CENTRAL POLYTECHNIC COLLEGE, THARAMANI-600 113.
(An Autonomous Institution)

DEPARTMENT OF CIVIL ENGINEERING

QUESTION BANK

ECE41010 – MECHANICS OF STRUCTURES

ECE41010	Mechanics of Structures	L	T	P	C
Theory		3	0	0	3

Unit I	SLOPE AND DEFLECTION OF BEAMS	
Deflected shapes / Elastic curves of beams with different support conditions – Definition of Slope and Deflection- Flexural rigidity and Stiffness of beams Mohr's Theorems – Area Moment method for slope and deflection of beams – Derivation of expressions for maximum slope and maximum deflection of standard cases by area moment method for cantilever and simply supported beams subjected to symmetrical UDL& point loads. Numerical problems on determination of slopes and deflections at salient points of Cantilever Beam with maximum two point loads, udl throughout the beam, udl for the half length from fixed end and Combination of single point load and udl throughout the beam only Determination of slopes and deflections at salient points of Simply supported beams with central point load, Two equal point loads at one third points, udl throughout the beam and Combination of central point load and udl throughout the beam only from first principles and by using formulae.		9
Unit II	**FIXED BEAMS–AREA MOMENT METHOD**	
Introduction to fixed beam - Advantages –Degree of indeterminacy of fixed beam- Sagging and Hogging bending moments- Points of Contra flexure. – Determination of fixing end(support) moments(FEM) by Area Moment method– Bending moment diagram(BMD)- Free BMD –Fixed BMD Derivation of Expression for subjected to concentrated load at mid span, Single eccentric point load, udl throughout the beams. Numerical Problems for Fixed beams subjected to concentrated load at mid span, Single eccentric point load, Two equal point loads at one third points, udl throughout the beams, Combination of central point load and udl throughout the beam only. Drawing SF and BM diagrams for Fixed beams with supports at the same level (sinking of supports or supports at different levels are not included)		9
Unit III	**CONTINUOUS BEAMS–THEOREM OF THREE MOMENTS METHOD**	
Introduction to continuous beams-Advantages–Deflected shapes of continuous beam- Degree of indeterminacy of continuous beams with respect to number of spans and types of supports – Simple/ Fixed supports of beams- General methods of analysis of Indeterminate structures – Clapeyron's theorem of three moments– Application of Clapeyron's theorem of three moments for the following cases–Two span beams with both ends simply supported –Two span beams with one end fixed and the other end simply supported. Numerical Problems on Two span beams with both ends simply supported –Two span beams with one end fixed and		9

the other end simply supported -Sketching of SFD and BMD for all the above cases.		
Unit IV	**PORTAL FRAMES – MOMENT DISTRIBUTION METHOD**	
Introduction to moment distribution method- Carry over moment-Carryover factor and Stiffness factor (Derivation not required)-Distribution moment- Distribution factor— Stiffness Ratio or Relative Stiffness- Concept of distribution of un balanced moments at joints - Sign conventions, Definition of Frames– Types–Bays and Story - Sketches of Single/Multi Story Frames, Single/Multi Bay Frames- Portal Frame– Sway and Non- sway Frames Deflected shapes of Portal frames under different loading / support conditions Numerical problems of Non sway (Symmetrical) Portal Frames for Joint moments by Moment Distribution Method and drawing BMD only.		9
Unit V	**COLUMNS AND STRUTS**	
Columns and Struts–Definition–Short and Long columns–End conditions – Equivalent length / Effective length– Slenderness ratio – Axially loaded short column - Axially loaded long column – Euler's theory of long columns-Assumptions – Expression for Critical load of Columns standard cases of end conditions-Limitations of Euler's formula – Modes of failure of column-Buckling of column-Buckling load-crushing load-safe load- Factor of Safety– Expression of Rankine's formula for Crippling load of Columns - Simple problems for circular column, Hollow circular column, Rectangular column, Single I section without cover plate only.		9

UNIT	Q.NO	QUESTION
1	1	What is the primary cause of deflected shapes or elastic curves in beams? (a) Material density (b) Applied loads (c) Beam color (d) Support roughness *Ans: (B) Applied loads*
1	2	The elastic curve of a beam represents the shape of its what? (a) Neutral axis (b) Top surface (c) Shear force (d) Bending moment *Ans: (A) Neutral axis*
1	3	Analyzing the deflected shape of a cantilever beam helps primarily in determining what? (a) Beam's weight (b) Maximum deflection (c) Support reactions only (d) Material cost *Ans: (B) Maximum deflection*
1	4	The curvature of a beam's elastic curve is directly proportional to what? (a) Shear force (b) Bending moment (c) Axial load (d) Temperature change *Ans: (B) Bending moment*
1	5	Comparing the deflected shapes of simply supported and fixed beams under the same UDL, which will have a smaller maximum deflection? (a) Simply supported beam (b) Fixed beam (c) Both will be equal (d) Cannot be determined *Ans: (B) Fixed beam*
1	6	The term 'elastic curve' implies that the beam material obeys which law? (a) Newton's Law (b) Hooke's Law (c) Pascal's Law (d) Fourier's Law *Ans: (B) Hooke's Law*
1	7	What is the physical meaning of the slope at a point on a beam's elastic curve? (a) bending moment (b) angle of rotation (c) shear force (d) deflection *Ans: (B) angle of rotation*
1	8	Flexural rigidity (EI) of a beam is a measure of its resistance to? (a) axial deformation (b) bending deformation (c) shear deformation (d) torsional deformation *Ans: (B) bending deformation*
1	9	A beam with higher flexural rigidity (EI) will, under the same load, experience: (a) Larger deflection (b) Smaller deflection (c) Same deflection (d) Zero deflection *Ans: (B) Smaller deflection*
1	10	According to Mohr's theorems, the change in slope between two points on a beam equals what of M/EI diagram? (a) Area (b) Ordinate (c) Height (d) Perimeter *Ans: (A) Area*

UNIT	Q.NO	QUESTION	
1	11	Mohr's second theorem relates the deflection of one point relative to the tangent at another point to what of M/EI Diargam?	
		(a) Area	(b) Ordinate
		(c) Height	(d) Area x Centroid
		Ans: (C) Height	
1	12	The derivation of expressions for slope and deflection using Area-Moment method involves which mathematical operation on the M/EI diagram?	
		(a) Differentiation	(b) Integration
		(c) Multiplication	(d) Division
		Ans: (B) Integration	
1	13	When using the Area-Moment method for a cantilever with a Point load, the shape of the Bending Moment diagram is:	
		(a) Rectangular	(b) Triangular
		(c) Parabolic	(d) Cubic
		Ans: (B) Triangular	
1	14	The tangential deviation used in Mohr's second theorem is a measure of:	
		(a) Slope	(b) Deflection
		(c) Bending moment	(d) Shear force
		Ans: (B) Deflection	
1	15	For a cantilever with end point load P and length L, the maximum slope (at free end) is?	
		(a) $PL^2/(2EI)$	(b) $PL^2/(EI)$
		(c) $PL^2/(3EI)$	(d) $PL^2/(6EI)$
		Ans: (A) $PL^2/(2EI)$	
1	16	For a cantilever with end point load, the maximum deflection (at free end) is?	
		(a) $PL^3/(2EI)$	(b) $PL^3/(3EI)$
		(c) $PL^3/(6EI)$	(d) $PL^3/(8EI)$
		Ans: (B) $PL^3/(3EI)$	
1	17	For a simply supported beam with central point load P and span L, the maximum slope is?	
		(a) $PL^2/(8EI)$	(b) $PL^2/(16EI)$
		(c) $PL^2/(24EI)$	(d) $PL^2/(48EI)$
		Ans: (B) $PL^2/(16EI)$	
1	18	For a simply supported beam with central point load, the maximum deflection (at center) is?	
		(a) $PL^3/(24EI)$	(b) $PL^3/(48EI)$
		(c) $PL^3/(96EI)$	(d) $PL^3/(192EI)$
		Ans: (B) $PL^3/(48EI)$	
1	19	What would be the shape of the M/EI diagram that is used for beam subjected to UDL	
		(a) Rectangular	(b) Triangular
		(c) Parabolic	(d) Cubic
		Ans: (C) Parabolic	
1	20	The standard case of a cantilever with UDL (w per unit length) of length L has a maximum deflection of?	
		(a) $wL^4/(3EI)$	(b) $wL^4/(8EI)$
		(c) $wL^4/(12EI)$	(d) $wL^4/(24EI)$
		Ans: (B) $wL^4/(8EI)$	

