



ACADEMIC YEAR : 2018-2019

Subject Code	CE6602	L	P	T	C
Subject Title	STRUCTURAL ANALYSIS II	3	1	0	4
Year / Dept / Sem	III/CIVIL/VI	Regulation Year	2013		
Faculty Name / Desg / Dept	Ms.S.NAGAJOTHI/AP/CIVIL				
Course Prerequisite	<p>✓ The students must have more knowledge about basic fundamentals of mathematics.</p> <p>✓ They have details about Strength of Materials</p>				

CE6602	STRUCTURAL ANALYSIS II	L T P C	3 1 0 4
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OBJECTIVES:

To introduce the students to advanced methods of analysis like matrix methods, Plastic analysis and FE method and also analysis of space structures.

UNIT I FLEXIBILITY METHOD

9

Equilibrium and compatibility – Determinate vs Indeterminate structures – Indeterminacy - Primary structure – Compatibility conditions – Analysis of indeterminate pin-jointed plane frames, continuous beams, rigid jointed plane frames (with redundancy restricted to two).

UNIT II STIFFNESS MATRIX METHOD

9

Element and global stiffness matrices – Analysis of continuous beams – Co-ordinate transformations – Rotation matrix – Transformations of stiffness matrices, load vectors and displacements vectors – Analysis of pin-jointed plane frames and rigid frames (with redundancy limited to two)

UNIT III FINITE ELEMENT METHOD

9

Introduction – Discretisation of a structure – Displacement functions – Truss element – Beam element – Plane stress and plane strain - Triangular elements

UNIT IV PLASTIC ANALYSIS OF STRUCTURES

9

Statically indeterminate axial problems – Beams in pure bending – Plastic moment of resistance – Plastic modulus – Shape factor – Load factor – Plastic hinge and mechanism – Plastic analysis of indeterminate beams and frames – Upper and lower bound theorems

UNIT V SPACE AND CABLE STRUCTURES

9

Analysis of Space trusses using method of tension coefficients – Beams curved in plan
Suspension cables – suspension bridges with two and three hinged stiffening girders

TOTAL (L:45+T:15): 60 PERIODS

OUTCOMES:

The student will have the knowledge on advanced methods of analysis of structures including space and cable structures.

TEXT BOOKS:

1. Punmia.B.C., Ashok Kumar Jain and Arun Kumar Jain, “Theory of Structures”, Laxmi Publications, 2004.
2. Vaidyanathan, R. and Perumal, P., “Comprehensive structural Analysis – Vol. I & II”, Laxmi Publications, New Delhi, 2003

3. Negi L.S. & Jangid R.S., "Structural Analysis", Tata McGraw Hill Publications, New Delhi,
4. BhavaiKatti, S.S, "Structural Analysis – Vol. 1 Vol. 2", Vikas Publishing House Pvt. Ltd., New Delhi, 2008

REFERENCES:

1. Ghali.A, Nebille,A.M. and Brown,T.G. "Structural Analysis" A unified classical and Matrix approach" 6th edition. Spon Press, London and New York, 2013.
2. Coates R.C, Coutie M.G. and Kong F.K., "Structural Analysis", ELBS and Nelson, 1990
3. Pandit G.S. & Gupta S.P. "Structural Analysis – A Matrix Approach", Tata McGraw Hill 2004.
4. William Weaver Jr. & James M. Gere, "Matrix Analysis of Framed Structures", CBS Publishers and Distributors, Delhi, 2004
5. Viswanathan T.S & Sudharsanan.R. "Structural Analysis II" Hitech Publishing company Pvt.Ltd

Course Objectives (CO)	CO1: To introduce the students to advanced methods of analysis like matrix methods, Plastic analysis and FE method and also analysis of space structures.
Expected Course Outcomes (ECO)	At the end of the course, the students should be able to: ECO1: analysis trusses, frames and arch Bridges ECO2 :analyze structures for space and cable ECO3 :Will be conversant with classical methods of analysis.

Mapping of CO & PO(Specify the PO's) - (Fill the col.s with the legend given below)**PROGRAM OUTCOMES (Pos)**

Engineering graduates will be able to:

1. ENGINEERING KNOWLEDGE: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. PROBLEM ANALYSIS: identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principals of mathematics, natural sciences and engineering sciences.
3. DESIGN/ DEVELOPMENT OF SOLUTIONS: Design solutions for complex engineering problems and design systems components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural societal, and environmental considerations.
4. CONDUCT INVESTIGATIONS COMPLEX PROBLEMS: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions.
5. MODERN TOOL USAGE: Create, select, and apply appropriate techniques resources, and modern engineering and it tools including production and modeling to complex engineering activities with an understanding of the limitations.
- 6.THE ENGINEERING AND SOCIETY: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practices.
7. ENVIRONMENT AND SUSTAINABILITY: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. ETHICS: Apply ethical principles and commit to professional and responsibilities and norms of the engineering practices.

9. **INDIVIDUAL AND TEAM WORK:** Function effectively as an individual and as a member or leader in diverse teams, and in multidisciplinary setting.

10. **COMMUNICATION:** Communicate effectively on complex engineering activities with the engineering community and with society at large such as being able to comprehend and write effective reports and design documentations, make presentations, and give and receive clear instructions.

11. **PROJECT MANAGEMENT AND FINANCE:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work as a member and leader in a team to manage project and in multidisciplinary environments.

