

ANNA UNIVERSITY, CHENNAI
NON-AUTONOMOUS COLLEGES AFFILIATED TO ANNA UNIVERSITY
M. E. STRUCTURAL ENGINEERING
REGULATIONS 2021
CHOICE BASED CREDIT SYSTEM
I TO IV SEMESTERS CURRICULA AND I SEMESTER SYLLABUS
SEMESTER I

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	MA4153	Advanced Mathematical Methods	FC	4	0	0	4	4
2.	ST4101	Theory of Elasticity and Plasticity	PCC	3	1	0	4	4
3.	ST4102	Structural Dynamics and Earthquake Engineering	PCC	3	1	0	4	4
4.	RM4151	Research Methodology and IPR	RMC	2	0	0	2	2
5.		Professional Elective I	PEC	3	0	0	3	3
6.		Audit Course I*	AC	2	0	0	2	0
PRACTICALS								
7.	ST4161	Advanced Construction Engineering and Experimental Techniques Laboratory	PCC	0	0	4	4	2
8.	ST4111	Technical Seminar	EEC	0	0	2	2	1
TOTAL				17	2	6	25	20

* Audit Course is optional

SEMESTER II

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	ST4201	Advanced Steel Structures	PCC	3	1	0	4	4
2.	ST4202	Advanced Concrete Structures	PCC	3	1	0	4	4
3.	ST4203	Finite Element Analysis in Structural Engineering	PCC	3	0	0	3	3
4.		Professional Elective II	PEC	3	0	0	3	3
5.		Professional Elective III	PEC	3	0	0	3	3
6.		Audit Course II*	AC	2	0	0	2	0
PRACTICALS								
7.	ST4211	Numerical and Finite Element Analysis Laboratory	PCC	0	0	4	4	2
8.	ST4212	Structural Design Studio	PCC	0	0	4	4	2
TOTAL				17	2	8	27	21

* Audit Course is optional

SEMESTER III

S. NO.	COURSE CODE	COURSE TITLE	CATE- GORY	PERIODS PERWEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.		Professional Elective IV	PEC	3	0	0	3	3
2.		Professional Elective V	PEC	3	0	0	3	3
3.		Open Elective	OEC	3	0	0	3	3
PRACTICALS								
4.	ST4311	Practical Training (4 Weeks)	EEC	0	0	0	0	2
5.	ST4312	Project Work I	EEC	0	0	12	12	6
TOTAL				9	0	12	21	17

SEMESTER IV

S. NO.	COURSE CODE	COURSE TITLE	CATE- GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
PRACTICALS								
1.	ST4411	Project Work II	EEC	0	0	24	24	12
TOTAL				0	0	24	24	12

TOTAL NO. OF CREDITS: 70

FOUNDATION COURSES (FC)

S. NO	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			CREDITS	SEMESTER
			Lecture	Tutorial	Practical		
1.	MA4153	Advanced Mathematical Methods	4	0	0	4	1

PROFESSIONAL CORE COURSES (PCC)

S. NO	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			CREDITS	SEMESTER
			Lecture	Tutorial	Practical		
1.	ST4101	Theory of Elasticity and Plasticity	3	1	0	4	1
2.	ST4102	Structural Dynamics and Earthquake Engineering	3	1	0	4	1
3.	ST4161	Advanced Construction Engineering and Experimental Techniques Laboratory	0	0	4	2	1
4.	ST4201	Advanced Steel Structures	3	1	0	4	2
5.	ST4202	Advanced Concrete Structures	3	1	0	4	2
6.	ST4203	Finite Element Analysis in Structural Engineering	3	0	0	3	2
7.	ST4211	Numerical and Finite Element Analysis Laboratory	0	0	4	2	2
8.	ST4212	Structural Design Studio	0	0	4	2	2
TOTAL CREDITS						25	