UNIT	Q.NO	QUESTION	
1	21	For a simply supported beam with UDL w over span L, the maximum slope (at supports) is?	
		(a) $wL^3/(12EI)$	(b) $wL^3/(24EI)$
		(c) $wL^3/(48EI)$	(d) $wL^3/(96EI)$
		Ans: (B) $wL^3/(24EI)$	
1	22	The area-moment method is particularly useful for which types of loading on simply supported beams?	
		(a) Only axial loads	(b) Only torsional loads
		(c) Symmetrical UDL & point loads	(d) Only impact loads
		Ans: (C) Symmetrical UDL & point loads	
1	23	For a cantilever with a point load at the free end, the bending moment diagram is what shape?	
		(a) Rectangular	(b) Triangular
		(c) Parabolic	(d) Cubic
		Ans: (B) Triangular	
1	24	For a simply supported beam with symmetrical UDL, the bending moment diagram is what shape?	
		(a) Rectangular	(b) Triangular
		(c) Parabolic	(d) Cubic
		Ans: (C) Parabolic	
1	25	When applying area-moment to a simply supported beam with central point load, the M/EI diagram is:	
		(a) A rectangle	(b) Triangle
		(c) A parabola	(d) A complex shape
		Ans: (B) Triangle	
1	26	The maximum slope for a simply supported beam with central point load occurs at:	
		(a) Mid-span	(b) supports
		(c) Below Load	(d) The quarter points
		Ans: (B) supports	
1	27	For a cantilever with UDL throughout, the slope at the free end is given by which formula?	
		(a) $wL^3/(6EI)$	(b) $wL^3/(8EI)$
		(c) $wL^3/(12EI)$	(d) $wL^3/(24EI)$
		Ans: (A) $wL^3/(6EI)$	
1	28	For a cantilever with UDL for half length from the fixed end, the M/EI diagram is:	
		(a) Rectangular	(b) Triangular
		(c) Parabolic	(d) Zero
		Ans: (C) Parabolic	
1	29	For a cantilever with UDL throughout, the maximum deflection occurs at:	
		(a) The fixed end	(b) The free end
		(c) The midpoint	(d) The support
		Ans: (B) The free end	
1	30	Mohr's second theorem gives deflection as ______ of M/EI diagram?	
		(a) Area x Load	(b) Area x Centroid
		(c) Area x Span	(d) Area x Slope
		Ans: (B) Area x Centroid	

UNIT	Q.NO	QUESTION
1	31	Cantilever L=2.5m with UDL 4kN/m, EI=3125 kN.m². Maximum deflection ($wL^4/(8EI)$)? (a) 6.25 mm (b) 10.00 mm (c) 3.13 mm (d) 12.50 mm *Ans: (A) 6.25 mm*
1	32	If EI decreases by 50%, deflection increases by? (a) 50% (b) 100% (c) 150% (d) 200% *Ans: (D) 2*
1	33	If EI increases by 50%, slope decreases by? (a) 50% (b) 100% (c) 150% (d) 200% *Ans: (A) 0.5*
1	34	If EI increases by 50%, stiffness increases by? (a) 50% (b) 100% (c) 150% (d) 200% *Ans: (A) 0.5*
1	35	Area under M/EI diagram from A to B is 0.005 rad. Relative slope θ_{AB} =? (a) 0.005 rad (b) 0.01 rad (c) 0.0025 rad (d) 0.02 rad *Ans: (A) 0.005 rad*
1	36	Maximum deflection for cantilever with end load: $\delta_{max} = PL^3/3EI$. If L is doubled, δ becomes? (a) 2δ (b) 4δ (c) 8δ (d) 16δ *Ans: (C) 8δ*
1	37	Simply supported with symmetrical UDL: $\delta_{max} = 5wL^4/384EI$. For w=6kN/m, L=8m, EI=24576 kN.m², δ=? (a) 20 mm (b) 25 mm (c) 30 mm (d) 35 mm *Ans: (A) 20 mm*
1	38	Beam with higher EI has ______ deflection for same load. (a) Higher (b) Lower (c) Same (d) Zero *Ans: (B) Lower*
1	39	Cantilever with end moment M: Maximum slope = ML/EI. If M=6kN.m, L=3m, EI=4500 kN.m², θ=? (a) 0.004 rad (b) 0.006 rad (c) 0.008 rad (d) 0.012 rad *Ans: (A) 0.004 rad*
1	40	For cantilever with point load in Midspan, maximum deflection occurs at? (a) Fixed end (b) Free end (c) Midspan (d) Quarter span *Ans: (B) Free end*

UNIT	Q.NO	QUESTION

1 41 Flexural rigidity EI=3000 kN.m². If $I=15\times10^{-6}$ m⁴, E=?

(a) 200 GPa (b) 150 GPa
(c) 100 GPa (d) 50 GPa

Ans: (A) 200 GPa

1 42 Shape of elastic curve depends on?

(a) Load type (b) Support conditions
(c) Both A and B (d) Material only

Ans: (C) Both A and B

1 43 Mohr's theorems are based on?

(a) Hooke's law (b) Bernoulli-Euler equation
(c) St. Venant's principle (d) Maxwell's theorem

Ans: (B) Bernoulli-Euler equation

1 44 Maximum deflection for cantilever with UDL: $\delta_{max} = wL^4/8EI$. For w=2kN/m, L=5m, EI=6250 kN.m², δ=?

(a) 12.5 mm (b) 15.0 mm
(c) 17.5 mm (d) 20.0 mm

Ans: (A) 12.5 mm

1 45 Using Mohr's first theorem, if the area under M/EI diagram between two points is 0.006 rad, what is the change in slope?

(a) 0.003 rad (b) 0.006 rad
(c) 0.0015 rad (d) 0.03 rad

Ans: (B) 0.006 rad

1 46 A beam has maximum deflection $\delta = 5wL^4/384EI$. If w is trippled, δ becomes?

(a) δ (b) 2δ
(c) 3δ (d) 8δ

Ans: (C) 3δ

1 47 For a cantilever with end point load, $\delta = PL^3/3EI$. If L is halved, δ becomes?

(a) δ/2 (b) δ/4
(c) δ/8 (d) δ/16

Ans: (C) δ/8

1 48 Cantilever L=5m with UDL 3kN/m throughout. EI=7500 kN.m². Maximum slope?

(a) 0.0156 rad (b) 0.0313 rad
(c) 0.0234 rad (d) 0.0117 rad

Ans: (A) 0.0156 rad

1 49 Maximum slope for simply supported with central load is $PL^2/16EI$. For P=16kN, L=4m, EI=5120 kN.m², θ=?

(a) 0.008 rad (b) 0.005 rad
(c) 0.010 rad (d) 0.012 rad

Ans: (A) 0.008 rad

1 50 Elastic curve equation for cantilever with end moment M is?