12. **LIFE LONG LEARNING:** Recognize the need for, and have the preparations and ability to engage independent and lifelong learning in the broadest context of technological change.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	1	-	-	-	-	-	-	-	-	2
CO2	2	-	-	-	-	-	-	-	-	-	-	-
CO3	2	2	1	1	-	-	-	1		-	-	-
CO4	2	2	2	1	-	-	-	-	-	-	-	-
CO5	2	2	2	1	-	-	-	-	-	-	-	-
CO6	2	2	2	1	-	-	-	1	-	-	-	-
Bridging the Curriculum Gap (Additional Topics beyond syllabus/Seminars/Assignments)				BCG1: Introduction to components of buildings BCG2: Bow Girder Bridge BCG3: Indoor Stadium Analysis								
Related Website URLs				W1: www.liv.ac.uk/~halim/COMP.ppt W2: www.transportation.nebraska.gov/ref-man/specbooke/1000-.pdf W3: http://www.sals.org.cn/teaching/zhaosir/connection-6.pdf								
Related Video Course Materials (min. 3 no.s)				V1: https://www.youtube.com/watch?v=KQEDlqvPmO8 V2: https://www.youtube.com/watch?v=JwCAN3_1lfA V3: https://www.youtube.com/watch?v=TsdS1unC8xI V4: https://www.youtube.com/watch?v=85oJ_aA1yDI								

S.No	Topic Name	Book	Page No	Teaching Aids	No of hrs	Cumulative hrs
UNIT I- FLEXIBILITY METHOD						
1	Determinate Vs Indeterminate structures – Indeterminacy, Primary structure – Compatibility conditions	R5	1.7	Black Board	2	2
2	Analysis of indeterminate pin-jointed	R5	1.70	Black Board	2	4
3	continuous beams	R5	1.22	Black Board	2	6
4	rigid jointed plane frames	R5	1.42	Black Board	1	7
5	Equilibrium Conditions	R5	1.6	Black Board	2	9
6	Compatibility Conditions	R5	1.4	Black Board	1	10
7	Solved problems	R5	1.7	Black Board	1	11
8	Tutorials – Continuous Beams	UQ	UQ	Black Board	2	13

	Problems					
9	Tutorials – Continuous Beams Problems	UQ	UQ	Black Board	1	14
UNIT II- STIFFNESS MATRIX METHOD						
1	Analysis of continuous beams – Co-ordinate transformations	R5	2.1	Black Board	2	16
2	Rotation matrix	R5	2.5	Black Board	1	17
3	Transformations of stiffness matrices	R5	2.5	Black Board	2	19
4	load vectors and displacements vectors	R5	2.2	Black Board	2	21
5	Analysis of pin-jointed plane frames	R5	2.45	Black Board	2	23
6	Analysis of rigid frames (with redundancy vertical to two)	R5	2.34	Black Board	1	24
7	Solved Problems	R5	2.48	Black Board	1	25
8	Tutorials – frames Analysis	UQ	UQ	Black Board	2	27
9	Tutorials – frames Analysis	UQ	UQ	Black Board	1	28
UNIT III- FINITE ELEMENT METHOD						
1	Discretization of a structure	R5	3.2	Black Board	2	30
2	Displacement functions	R5	3.4	Black Board	1	31
3	Truss element	R5	3.15	Black Board	2	33
4	Solved problems	R5	3.17	Black Board	1	34
5	Beam element	R5	3.22	Black Board	2	36
6	Plane stress and plane strain -	R5	3.29	Black Board	1	37
7	Triangular elements	R5	3.29	Black Board	1	38
8	Solved Problems	R5	3.20	Black Board	1	39
9	Tutorials – 2D Elements problems	UQ	UQ	Black Board	2	41
10	Tutorials – 2D Elements problems	UQ	UQ	Black Board	1	42
UNIT IV- PLASTIC ANALYSIS OF STRUCTURES						
1	Statically indeterminate axial problems, Beams in pure bending, Plastic moment of resistance – Plastic modulus.	T2	377	Black Board	2	44
2	Shape factor.	T2	380	Black Board	2	46
3	Load factor.	T2	383	Black Board	1	47
4	Plastic analysis of indeterminate beams	T2	391	Black Board	1	48
5	Plastic analysis of frames	T2	391	Black Board	1	49
6	Upper and lower bound theorems	T2	391	Black Board	1	50

7	Solved problems	T2	396	Black Board	2	52
8	Solved problems	T2	396	Black Board	1	53
9	Tutorials-University Question problems in plastic analysis	UQ	UQ	Black Board	2	55
10	Tutorials-University Question problems in plastic analysis	UQ	UQ	Black Board	1	56

UNIT V- SPACE AND CABLE STRUCTURES

1	Analysis of Space trusses using method of tension coefficients	T2	210	Black Board	2	58
2	Analysis of Space trusses using method of tension coefficients – numerical problems	T2	210	Black Board	1	59
3	Analysis of Space trusses using method of tension coefficients – numerical problems	T2	210	Black Board	1	60
4	Beams curved in plan Suspension cables	T2	211	Black Board	2	62
5	suspension bridges with two	T2	229	Black Board	1	63
6	suspension bridges three hinged	T2	250	Black Board	1	64
7	suspension bridges stiffening girders	T2	252	Black Board	1	65
8	Solved problems	T2	251	Black Board	2	67
9	Tutorials – Problems in Suspension bridge	UQ	UQ	Black Board	2	69
10	Tutorials – Problems in Suspension bridge	UQ	UQ	Black Board.	1	70

	<i>Prepared by</i>	<i>Approved by</i>
Signature		
Name	Ms.S.NAGAJOTHI	Mr.P.GANESAN
Designation	Assistant Professor / Civil	HOD / CIVIL
Signed date		

LEGEND:

METHODOLOGY TO MAP OBJECTIVE WITH OUTCOME

Course outcomes are achieved through

- a. Suitable Analogies.
- b. Class room teaching.
- c. Assignments.
- d. Tutorials
- e. Weekly, monthly and model exams.
- f. Brain storming.
- g. Group discussion and role play.
- h. Seminars