LIST OF PROFESSIONAL ELECTIVE COURSES [PEC]**SEMESTER I , ELECTIVE I**

S. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	ST4001	Non-linear Analysis of Structures	PEC	3	0	0	3	3
2.	ST4002	Structural Stability	PEC	3	0	0	3	3
3.	ST4003	Wind and Cyclone Effects on Structures	PEC	3	0	0	3	3
4.	ST4004	Prefabricated Structures	PEC	3	0	0	3	3

SEMESTER II, ELECTIVE II

S. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	CN4071	Advanced Concrete Technology	PEC	3	0	0	3	3
2.	ST4071	Advanced Prestressed Concrete	PEC	3	0	0	3	3
3.	ST4005	Reliability Analysis of Structures	PEC	3	0	0	3	3
4.	ST4006	Design of Formwork	PEC	3	0	0	3	3

SEMESTER II, ELECTIVE III

S. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	ST4073	Maintenance, Repair and Rehabilitation of Structures	PEC	3	0	0	3	3
2.	ST4007	Mechanics of Fiber Reinforced Polymer Composite Materials	PEC	3	0	0	3	3
3.	ST4008	Design of Steel Concrete Composite Structures	PEC	3	0	0	3	3
4.	ST4009	Design of Masonry Structures	PEC	3	0	0	3	3

SEMESTER III, ELECTIVE IV

S. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	ST4010	Design of Industrial Structures	PEC	3	0	0	3	3
2.	ST4011	Advanced Design of Foundation Structures	PEC	3	0	0	3	3
3.	ST4012	Optimization of Structures	PEC	3	0	0	3	3
4.	ST4013	Structural Health Monitoring	PEC	3	0	0	3	3

SEMESTER III, ELCTIVE V

S. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	ST4014	Design of Offshore Structures	PEC	3	0	0	3	3
2.	ST4015	Performance of Structures with Soil Structure Interaction	PEC	3	0	0	3	3
3.	ST4072	Design of Bridge Structures	PEC	3	0	0	3	3
4.	ST4016	Design of Shell and Spatial Structures	PEC	3	0	0	3	3

RESEARCH METHODOLOGY AND IPR COURSES (RMC)

S. NO	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			CREDITS	SEMESTER
			Lecture	Tutorial	Practical		
1.	RM4151	Research Methodology and IPR	2	0	0	2	1
TOTAL CREDITS						2	

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

S. NO	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			CREDITS	SEMESTER
			Lecture	Tutorial	Practical		
1.	ST4111	Technical Seminar	0	0	2	1	1
2.	ST4311	Practical Training (4 Weeks)	0	0	0	2	3
3.	ST4312	Project Work I	0	0	12	6	3
4.	ST4411	Project Work II	0	0	24	12	4
TOTAL CREDITS						21	

AUDIT COURSES (AC)

Registration for any of these courses is optional to students

SL. NO	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			CREDITS	SEMESTER
			Lecture	Tutorial	Practical		
1.	AX4091	English for Research Paper Writing	2	0	0	0	1/2
2.	AX4092	Disaster Management	2	0	0	0	
3.	AX4093	Constitution of India	2	0	0	0	
4.	AX4094	நற்றமிழ் இலக்கியம்	2	0	0	0	

SUMMARY

Sl. No.	Name of the Programme: M.E STRUCTURAL ENGINEERING					
	SUBJECT AREA	CREDITS PER SEMESTER				CREDITS TOTAL
		I	II	III	IV	
1.	FC	04	00	00	00	04
2.	PCC	10	15	00	00	25
3.	PEC	03	06	06	00	15
4.	RMC	02	00	00	00	02
5.	OEC	00	00	03	00	03
6.	EEC	01	00	08	12	21
7.	Non Credit/Audit Course	✓	✓	00	00	
8.	TOTAL CREDIT	20	21	17	12	70

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OBJECTIVES :

- The main objective of this course is to provide the student with a repertoire of mathematical methods that are essential to the solution of advanced problems encountered in the fields of applied physics and engineering. This course covers a broad spectrum of mathematical techniques such as Laplace Transform, Fourier Transform, Calculus of Variations, Conformal Mapping and Tensor Analysis. Application of these topics to the solution of problems in physics and engineering is stressed.