(a) Parabolic (b) Cubic
(c) Linear (d) Circular

Ans: (D) Circular

UNIT	Q.NO	QUESTION	
2	1	What is a fixed beam?	
		(a) Both ends simply supported	(b) Both ends rigidly fixed
		(c) One end fixed, one end free	(d) One end fixed, one end hinged
		Ans: (B) Both ends rigidly fixed	
2	2	Main advantage of fixed beam over simply supported beam?	
		(a) Larger deflection	(b) Smaller maximum bending moment
		(c) Easier to construct	(d) No need for reinforcement
		Ans: (B) Smaller maximum bending moment	
2	3	Degree of static indeterminacy for a fixed-fixed beam?	
		(a) 1	(b) 2
		(c) 3	(d) 4
		Ans: (C) 3	
2	4	What makes a beam "fixed"?	
		(a) Vertical restraint only	(b) Rotation prevented at ends
		(c) Translation allowed	(d) No moments at supports
		Ans: (B) Rotation prevented at ends	
2	5	Fixed beams are also called:	
		(a) Cantilevers	(b) Built-in beams
		(c) Continuous beams	(d) Overhanging beams
		Ans: (B) Built-in beams	
2	6	Number of unknown reactions in fixed beam?	
		(a) 2	(b) 3
		(c) 4	(d) 6
		Ans: (D) 6	
2	7	Sagging moment causes beam to:	
		(a) Top fibers in tension	(b) Bottom fibers in tension
		(c) No tension	(d) Equal tension
		Ans: (B) Bottom fibers in tension	
2	8	Hogging moment causes:	
		(a) Top fibers in tension	(b) Bottom fibers in tension
		(c) No tension	(d) Equal tension
		Ans: (A) Top fibers in tension	
2	9	Point of contraflexure is where:	
		(a) SF is maximum	(b) BM is zero
		(c) BM changes sign	(d) Deflection is zero
		Ans: (C) BM changes sign	
2	10	In fixed beam BM diagram, hogging occurs at:	
		(a) Mid-span	(b) Supports
		(c) Quarter points	(d) Everywhere
		Ans: (B) Supports	

UNIT	Q.NO	QUESTION	
2	11	Sagging moment is considered:	
		(a) Negative	(b) Positive
		(c) Zero	(d) Variable
		Ans: (B) Positive	
2	12	Shear Force at Contraflexure point is:	
		(a) Negative	(b) Positive
		(c) Zero	(d) Any value
		Ans: (D) Any value	
2	13	Slope at Fixed support is	
		(a) Negative	(b) Positive
		(c) Zero	(d) Any value
		Ans: (C) Zero	
2	14	The slope at mid-span on a fixed beam carrying UDL on entire span span	
		(a) Negative	(b) Positive
		(c) Zero	(d) Variable
		Ans: (C) Zero	
2	15	A fixed beam carrying central point load, Fixed end moment is:	
		(a) PL/8	(b) PL/4
		(c) PL/12	(d) PL/16
		Ans: (A) PL/8	
2	16	A fixed beam carrying UDL on entire span, Fixed end moment is:	
		(a) $wL^2/8$	(b) $wL^2/12$
		(c) $wL^2/16$	(d) $wL^2/24$
		Ans: (B) $wL^2/12$	
2	17	EI is called:	
		(a) Modulus	(b) Stiffness
		(c) Flexural rigidity	(d) Elastic constant
		Ans: (C) Flexural rigidity	
2	18	Fixed beam deflection is ___ than simply supported beam	
		(a) More	(b) Less
		(c) Equal	(d) Unpredictable
		Ans: (B) Less	
2	19	Maximum deflection in fixed beam with UDL on entire span is at:	
		(a) Supports	(b) Quarter points
		(c) Mid-span	(d) Ends
		Ans: (C) Mid-span	
2	20	Fixed beam span 4m, central load 20kN. Fixed end moment is:	
		(a) 10 kN.m	(b) 15 kN.m
		(c) 20 kN.m	(d) 25 kN.m
		Ans: (A) 10 kN.m	

UNIT	Q.NO	QUESTION	
2	21	If Fixed end moment is 16kN.m for central load, span=4m, load=?	
		(a) 8 kN	(b) 16 kN
		(c) 32 kN	(d) 64 kN
		Ans: (C) 32 kN	
2	22	Fixed beam L=5m, P=40kN at center. Reaction at support=?	
		(a) 10 kN	(b) 20 kN
		(c) 30 kN	(d) 40 kN
		Ans: (B) 20 kN	
2	23	Fixed beam L=10m, UDL 8kN/m. Fixed end moment is ?	
		(a) 66.67 kN.m	(b) 100 kN.m
		(c) 133.33 kN.m	(d) 166.67 kN.m
		Ans: (A) 66.67 kN.m	
2	24	Points of contraflexure for UDL fixed beam at:	
		(a) 0.125L from ends	(b) 0.146L from ends
		(c) 0.207L from ends	(d) 0.25L from ends
		Ans: (C) 0.207L from ends	
2	25	When drawing SFD, first find:	
		(a) Deflections	(b) Reactions
		(c) Moments	(d) Stresses
		Ans: (B) Reactions	
2	26	In a fixed beam support settlement causes:	
		(a) No change	(b) Additional moments
		(c) Reduced moments	(d) Zero SF
		Ans: (B) Additional moments	
2	27	In fixed beam, rotation at ends is:	
		(a) Maximum	(b) Zero
		(c) 0.5 radian	(d) 1 radian
		Ans: (B) Zero	
2	28	Number of contraflexure points in fixed beam with central load:	
		(a) 0	(b) 1
		(c) 2	(d) 3
		Ans: (C) 2	
2	29	At contraflexure point, bending stress is:	
		(a) Maximum	(b) Minimum
		(c) Zero	(d) Average
		Ans: (C) Zero	
2	30	Fixed beam carries ___ load than simply supported for same stress	
		(a) More	(b) Less
		(c) Equal	(d) Cannot say
		Ans: (A) More	

UNIT	Q.NO	QUESTION	
2	31	A fixed beam carrying central point load, maximum sagging bending moment is:	
		(a) PL/8	(b) PL/4
		(c) PL/12	(d) PL/16
		Ans: (A) PL/8	
2	32	BMD for fixed beam with UDL is ___ shaped	
		(a) Cubic	(b) Parabolic
		(c) Linear	(d) Circular
		Ans: (B) Parabolic	
2	33	A fixed beam with central point load, points of contraflexure at:	
		(a) L/4 from ends	(b) L/3 from ends
		(c) L/6 from ends	(d) L/8 from ends
		Ans: (B) L/3 from ends	
2	34	To draw BMD, we need ___ values	
		(a) SF at points	(b) BM at points
		(c) Both	(d) Neither
		Ans: (B) BM at points	
2	35	Fixed beams are ___ structures	
		(a) Determinate	(b) Indeterminate
		(c) Unstable	(d) Mechanism
		Ans: (B) Indeterminate	
2	36	Number of equilibrium equations available:	
		(a) 2	(b) 3
		(c) 4	(d) 6
		Ans: (B) 3	
2	37	Compared to simply supported, fixed beam is:	
		(a) Less stiff	(b) More stiff
		(c) Same stiffness	(d) Flexible
		Ans: (B) More stiff	
2	38	For UDL fixed beam, contraflexure points:	
		(a) 0	(b) 2
		(c) 4	(d) 6
		Ans: (B) 2	
2	39	Free BMD for central load is:	
		(a) Triangle	(b) Rectangle
		(c) Parabola	(d) Trapezoid
		Ans: (A) Triangle	
2	40	A fixed beam carries UDL on entire span. The support bending moments are _______ mid-span moments	
		(a) greater than	(b) lesser than
		(c) equal to	(d) both A and B
		Ans: (A) greater than	

