SARVAJANIK UNIVERSITY
Sarvajanik College of Engineering and Technology
Master of Technology
Structural Engineering

M. Tech. I Semester I

Subject Name: Nonlinear Analysis **Subject Code:** MTST14101

Type of course: PE-I

Prerequisite: Fundamentals of linear analysis

Rationale: Students will able to understand the nonlinear modelling and analysis of structures when subjected to monotonic, cyclic, and dynamic loadings, focusing in particular on the seismic response of structures,and also familiar with solution methods for nonlinear static and dynamic problems

Teaching and Examination Scheme:

TEACHING SCHEME				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	
3	0	2	4	60	25	15	30	20	150

CA1: Continuous Assessment (assignments/projects/open book tests/closed book tests CA2: Sincerity in attending classes/class tests/ timely submissions of assignments/self-learning attitude/solving advanced problems TEE: Term End Examination TEP: Term End Practical Exam (Performance and viva on practical skills learned in course) CA3: Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in course

Content:

Sr. No.	Content	Total Hrs	Module Weightage %
1	**Types of Nonlinearities** - Geometric Nonlinearity, Material Nonlinearity, Nonlinear Governing Equation for Beams: Moment-curvature Nonlinearity, Geometric Nonlinearity Due to Stretching, Material Nonlinearity, Geometrically Nonlinear Beam Problems - Moment-Curvature Nonlinearity-Cantilever Beam, Centrally Loaded beam with two supports, Cantilever Beam subjected to Tip Load	**12**	**29%**

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2	**Nonlinear Analysis of Columns-** Post buckling of cantilever column, Large deflection of column with both ends hinged	**8**	**19%**
3	**Nonlinear Analysis of Trusses and Nonlinear Elastic Analysis of Frames -** Derivation of nonlinear stiffness matrix, Matrix displacement method for nonlinear analysis of structures, Nonlinear analysis of plane frames.	**10**	**24%**
4	**Nonlinear Static Analysis of Plates -** Geometric and Material Nonlinearities, Governing Nonlinear Equations of Plates: Stress Function Approach, Displacement Equations Approach. Nonlinear Static Analysis of Plates - Boundary Conditions and method of solution, Large Deflection of Rectangular Plates.	**12**	**28%**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
25%	20%	25%	15%	10%	10%

Legends: R: Remembrance; **U:** Understanding**; A:** Application**, N:** Analyze and **E:** Evaluate **C:** Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

Sr no	**Title of book /article**	**Author(s)**	**Publisher and details like ISBN**	**Year of publication**	**Publication Edition**
1.	'Nonlinear Analysis of Structures'	M.Sathyamoorthy	CRC Press, New York	1997	1st Edition
2.	'Non Linear Structures'	K.I. Majid,	Butter worth Publishers, London.	1972	1st Edition

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3.	'Elastic Stability of Structural elements'	N G R Iyengar,	Macmillan India Ltd.	2007	1st Edition
4.	Nonlinear Analysis	QamrulHasan	Springer, India, Private Ltd	2014	1st Edition

Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	Tounderstand different structural members with adequate modelling approaches. (Cognitive Level U&N)	20%
CO-2	To understand and applyappropriate constitutive laws, element formulations and solution methods for structures undergoing inelastic deformations. (Cognitive Level U,R&A)	20%
CO-3	Conduct nonlinear static and dynamic analyses of complete structures (Cognitive Level R&A)	15%
CO-4	Apply a nonlinear finite element software for seismic modelling and analysis (Cognitive Level A)	25%
CO-5	Interpret output and estimate achievable simulation accuracy (Cognitive Level N&A)	20%

FOR TUTORIAL SESSION

List of Practicals:

1. Develop computer program for geometric non-linearity
2. Analyze structures considering geometric as well a material non-linearity.
3. Exercise on different structural members with adequate modelling approaches.