stiffness Matrix Method, analyze the frame & draw Bending Moment Diagram.
E	A continuous beam ABC has left end A fixed & right end C roller-supported. The intermediate support B is roller-supported. Span AB of length 4 m carries a downward point load of 20 kN at its mid-span. Span BC of length 5 m carries a UDL of 12 kN/m on it's entire length. Using Clapeyron's Three Moment Theorem or Moment Distribution Method, analyze the beam & draw Bending Moment Diagram.
F	Two mild steel planks of dimensions (180 mm X 30 mm) each, are joined together to form a symmetrical T-section. Taking f_y = 250 MPa, determine the shape factor.
G	A three hinged symmetrical parabolic arch ADCEB having central rise 6m has a span of 40m. It is hinged at A, B and at crown C. Point D and E are 10m away from left and right support respectively. The arch carries an UDL of 20 KN/m over the portion DE. Find i) support reactions, ii) BM, Normal thrust at D iii) BM and radial shear force at E.
H	Analyse the beam using moment distribution method 
I	Analyse the beam using three moment theorem 
J	Analyse the frame using flexibility method and draw SFD BMD . 
K	Analyse by using stiffness method draw SFD and BMD.

	
L	Find Static and Kinematic Indeterminacy (neglecting and considering axial deformation**).**  
M	Using influence line diagram, determine the S.F and B.M at section 'C' in the simply supported beam shown in fig. 
N	A Symmetrical three hinged parabolic arch of span 36 m and rise 6 m is subjected to a concentrated load of 120 kN at 12 m from the left support. Draw bending moment diagram for the arch.
O	Analyse two span continuous beam as shown in fig. by stiffness method.

	
P	Analyse continuous beam by using three moment theorem. 
Q	Analyse portal frame by using Moment distribution method. 
R	Find the shape factor and plastic moment for the I- Section having flange 200 mm x20 mm. and web 400 mm x 10 mm, if the permissible yield stress in tension and compression is 250 MPa.