UNIT	Q.NO	QUESTION	
2	41	In fixed beam, deflection at ends is:	
		(a) Maximum	(b) Minimum
		(c) Zero	(d) Infinite
		Ans: (C) Zero	
2	42	L=2m, P=8kN center. Fixed end moment =?	
		(a) 2 kN.m	(b) 4 kN.m
		(c) 6 kN.m	(d) 8 kN.m
		Ans: (A) 2 kN.m	
2	43	SFD for UDL fixed beam is ___ shaped	
		(a) Linear	(b) Parabolic
		(c) Cubic	(d) Constant
		Ans: (A) Linear	
2	44	At supports of fixed beam, BM is:	
		(a) Zero	(b) Maximum hogging
		(c) Maximum sagging	(d) Minimum
		Ans: (B) Maximum hogging	
2	45	To find contraflexure points, solve:	
		(a) SF=0	(b) BM=0
		(c) Deflection=0	(d) Slope=0
		Ans: (B) BM=0	
2	46	BMD always passes through zero at contraflexure:	
		(a) TRUE	(b) FALSE
		(c) Sometimes	(d) Never
		Ans: (A) TRUE	
2	47	Main advantage of fixed beam is Reduced ___	
		(a) Deflection	(b) Bending moment
		(c) Both	(d) Neither
		Ans: (C) Both	
2	48	For a fixed beam with central point load PL/8 is:	
		(a) FEM	(b) Max sagging
		(c) Reaction	(d) Deflection
		Ans: (A) FEM	
2	49	Deflection formula for central load fixed beam:	
		(a) $PL^3/192EI$	(b) $PL^3/48EI$
		(c) $PL^3/384EI$	(d) $PL^3/768EI$
		Ans: (A) $PL^3/192EI$	
2	50	In fixed beam, deflection at mid-span is:	
		(a) Maximum	(b) Minimum
		(c) Zero	(d) Infinite
		Ans: (A) Maximum	

UNIT	Q.NO	QUESTION	
3	1	What is a continuous beam?	
		(a) Beam with one span	(b) Beam with multiple spans over supports
		(c) Cantilever beam	(d) Simply supported beam
		Ans: (B)	
3	2	Main advantage of continuous beams over simply supported beams?	
		(a) Larger deflections	(b) Smaller maximum bending moments
		(c) Simpler analysis	(d) No support reactions
		Ans: (B)	
3	3	The deflected shape of a continuous beam has:	
		(a) Discontinuous slope at supports	(b) Continuous slope over supports
		(c) Sharp corners at supports	(d) Maximum slope at supports
		Ans: (B)	
3	4	Continuous beams are commonly used in:	
		(a) Small sheds	(b) Bridges and multi-story buildings
		(c) Isolated footings	(d) Retaining walls
		Ans: (B)	
3	5	In continuous beams, internal supports are typically:	
		(a) Hinged	(b) Roller
		(c) simple	(d) Free
		Ans: (C)	
3	6	For a continuous beam with 'n' spans and all simple supports, degree of static indeterminacy is:	
		(a) n	(b) n-1
		(c) n+1	(d) 2n
		Ans: (B)	
3	7	If a continuous beam has 3 spans with all simple supports, its degree of indeterminacy is:	
		(a) 1	(b) 2
		(c) 3	(d) 4
		Ans: (B)	
3	8	Degree of indeterminacy depends on:	
		(a) Number of spans only	(b) Type of supports only
		(c) Both spans and supports	(d) Load type only
		Ans: (C)	
3	9	For 2-span beam with both ends simply supported, degree of indeterminacy is:	
		(a) 1	(b) 2
		(c) 3	(d) 4
		Ans: (A)	
3	10	Additional unknowns in continuous beams are:	
		(a) Load magnitudes	(b) Support moments
		(c) Material properties	(d) Cross-section dimensions
		Ans: (B)	

UNIT	Q.NO	QUESTION	
3	11	A simple support allows:	
		(a) Rotation and translation	(b) Rotation only
		(c) Translation only	(d) No movement
		Ans: (B)	
3	12	A fixed support prevents:	
		(a) Rotation only	(b) Translation only
		(c) Both rotation and translation	(d) Neither rotation nor translation
		Ans: (C)	
3	13	General methods for analyzing indeterminate structures include:	
		(a) Equilibrium equations only	(b) Compatibility conditions only
		(c) Both equilibrium and compatibility	(d) Neither
		Ans: (C)	
3	14	Continuous beams are analyzed as indeterminate because:	
		(a) They have more unknowns than equations	(b) They are unstable
		(c) They have fewer supports	(d) Loads are unknown
		Ans: (A)	
3	15	Clapeyron's theorem is also called:	
		(a) Theorem of two moments	(b) Theorem of three moments
		(c) Theorem of four moments	(d) Theorem of equilibrium
		Ans: (B)	
3	16	Three moment theorem relates moments at:	
		(a) Two consecutive supports	(b) Three consecutive supports
		(c) Four consecutive supports	(d) All supports
		Ans: (B)	
3	17	The three moment equation involves:	
		(a) Loads only	(b) Moments only
		(c) Moments and span properties	(d) Deflections only
		Ans: (C)	
3	18	For two-span beam with both ends simply supported, number of three moment equations needed:	
		(a) 0	(b) 1
		(c) 2	(d) 3
		Ans: (B)	
3	19	In applying three moment theorem, we consider spans as:	
		(a) Independent	(b) Simply supported
		(c) Fixed at ends	(d) Overhanging
		Ans: (B)	
3	20	The theorem connects moments at supports:	
		(a) M_0, M_1, M_2	(b) M_1, M_2, M_3
		(c) Any three consecutive	(d) Only end moments
		Ans: (C)	

UNIT	Q.NO	QUESTION	
3	21	For two spans with equal EI, the equation simplifies because:	
		(a) EI cancels out	(b) EI becomes zero
		(c) EI doubles	(d) EI is constant
		Ans: (A)	
3	22	With one end fixed, degree of indeterminacy is:	
		(a) Same as both ends simple	(b) One more than both ends simple
		(c) One less than both ends simple	(d) Unchanged
		Ans: (B)	
3	23	Two-span beam: L1=4m, L2=6m, both ends simply supported. Number of unknown support moments?	
		(a) 0	(b) 1
		(c) 2	(d) 3
		Ans: (B)	
3	24	SFD for continuous beam shows:	
		(a) Constant shear in spans	(b) Linear variation for point loads
		(c) Parabolic for UDL	(d) Both B and C
		Ans: (D)	
3	25	BMD for continuous beam has maximum moments:	
		(a) Only at supports	(b) Only at mid-spans
		(c) At supports and/or mid-spans	(d) At quarter points
		Ans: (C)	
3	26	Sketching SFD requires finding:	
		(a) Reactions first	(b) Moments first
		(c) Deflections first	(d) Loads first
		Ans: (A)	
3	27	In BMD, points of contraflexure occur where:	
		(a) BM=0	(b) SF=0
		(c) Deflection=0	(d) Slope=0
		Ans: (A)	
3	28	Continuous beams have:	
		(a) More than two supports	(b) Exactly two supports
		(c) One support	(d) No supports
		Ans: (A)	
3	29	Number of equilibrium equations for continuous beam:	
		(a) 2	(b) 3
		(c) n	(d) 2n
		Ans: (B)	
3	30	If unknowns = 3, degree of indeterminacy is:	
		(a) 3	(b) 2
		(c) 1	(d) 0
		Ans: (D)	