UNIT I LAPLACE TRANSFORM TECHNIQUES FOR PARTIAL DIFFERENTIAL EQUATIONS
12

Laplace transform : Definitions – Properties – Transform error function – Bessel's function - Dirac delta function – Unit step functions – Convolution theorem – Inverse Laplace transform : Complex inversion formula – Solutions to partial differential equations : Heat equation – Wave equation.

UNIT II FOURIER TRANSFORM TECHNIQUES FOR PARTIAL DIFFERENTIAL EQUATIONS
12

Fourier transform : Definitions – Properties – Transform of elementary functions – Dirac delta function – Convolution theorem – Parseval's identity – Solutions to partial differential equations : Heat equation – Wave equation – Laplace and Poisson's equations.

UNIT III CALCULUS OF VARIATIONS
12

Concept of variation and its properties – Euler's equation – Functional dependant on first and higher order derivatives – Functionals dependant on functions of several independent variables – Variational problems with moving boundaries – Isoperimetric problems – Direct methods – Ritz and Kantorovich methods.

UNIT IV CONFORMAL MAPPING AND APPLICATIONS
12

Introduction to conformal mappings and bilinear transformations – Schwarz Christoffel transformation – Transformation of boundaries in parametric form – Physical applications : Fluid flow and heat flow problems.

UNIT V TENSOR ANALYSIS
12

Summation convention – Contravariant and covariant vectors – Contraction of tensors – Inner product – Quotient law – Metric tensor – Christoffel symbols – Covariant differentiation – Gradient - Divergence and curl.

TOTAL : 60 PERIODS**OUTCOMES :**

After completing this course, students should demonstrate competency in the following skills:

- Application of Laplace and Fourier transforms to initial value, initial-boundary value and boundary value problems in Partial Differential Equations.
- Maximizing and minimizing the functional that occur in various branches of Engineering Disciplines.
- Construct conformal mappings between various domains and use of conformal mapping in studying problems in physics and engineering particularly to fluid flow and heat flow problems.
- Understand tensor algebra and its applications in applied sciences and engineering and develops ability to solve mathematical problems involving tensors.
- Competently use tensor analysis as a tool in the field of applied sciences and related fields.

REFERENCES :

1. Andrews L.C. and Shivamoggi, B., "Integral Transforms for Engineers", Prentice Hall of India Pvt. Ltd., New Delhi, 2003.
2. Elsgolc, L.D., "Calculus of Variations", Dover Publications Inc., New York, 2007.
3. Mathews, J. H., and Howell, R.W., "Complex Analysis for Mathematics and Engineering", 6th Edition, Jones and Bartlett Publishers, 2011.
4. Kay, D. C., "Tensor Calculus", Schaum's Outline Series, Tata McGraw Hill Edition, 2014.
5. Naveen Kumar, "An Elementary Course on Variational Problems in Calculus ", Narosa Publishing House, 2005.
6. Saff, E.B and Snider, A.D, "Fundamentals of Complex Analysis with Applications in Engineering, Science and Mathematics", 3rd Edition, Pearson Education, New Delhi, 2014.
7. Sankara Rao, K., "Introduction to Partial Differential Equations", 3rd Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2010.
8. Spiegel, M.R., "Theory and Problems of Complex Variables and its Applications", Schaum's Outline Series, McGraw Hill Book Co., 1981.
9. Ramaniah. G. "Tensor Analysis", S. Viswanathan Pvt. Ltd., 1990.