UNIT	Q.NO	QUESTION	
3	31	Degree of indeterminacy indicates:	
		(a) Number of extra equations needed	(b) Number of loads
		(c) Number of spans	(d) Span lengths
		Ans: (A)	
3	32	For 4-span simple supports, degree = ?	
		(a) 1	(b) 2
		(c) 3	(d) 4
		Ans: (C)	
3	33	Continuous beams are ___ structures	
		(a) Determinate	(b) Indeterminate
		(c) Unstable	(d) Mechanisms
		Ans: (B)	
3	34	For two spans, equation involves:	
		(a) M0, M1, M2	(b) M1, M2, M3
		(c) M0, M1 only	(d) M1, M2 only
		Ans: (A)	
3	35	With both ends simple, known moments:	
		(a) M0 and M2 = 0	(b) M0 and M1 = 0
		(c) M1 and M2 = 0	(d) None = 0
		Ans: (A)	
3	36	For UDL, free BM diagram is:	
		(a) Parabolic	(b) Linear
		(c) Rectangular	(d) Triangular
		Ans: (A)	
3	37	With point load, free BM diagram is:	
		(a) Triangular	(b) Parabolic
		(c) Rectangular	(d) Trapezoidal
		Ans: (A)	
3	38	Number of equations to solve for two-span simple:	
		(a) 1	(b) 2
		(c) 3	(d) 4
		Ans: (A)	
3	39	Number of equations to solve for two-span FIXED:	
		(a) 1	(b) 2
		(c) 3	(d) 4
		Ans: (C)	
3	40	Advantage: Reduced ___ compared to simply supported	
		(a) Deflection	(b) Load carrying capacity
		(c) Span length	(d) Number of supports
		Ans: (A)	

UNIT	Q.NO	QUESTION	
3	41	Degree for 2-span, both ends simple:	
		(a) 1	(b) 2
		(c) 3	(d) 4
		Ans: (A)	
3	42	Degree for 2-span, one end fixed:	
		(a) 1	(b) 2
		(c) 3	(d) 4
		Ans: (B)	
3	43	Each additional span adds how many unknowns?	
		(a) 1	(b) 2
		(c) 3	(d) 4
		Ans: (A)	
3	44	For 5-span simple supports, degree = ?	
		(a) 3	(b) 4
		(c) 5	(d) 6
		Ans: (B)	
3	45	The theorem is particularly useful for:	
		(a) Continuous beams	(b) Trusses
		(c) Columns	(d) Foundations
		Ans: (A)	
3	46	Clapeyron was a:	
		(a) French engineer	(b) German physicist
		(c) British mathematician	(d) American architect
		Ans: (A)	
3	47	For two spans, we write equation for supports:	
		(a) 0,1,2	(b) 1,2,3
		(c) 0,1 only	(d) 1,2 only
		Ans: (A)	
3	48	Fixed end typically has:	
		(a) Hogging moment	(b) Sagging moment
		(c) Zero moment	(d) Variable moment
		Ans: (A)	
3	49	BMD for continuous beam typically has:	
		(a) Peaks at supports and midspans	(b) Constant throughout
		(c) Zero everywhere	(d) Only positive values
		Ans: (A)	
3	50	Three moment equation is based on:	
		(a) Slope compatibility	(b) Shear equilibrium
		(c) Load balancing	(d) Moment equilibrium
		Ans: (A)	

UNIT	Q.NO	QUESTION	
4	1	The moment distribution method was developed by:	
		(a) Timoshenko	(b) Hardy Cross
		(c) Rankine	(d) Euler
		Ans: (B)	
4	2	In moment distribution, carryover moment refers to:	
		(a) Moment transferred to adjacent joint	(b) Moment applied externally
		(c) Moment due to loading	(d) Moment at supports
		Ans: (A)	
4	3	The carryover factor for a member with far end fixed is:	
		(a) 0	(b) 0.5
		(c) 1	(d) 2
		Ans: (B)	
4	4	The carryover factor for a member with far end simply supported is:	
		(a) 0	(b) 0.5
		(c) 1	(d) 2
		Ans: (A)	
4	5	In moment distribution, joints are initially assumed to be:	
		(a) Fixed	(b) Hinged
		(c) Free	(d) Roller
		Ans: (A)	
4	6	A beam AB fixed at A and simply supported at B has length 4m, EI constant. The stiffness factor for member AB is:	
		(a) EI/4	(b) 3EI/4
		(c) 4EI/4	(d) 4EI/3
		Ans: (B)	
4	7	For a beam with far end fixed, the carryover factor is 0.5. If 100 kNm is applied at near end, carryover moment to far end is:	
		(a) 0 kNm	(b) 50 kNm
		(c) 100 kNm	(d) 200 kNm
		Ans: (B)	
4	8	In a continuous beam, if a moment of 80 kNm is applied at joint B and carryover factor is 0.5, moment carried over to adjacent joint C is:	
		(a) 0 kNm	(b) 40 kNm
		(c) 80 kNm	(d) 160 kNm
		Ans: (B)	
4	9	The carryover factor for a prismatic member with far end hinged is:	
		(a) 0	(b) 0.5
		(c) 1	(d) 2
		Ans: (A)	
4	10	Stiffness factor for a prismatic beam fixed at far end is:	
		(a) 4EI/L	(b) 3EI/L
		(c) 2EI/L	(d) EI/L
		Ans: (A)	

UNIT	Q.NO	QUESTION	
4	11	Stiffness factor for a prismatic beam hinged at far end is:	
		(a) 4EI/L	(b) 3EI/L
		(c) 2EI/L	(d) EI/L
		Ans: (B)	
4	12	Distribution factor for a member at a joint is calculated as:	
		(a) Stiffness of member/Sum of stiffnesses of all members	(b) Sum of stiffnesses/Stiffness of member
		(c) 1/Stiffness of member	(d) Stiffness of member × Length
		Ans: (A)	
4	13	If a joint connects three members with stiffnesses 2K, 3K, and 5K, the distribution factor for the first member is:	
		(a) 0.1	(b) 0.2
		(c) 0.3	(d) 0.4
		Ans: (B)	
4	14	The sum of distribution factors at any joint is always:	
		(a) 0	(b) 0.5
		(c) 1	(d) Depends on loading
		Ans: (C)	
4	15	At joint B, three members meet with stiffnesses: K_BA=3EI/L, K_BC=4EI/L, K_BD=EI/L. Distribution factor for member BC is:	
		(a) 0.25	(b) 0.375
		(c) 0.5	(d) 0.625
		Ans: (C)	
4	16	A joint connects two members with stiffnesses 3K and 7K. The distribution factor for stiffer member is:	
		(a) 0.3	(b) 0.7
		(c) 0.5	(d) 0.4
		Ans: (B)	
4	17	For a fixed support, the distribution factor is:	
		(a) 0	(b) 0.5
		(c) 1	(d) Not defined
		Ans: (A)	
4	18	Member AB has L=6m, EI=6000 kNm², far end fixed. Its stiffness factor is:	
		(a) 1000 kNm/rad	(b) 2000 kNm/rad
		(c) 3000 kNm/rad	(d) 4000 kNm/rad
		Ans: (D)	
4	19	Distribution moment is calculated as:	
		(a) Unbalanced moment × Distribution factor	(b) Stiffness × Rotation
		(c) Fixed end moment × Carryover factor	(d) Load × Length
		Ans: (A)	
4	20	Relative stiffness is defined as:	
		(a) I/L	(b) EI/L
		(c) 4EI/L	(d) L/EI
		Ans: (A)	

UNIT	Q.NO	QUESTION	
4	21	In moment distribution, unbalanced moment at a joint is: (a) Sum of fixed end moments (c) Average of fixed end moments *Ans: (A)*	 (b) Difference of fixed end moments (d) Maximum of fixed end moments
4	22	Concept of distributing unbalanced moments involves: (a) Releasing joints and redistributing moments (c) Changing support conditions *Ans: (A)*	 (b) Applying additional loads (d) Increasing member sizes
4	23	Two members BA and BC meet at joint B. FEM_BA=+60 kNm, FEM_BC=-40 kNm. Unbalanced moment at B is: (a) 20 kNm (c) -20 kNm *Ans: (A)*	 (b) 100 kNm (d) -100 kNm
4	24	For the joint in Two members BA and BC meet at joint B. FEM_BA=+60 kNm, FEM_BC=-40 kNm. Unbalanced moment at B is 20 kNm if distribution factor for BA is 0.6, distribution moment for BA is: (a) 12 kNm (c) 36 kNm *Ans: (A)*	 (b) -12 kNm (d) -36 kNm
4	25	Relative stiffness of member with I=8000 cm^4, L=4m is: (a) 2000 cm^4/m (c) 8000 cm^4/m *Ans: (A)*	 (b) 4000 cm^4/m (d) 16000 cm^4/m
4	26	If stiffness of member AB is K and BC is 2K, relative stiffness ratio AB:BC is: (a) 01:01 (c) 02:01 *Ans: (B)*	 (b) 01:02 (d) 01:04
4	27	Unbalanced moment at joint is 120 kNm, distribution factors are 0.4 and 0.6. Distribution moments are: (a) 48 kNm and 72 kNm (c) 40 kNm and 80 kNm *Ans: (A)*	 (b) 60 kNm and 60 kNm (d) 30 kNm and 90 kNm
4	28	At joint B, moment from BA is +50 kNm (clockwise), from BC is -30 kNm (anticlockwise). Unbalanced moment is: (a) 20 kNm (c) -20 kNm *Ans: (A)*	 (b) 80 kNm (d) -80 kNm
4	29	Moment at end A of AB is +80 kNm. With carryover factor 0.5, moment at B due to carryover is: (a) +40 kNm (c) +80 kNm *Ans: (A)*	 (b) -40 kNm (d) -80 kNm
4	30	After distribution, final moment at joint B from BA is -60 kNm, from BC is +40 kNm. Net moment at joint B is: (a) -20 kNm (c) -100 kNm *Ans: (A)*	 (b) +20 kNm (d) +100 kNm

UNIT	Q.NO	QUESTION	
4	31	A structural frame consists of:	
		(a) Beams only	(b) Columns only
		(c) Beams and columns	(d) Foundation only
		Ans: (C)	
4	32	The horizontal spacing between columns in a frame is called:	
		(a) Story	(b) Bay
		(c) Panel	(d) Grid
		Ans: (B)	
4	33	The vertical distance between floor levels in a frame is called:	
		(a) Bay	(b) Story
		(c) Span	(d) Height
		Ans: (B)	
4	34	A single-story frame has:	
		(a) One floor level	(b) One bay
		(c) One column	(d) One beam
		Ans: (A)	
4	35	A multi-bay frame has:	
		(a) Multiple floor levels	(b) Multiple column spacings
		(c) Multiple foundations	(d) Multiple materials
		Ans: (B)	
4	36	A frame with 3 columns and 2 beams has how many bays?	
		(a) 1	(b) 2
		(c) 3	(d) 4
		Ans: (B)	
4	37	A 4-story frame with 5 bays per story has total beams (assuming one beam per bay per story):	
		(a) 20	(b) 25
		(c) 30	(d) 35
		Ans: (A)	
4	38	Sketch of single-story single-bay frame typically shows:	
		(a) Two columns and one beam	(b) One column and one beam
		(c) Two columns and two beams	(d) Three columns and one beam
		Ans: (A)	
4	39	A portal frame typically consists of:	
		(a) Two columns and a beam	(b) One column and one beam
		(c) Three columns and two beams	(d) Four columns and one beam
		Ans: (A)	
4	40	A non-sway frame:	
		(a) Permits lateral displacement	(b) Prevents lateral displacement
		(c) Has only vertical loads	(d) Has pinned supports
		Ans: (B)	

UNIT	Q.NO	QUESTION	
4	41	Multi-bay portal frames have:	
		(a) Multiple beams	(b) Multiple columns in row
		(c) Both A and B	(d) Neither A nor B
		Ans: (C)	
4	42	For non-sway condition, frame must have:	
		(a) Symmetrical geometry and loading	(b) Asymmetrical loading
		(c) Horizontal loads only	(d) Flexible columns
		Ans: (A)	
4	43	Fixed end moments for portal frame beam with UDL w are calculated as:	
		(a) $wL^2/8$ (simply supported)	(b) $wL^2/12$ (fixed-fixed)
		(c) $wL^2/24$	(d) $wL^2/48$
		Ans: (B)	
4	44	Symmetrical portal, span 8m, UDL 15 kN/m on beam. FEM for beam (assuming fixed ends):	
		(a) +80 kNm	(b) -80 kNm
		(c) +120 kNm	(d) -120 kNm
		Ans: (B)	
4	45	Carryover moment travels to the _____ end.	
		(a) Same	(b) Opposite
		(c) Adjacent	(d) Far
		Ans: (D)	
4	46	If carryover factor is 0, far end is:	
		(a) Fixed	(b) Hinged
		(c) Free	(d) Roller
		Ans: (B)	
4	47	Distribution factor depends on:	
		(a) Length only	(b) Stiffness only
		(c) Load only	(d) Both stiffness and geometry
		Ans: (D)	
4	48	At joint, four members meet with equal stiffness. Each distribution factor is:	
		(a) 0.1	(b) 0.25
		(c) 0.5	(d) 1
		Ans: (B)	
4	49	Stiffness factor has units of:	
		(a) kN/m	(b) kNm/rad
		(c) kN	(d) m
		Ans: (B)	
4	50	Distribution factor is always between:	
		(a) -1 and +1	(b) 0 and 1
		(c) 1 and 10	(d) 0 and infinity
		Ans: (B)	

UNIT	Q.NO	QUESTION
5	1	What is the primary difference between short and long columns? (a) Material strength (b) Slenderness ratio (c) Cross-sectional area (d) Load direction *Ans: (B)*
5	2	Which end condition provides the maximum effective length for a column? (a) Both ends fixed (b) One end fixed, one end hinged (c) Both ends hinged (d) One end fixed, one end free *Ans: (D)*
5	3	A column with both ends fixed has an effective length factor of: (a) 0.5 (b) 0.65 (c) 1 (d) 2 *Ans: (A)*
5	4	Effective length is defined as: (a) Actual length of column (b) Distance between points of zero moment (c) Distance between supports (d) Length of unsupported portion *Ans: (B)*
5	5	Slenderness ratio is the ratio of: (a) Length to radius (b) length to radius of gyration (c) Diameter to length (d) Load to area *Ans: (B)*
5	6	Euler's theory is applicable to: (a) Short columns (b) Long columns (c) Medium columns (d) All columns *Ans: (B)*
5	7	Which assumption is NOT made in Euler's theory? (a) Column is initially straight (b) Material is homogeneous (c) Load is eccentric (d) Material obeys Hooke's law *Ans: (C)*
5	8	The critical load in Euler's formula is inversely proportional to: (a) E (b) I (c) L^2 (d) A *Ans: (C)*
5	9	For a column with both ends fixed, Euler's critical load is: (a) $\pi^2 EI/L^2$ (b) $4\pi^2 EI/L^2$ (c) $2\pi^2 EI/L^2$ (d) $\pi^2 EI/4L^2$ *Ans: (B)*
5	10	For a column with one end fixed and one end free, Euler's critical load is: (a) $\pi^2 EI/4L^2$ (b) $\pi^2 EI/L^2$ (c) $4\pi^2 EI/L^2$ (d) $2\pi^2 EI/L^2$ *Ans: (A)*