ST4101

THEORY OF ELASTICITY AND PLASTICITY

L T P C
3 1 0 4

OBJECTIVE:

- To develop the ability to use the principles of theory of elasticity in engineering problems and to introduce theoretical fundamentals of theory of plasticity

UNIT I ELASTICITY

12

Analysis of stress and strain, Equilibrium Equations - Compatibility Equations - Stress Strain Relationship. Generalized Hooke's law-Constitutive Equations

UNIT II 2D STRESS STRAIN PROBLEMS

12

Plane stress and plane strain - Simple two dimensional problems in Cartesian and Polar Coordinates.

UNIT III TORSION OF NON-CIRCULAR SECTION

12

St.Venant's approach - Prandtl's approach – Membrane analogy - Torsion of Thin Walled- Open and Closed sections-Design approach to open web section subjected to torsion - Finite Difference Method

UNIT IV BEAMS ON ELASTIC FOUNDATIONS

12

Beams on Elastic foundation – Methods of analysis – Elastic line method – Idealization of soil medium – Winkler model – Infinite beams – Semi-infinite and finite beams – Rigid and flexible – Uniform Cross Section – Point load and UDL – Solution by Finite Differences.

UNIT V PLASTICITY

12

Physical Assumptions – Yield Criteria – Failure Theories –Thick Cylinder – Plastic Stress Strain Relationship - Bending and Torsion in Elasto-Plastic Materials -Strain hardening Materials

TOTAL :60 PERIODS

OUTCOMES:

On completion of this course, the student is expected to be able to

- CO1** Derive and write the fundamental equations of elasticity describing the linear behavior of element and develop constitutive models based on material behavior
- CO2** Demonstrate the application of plane stress and plane strain in a given situation in both cartesian and polar coordinate systems
- CO3** Solve torsion problems in circular and non-circular cross-sections
- CO4** Analyse beams resting on elastic foundations
- CO5** Solve analytically the simple boundary value problems with elasto-plastic and strain hardening properties

REFERENCES:

1. Ansel.C.Ugural and Saul.K.Fenster, "Advanced Strength and Applied Elasticity," Fourth Edition, Prentice Hall Professional technical Reference, New Jersey, 2003.
2. Chakrabarty.J, "Theory of Plasticity", Third Edition, Elsevier Butterworth - Heinmann – UK, 2007.
3. Jane Helena H, "Theory of Elasticity and Plasticity", PHI, New Delhi 2017.
4. Slater R.A.C, "Engineering Plasticity", John Wiley and Son, New York, 1977.
5. Timoshenko, S. and GoodierJ.N."Theory of Elasticity", Third Edition, McGraw Hill Book Co., New York, 2017.

ST4102**STRUCTURAL DYNAMICS AND EARTHQUAKE ENGINEERING****L T P C**
3 1 0 4

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OBJECTIVE:

- To make the students understand the basics of structural dynamics and earthquake engineering and to develop the ability to design a earthquake resistant structure ,

UNIT I PRINCIPLES OF VIBRATION ANALYSIS**12**

Mathematical models of single degree of freedom systems - Free and forced vibration of SDOF systems, Response of SDOF to special forms of excitation, Effect of damping, Evaluation of damping, Transmissibility, vibration control,Tuned mass damper.

UNIT II DYNAMIC RESPONSE OF MULTI-DEGREE OF FREEDOM SYSTEMS**12**

Mathematical models of two degree of freedom systems and multi degree of freedom systems, free and forced vibrations of two degree and multi degree of freedom systems, normal modes of vibration, applications. orthogonality of normal modes, free and forced vibrations of multi degree of freedom systems, Mode superposition technique, Applications.

UNIT III DYNAMIC RESPONSE OF CONTINUOUS SYSTEMS**12**

Mathematical models of continuous systems, Free and forced vibration of continuous systems, Rayleigh – Ritz method – Formulation using Conservation of Energy – Formulation using Virtual Work, Applications.Damping in MDOF systems, Nonlinear MDOF systems, and step-by-step numerical integration algorithms.