UNIT	Q.NO	QUESTION
5	11	Major limitation of Euler's formula is: (a) Not applicable to steel (b) Not applicable to long columns (c) Not considering direct stress (d) Only for ideal conditions *Ans: (D)*
5	12	Buckling load is also known as: (a) Crushing load (b) Critical load (c) Safe load (d) Working load *Ans: (B)*
5	13	Safe load is obtained by dividing crippling load by: (a) Stress factor (b) Load factor (c) Factor of safety (d) Safety margin *Ans: (C)*
5	14	Rankine's formula considers: (a) Only buckling (b) Only crushing (c) Both buckling and crushing (d) Only bending *Ans: (C)*
5	15	In Rankine's formula, 'a' represents: (a) Euler's constant (b) Rankine's constant (c) Factor of safety (d) Slenderness ratio *Ans: (B)*
5	16	Rankine's formula is applicable to: (a) Only short columns (b) Only long columns (c) Both short and long columns (d) Medium columns only *Ans: (C)*
5	17	For a circular column, the radius of gyration is: (a) D/4 (b) $D/\sqrt{8}$ (c) D/2 (d) $D/\sqrt{12}$ *Ans: (A)*
5	18	For a hollow circular column, the moment of inertia is: (a) $\pi(D^4-d^4)/32$ (b) $\pi(D^4-d^4)/64$ (c) $\pi(D^4-d^4)/128$ (d) $\pi(D^4-d^4)/256$ *Ans: (B)*
5	19	A column of length 3m has both ends fixed. Its effective length is: (a) 1.5 m (b) 2.1 m (c) 3.0 m (d) 6.0 m *Ans: (A)*
5	20	A column with one end fixed and other free has actual length 4m. Effective length is: (a) 2.0 m (b) 2.8 m (c) 4.0 m (d) 8.0 m *Ans: (D)*

UNIT	Q.NO	QUESTION
5	21	A column has effective length 3.5m and radius of gyration 0.05m. Slenderness ratio is: (a) 35 (b) 70 (c) 17.5 (d) 140 *Ans: (B)*
5	22	A short square column 300mm×300mm carries axial load. Area is: (a) 0.09 m^2 (b) 0.06 m^2 (c) 0.03 m^2 (d) 0.12 m^2 *Ans: (A)*
5	23	Calculate Euler's load for column with EI=5000 kNm^2, L=4m, both ends hinged: (a) 3084 kN (b) 1542 kN (c) 6168 kN (d) 12336 kN *Ans: (A)*
5	24	Using Euler's formula, find critical load for steel column (E=200 GPa, I=5×10^6 mm^4, L=3m, both ends fixed): (a) 2193 kN (b) 8762 kN (c) 4381 kN (d) 1095 kN *Ans: (C)*
5	25	For column with one fixed end and one hinged end, effective length factor is: (a) 0.5 (b) 0.7 (c) 1 (d) 2 *Ans: (B)*
5	26	Buckling load is 500 kN with FOS=3. Safe load is: (a) 1500 kN (b) 500 kN (c) 166.67 kN (d) 125 kN *Ans: (C)*
5	27	Crushing load is 800 kN, buckling load is 600 kN. Rankine load is: (a) 1400 kN (b) 342.86 kN (c) 480 kN (d) 685.71 kN *Ans: (B)*
5	28	Using Rankine's formula, crippling load for column with crushing load=1000 kN, buckling load=800 kN: (a) 1800 kN (b) 444.44 kN (c) 615.38 kN (d) 888.89 kN *Ans: (B)*
5	29	Circular column diameter 200mm. Radius of gyration is: (a) 40 mm (b) 50 mm (c) 60 mm (d) 80 mm *Ans: (B)*
5	30	Hollow circular column: D=250mm, d=150mm. Moment of inertia is: (a) 1.67×10^8 mm^4 (b) 3.34×10^8 mm^4 (c) 2.67×10^8 mm^4 (d) 5.34×10^8 mm^4 *Ans: (C)*

UNIT	Q.NO	QUESTION	
5	31	Solid circular column diameter 300mm carries load 1500 kN. Stress is:	
		(a) 17.68 MPa	(b) 21.22 MPa
		(c) 31.83 MPa	(d) 42.44 MPa
		Ans: (B)	
5	32	The end condition that provides maximum resistance to buckling is:	
		(a) Both ends fixed	(b) One end fixed, one end hinged
		(c) Both ends hinged	(d) One end fixed, one end free
		Ans: (A)	
5	33	A short column is primarily designed to resist:	
		(a) Bending moment	(b) Shear force
		(c) Axial compression	(d) Torsion
		Ans: (C)	
5	34	The boundary conditions affect a column's:	
		(a) Cross-sectional area	(b) Material properties
		(c) Effective length	(d) Load magnitude
		Ans: (C)	
5	35	Which end condition has an effective length factor of 2.0?	
		(a) Both ends fixed	(b) Both ends hinged
		(c) One fixed, one hinged	(d) One fixed, one free
		Ans: (D)	
5	36	A column with both ends hinged is also called:	
		(a) Fixed-fixed	(b) Pinned-pinned
		(c) Fixed-free	(d) Fixed-pinned
		Ans: (B)	
5	37	Equivalent length is the length of:	
		(a) An equivalent simply supported beam	(b) A column with both ends fixed
		(c) A column with same buckling load	(d) An ideal column
		Ans: (C)	
5	38	For a column with one end fixed and one end hinged, effective length factor is approximately:	
		(a) 0.5	(b) 0.7
		(c) 1	(d) 2
		Ans: (B)	
5	39	A column with slenderness ratio less than 10 is generally considered:	
		(a) Long column	(b) Medium column
		(c) Short column	(d) Very long column
		Ans: (C)	
5	40	Euler's theory assumes the material is:	
		(a) Plastic	(b) Elastic
		(c) Rigid	(d) Viscoelastic
		Ans: (B)	

UNIT	Q.NO	QUESTION	
5	41	In Euler's formula, critical load depends on:	
		(a) Only cross-sectional area	(b) Only length
		(c) Only material	(d) All of these
		Ans: (D)	
5	42	Euler's critical load formula is: Pcr =	
		(a) EI/L^2	(b) $\pi EI/L^2$
		(c) $\pi^2 EI/L^2$	(d) $2\pi^2 EI/L^2$
		Ans: (C)	
5	43	The critical load is independent of:	
		(a) Column length	(b) Material yield strength
		(c) Moment of inertia	(d) Modulus of elasticity
		Ans: (B)	
5	44	For a column with both ends fixed, Euler's formula becomes: Pcr =	
		(a) $\pi^2 EI/L^2$	(b) $\pi^2 EI/4L^2$
		(c) $4\pi^2 EI/L^2$	(d) $2\pi^2 EI/L^2$
		Ans: (C)	
5	45	Safe load = Crippling load ÷	
		(a) Factor of safety	(b) Load factor
		(c) Material factor	(d) Shape factor
		Ans: (A)	
5	46	Modes of failure for columns include both:	
		(a) Buckling and crushing	(b) Shear and torsion
		(c) Fatigue and creep	(d) Bending and shear
		Ans: (A)	
5	47	For a solid circular column, radius of gyration k =	
		(a) D/4	(b) $D/\sqrt{8}$
		(c) D/2	(d) $D/\sqrt{12}$
		Ans: (A)	
5	48	For hollow circular column, area A =	
		(a) $\pi(D^2-d^2)$	(b) $\pi(D^2-d^2)/4$
		(c) $\pi(D^2+d^2)/4$	(d) $\pi(D^2-d^2)/2$
		Ans: (B)	
5	49	The moment of inertia for circular section about any axis through centroid is:	
		(a) $\pi D^4/32$	(b) $\pi D^4/64$
		(c) $\pi D^4/128$	(d) $\pi D^4/256$
		Ans: (B)	
5	50	For rectangular section b×d, radius of gyration about minor axis =	
		(a) $d/\sqrt{12}$	(b) $b/\sqrt{12}$
		(c) $\sqrt{(bd/12)}$	(d) $\sqrt{(d^3/12b)}$
		Ans: (B)	