UNIT IV EARTHQUAKE GROUND MOTION AND ITS EFFECTS ON STRUCTURES**12**

Engineering Seismology Seismotectonics and Seismic Zoning of India, Earthquake Monitoring and Seismic Instrumentation, Characteristics of Strong Earthquake Motion, Estimation of Earthquake Parameters, Microzonation. Effect of Earthquake on Different Types of Structures - Lessons Learnt From Past Earthquakes -Evaluation of Earthquake Forces as per codal provisions - Response Spectra, Design Spectra

UNIT V EARTHQUAKE RESISTANT DESIGN OF MASONRY AND RC STRUCTURES 12
 Structural Systems - Types of Buildings - Causes of damage - Planning Considerations – effect of material of construction on performance of structures - Philosophy and Principle of Earthquake Resistant Design - Guidelines for Earthquake Resistant Design - Earthquake Resistant Design of Masonry Buildings and R.C.C. Buildings. Design consideration - Rigid Frames – Shear walls - Lateral load analysis of structures- –Capacity based Design and detailing

TOTAL : 60 PERIODS

OUTCOMES:

On completion of this course, the student is expected to be able to

- CO1** Do vibration analysis of system/structures with single degree of freedom and can explain the method of damping the systems
- CO2** Do dynamic analysis of system/structures with Multi degrees of freedom under free and forced vibration
- CO3** Derive a mathematical model of continuous system and do a dynamic analysis under free and forced vibration
- CO4** Explain the causes and effect of earthquake
- CO5** Design masonry and RC structures to the earthquake forces as per there commendations of IS codes of practice

REFERENCES:

1. Anil K.Chopra, Dynamics of Structures, Fifth edition, Pearson Education, 2017.
2. Leonard Meirovitch, Elements of Vibration Analysis, McGraw Hill, 1986, IOS Press, 2006.
3. Mario Paz, Structural Dynamics -Theory and Computation, Kluwer Academic Publishers, Fifth Edition, 2006.
4. Roy R.Craig, Jr, Andrew J. Kurdila, Fundamentals of Structural Dynamics, John Wiley & Sons, 2011.
5. Brebbia C. A., "Earthquake Resistant Engineering Structures VIII", WIT Press, 2011
6. Mohiuddin Ali Khan "Earthquake Resistant Structures: Design, Build and Retrofit", Elsevier Science & Technology, 2012
7. Pankaj Agarwal and Manish Shrikhande, "Earthquake Resistant Design of Structures", Prentice Hall of India, 2009.
8. Paulay.T and Priestley M.J.N., "Seismic Design of Reinforced Concrete and Masonry Buildings", John Wiley and Sons, 1992.
9. Duggal S K, "Earthquake Resistant Design of Structures", Oxford University Press, 2007.
10. Madhujit Mukhopadhyay , " Structural Dynamics: Vibrations and Systems", Ane's Student Edition, 2008

PROGRESS THROUGH KNOWLEDGE

RM4151

RESEARCH METHODOLOGY AND IPR

L T P C

2 0 0 2

UNIT I RESEARCH DESIGN

6

Overview of research process and design, Use of Secondary and exploratory data to answer the research question, Qualitative research, Observation studies, Experiments and Surveys.

UNIT II DATA COLLECTION AND SOURCES

6

Measurements, Measurement Scales, Questionnaires and Instruments, Sampling and methods. Data - Preparing, Exploring, examining and displaying.

UNIT III DATA ANALYSIS AND REPORTING

6

Overview of Multivariate analysis, Hypotheses testing and Measures of Association. Presenting Insights and findings using written reports and oral presentation.

UNIT IV INTELLECTUAL PROPERTY RIGHTS**6**

Intellectual Property – The concept of IPR, Evolution and development of concept of IPR, IPR development process, Trade secrets, utility Models, IPR & Bio diversity, Role of WIPO and WTO in IPR establishments, Right of Property, Common rules of IPR practices, Types and Features of IPR Agreement, Trademark, Functions of UNESCO in IPR maintenance.