PART B SHORT ANSWER QUESTIONS 3 marks

UNIT I

1 What is slope of a beam?

2 How does increasing stiffness affect beam deflection?

3 What is deflection of a beam?

4 Define flexural rigidity.

5 What does the area under the BMD represent?

6 What is stiffness of a beam?

7 State Mohr's first theorem.

8 State Mohr's second theorem.

9 Draw the deflected shape of a simply supported beam carrying UDL.

10 Draw the deflected shape of a cantilever beam carrying UDL.

UNIT II

1 Define a fixed beam.

2 Why are support moments developed in a fixed beam?

3 State advantages of fixed beam.

4 What is degree of indeterminacy?

5 How does fixing ends affect beam strength?

6 What is point of contra flexure?

7 Draw the deflected shape of a fixed beam carrying UDL.

8 Draw the deflected shape of a beam fixed at one end hinged at other end carrying UDL.

9 Why is a fixed beam 'indeterminate'?

10 Draw bending moment diagram of a fixed beam carrying UDL?

UNIT III

1 Define continuous beam.

2 Why are continuous beams more efficient than simply supported beams?

3 State advantage of continuous beam.

4 Why is a continuous beam statically indeterminate?

5 What is Clapeyron's theorem?

6 Why does an intermediate support cause negative moment?

7 Why is a three-span beam more indeterminate than two-span?

8 Why is BMD continuous over an intermediate support in continuous beam?

9 How does UDL on one span affect the adjacent span in continuous beam?

10 Why is the deflection over a support zero?

UNIT IV

1 What is moment distribution method?

2 Why is the carryover factor 1/2 for a prismatic member?

3 What does a distribution factor of 0.5 indicate?

4 What is carryover factor?

5 Define stiffness factor.

6 What is distribution moment?

7 What is unbalanced moment?

8 Sketch and mark a bay and story in a frame?

9 Define portal frame.

10 Differentiate sway and non-sway frame?

UNIT V

1 Define a column.

2 Define a strut.

3 What is a short column?

4 Why is Euler's formula not for short columns?

5 What is a long column?

6 How does slenderness ratio affect critical load?

7 Define effective length.

8 What is the difference between crushing and buckling?

9 What is the failure mode of a concrete column with slenderness ratio of 10?

10 State Rankine's formula.

PART C DETAILED ANSWER QUESTIONS 10 MARKS

UNIT I

1 A Cantilever beam of span 5m carries points load of 10kN at free end . Calculate the maximum slope and deflection. Take E=210kN/mm2 and I= 6x10^8 mm4

2 A cantilever beam of 4m length carries an UDL of 10kN/m throughout its span. Find the maximum slope and deflection at free end. Take E=2x10^5 N/mm2 and I=8x10^8 mm4

3 A cantilever beam of 6m span carries an UDL of 15kN/m over a length of 3m from the fixed end. Calculate the maximum slope and deflection at the free end by moment area method. Take EI=7x10^4 kNm^2.

4 A simply supported beam with width 200mmand depth 350mm size with 4m span carries a point load of 100kN at mid span . Find the maximum slope and deflection of the beam. Take E=2x10^5 N/mm2

5 A Cantilever beam of span 10m carries points loads of 20kN at free end. Calculate the maximum slope and deflection. Take E=200kN/mm2 and I= 6x10^8 mm4

UNIT II

1 A fixed beam of span 6m carries two point loads of 50 kN each of 2m from both support. Determine the fixed end moments and draw the SFD and BMD.

2 A fixed beam of 6 m span carries a Central point load of 20 kN. Determine the fixed end moments and draw the SFD and BMD.

3 A fixed beam of 9m span is subjected to an UDL of 10kN/m over the entire length Calculate the fixed end moments and draw the SFD and BMD.

4 A fixed beam of span 4m is subjected to a central point load of 50kN at 3m from the left support. Determine the fixed end moments and draw the SFD and BMD.

5 A fixed beam of span 8m carries two point loads of 30 kN each of 2m from both support. Determine the fixed end moments and draw the SFD and BMD.

UNIT III

1 A two span continuous beam AB=6m and BC=6m. The support A is simply supported and support C is simply supported. The span AB carries an point load of 100 kN at a distance of 3m from A. The span BC carries a point load of 80 kN at 1m from support B. Draw the bending moment diagram using the theorem of three moments method.

2 A two span continuous beam AB=4m and BC=4m. The support A is fixed and support C is simply supported. Both spans, AB and BC carry an UDL of 50 kN/m over their entire length. Draw the bending moment diagram using the theorem of three moments method.

3 A two span continuous beam AB=6m and BC=6m. The support A is simply supported and support C is fixed. The span AB carries an UDL of 10 kN/m over its entire length. The span BC carries a point load of 30 kN at 2m from support B. Draw the bending moment diagram using the theorem of three moments method.

4 A two span continuous beam AB=6m and BC=6m. The support A is simply supported and support C is simply supported. The span AB carries an point load of 60 kN at a distance of 4m from A. The span BC carries UDL load of 20 kN/m . Draw the bending moment diagram using the theorem of three moments method.

5 A two span continuous beam AB=8m and BC=8m. The support A is simply supported and support C is fixed. The span AB carries an udl of 20 kN/m over its entire length. The span BC carries a point load of 40 kN at 4m from support B. Draw the bending moment diagram using the theorem of three moments method.

UNIT IV

1 A portal frame has column height of 3m and beam length of 4m. Both columns are fixed at base. The beam carries a point load of 20kN at mid-span. Analyse the portal frame by Moment Distrubution Method and draw the bending moment diagram. All structural members haver same value of EI.

2 A portal frame has column height of 4m and beam length of 6m. Both columns are hinged at base. The beam carries UDL of 20kN/m through out the span. Analyse the portal frame by Moment Distrubution Method and draw the bending moment diagram. All structural members haver same value of EI.

3 A portal frame has column height of 5m and beam length of 6m. Both columns are fixed at base. The beam carries a point load of 100kN at mid-span. Analyse the portal frame by Moment Distrubution Method and draw the bending moment diagram. All structural members haver same value of EI.

4 A portal frame has column height of 3m and beam length of 6m. Both columns are hinged at base. The beam carries UDL of 30kN/m through out the span. Both columns carry inward point load of 50kN at mid-height. Analyse the portal frame by Moment Distrubution Method and draw the bending moment diagram. All structural members haver same value of EI.

5 A portal frame has column height of 3m and beam length of 4m. Both columns are fixed at base. The beam carries a point load of 80kN at mid-span. Both columns carry in point load of 20kN at mid-height. Analyse the portal frame by Moment Distrubution Method and draw the bending moment diagram. All structural members haver same value of EI.

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UNIT V

1 A hollow C.I column whose outside diameter is 150 mm has a thickness of 20 mm. It is 5m long and is fixed at both the ends. Determine crippling load by Euler's formula, E = 2x 10^5 N/mm^2

2 A column of timber section 400mmx400mm is 6m long, One end fixed and other end hinged. Take E= 17 x 10^3 N/mm^2 . Determine crippling load by Euler's formula for the column.

3 Find the crippling load given by Euler's a formula for a cast iron tubular column 5m Long having outer and inner diameters of 220mm and 180mm respectively.Both ends of the column are assumed to be hinged. Take E = 2x10^5N/mm^2.

4 Find the crippling load given by Euler's formula for a cast iron square tubular column 5m Long of cross sectional dimensions 200mmx200mm (outer dimensions) and 5mm thickness . The column is one end fixed and other end free. Take E = 2x10^5N/mm^2.

5 A circular timber column whose diameter is 500 mm is 10m long and is fixed at both the ends. Calculate the buckling load by Euler's formula if E = 20x 10^3 N/mm^2.