UNIT V PATENTS**6**

Patents – objectives and benefits of patent, Concept, features of patent, Inventive step, Specification, Types of patent application, process E-filing, Examination of patent, Grant of patent, Revocation, Equitable Assignments, Licences, Licensing of related patents, patent agents, Registration of patent agents.

TOTAL :30 PERIODS**REFERENCES**

1. Cooper Donald R, Schindler Pamela S and Sharma JK, "Business Research Methods", Tata McGraw Hill Education, 11e (2012).
2. Catherine J. Holland, "Intellectual property: Patents, Trademarks, Copyrights, Trade Secrets", Entrepreneur Press, 2007.
3. David Hunt, Long Nguyen, Matthew Rodgers, "Patent searching: tools & techniques", Wiley, 2007.
4. The Institute of Company Secretaries of India, Statutory body under an Act of parliament, "Professional Programme Intellectual Property Rights, Law and practice", September 2013.

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ST4161**ADVANCED CONSTRUCTION ENGINEERING AND EXPERIMENTAL
TECHNIQUES LABORATORY****L T P C
0 0 4 2****A) ADVANCED CONSTRUCTION ENGINEERING LABORATORY****OBJECTIVE:**

- To provides a thorough knowledge of material selection through the material testing based on specification

LIST OF EXPERIMENTS

1. Mix design of concrete as per IS, ACI & BS methods for high performance concrete.
2. Flow Characteristics of Self Compacting concrete.
3. Effect of minerals and chemical admixtures in concrete at fresh and hardened state with relevance to workability, strength and durability.
4. NDT on hardened concrete - UPV, Rebound hammer and core test.
5. Permeability test on hardened concrete (RCPT) – Demonstration

TOTAL :30 PERIODS**OUTCOMES:**

On completion of the course the student will be able to

- CO1** Do the mix proportion using IS and ACI codal provisions.
- CO2** Test the concrete in a non-destructive manner using rebound hammer.
- CO3** Know the permeability characteristics of concrete.

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B) EXPERIMENTAL TECHNIQUES LABORATORY

OBJECTIVE:

- To provide a detailed account of modern experimental techniques in construction Engineering research.
- To introduce the basic working principles, the operational know how, and the strength and limitations of the techniques.

LIST OF EXPERIMENTS

1. Determination of elastic constants – Hyperbolic fringes
2. Determination of elastic constants – Elliptical fringes
3. Strain gauge meter – Determination of Young's modulus of a metallic wire
4. Ultrasonic interferometer – ultrasonic velocity in liquids
5. Electrical conductivity of metals and alloys with temperature-four probe method
6. Resistivity measurements
7. NDT – Ultrasonic flaw detector
8. Calibration of Proving Ring and LVDT

TOTAL :30 PERIODS

OUTCOMES:

- On completion of the course, the student is expected to be able to
- CO1** Gain practical knowledge by applying the experimental methods to correlate with the theory.
- CO2** Learn the usage of electrical and optical systems for various measurements.
- CO3** Apply the analytical techniques and graphical analysis to interpret the experimental data

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ST4111

TECHNICAL SEMINAR

L T P C
0 0 2 1

OBJECTIVE:

- To work on a specific technical topic in Structural Engineering in order to acquire the skills of oral presentation and to acquire technical writing abilities for seminars and conferences.

SYLLABUS: The students will work for two hours per week guided by a group of staff members. They will be asked to talk on any topic of their choice related to Structural Engineering and to engage in dialogue with the audience. A brief copy of their talk also should be submitted. Similarly, the students will have to present a seminar of not less than fifteen minutes and not more than thirty minutes on the technical topic. They will also answer the queries on the topic. The students as audience also should interact. Evaluation will be based on the technical presentation and the report and also on the interaction during the seminar.

TOTAL: 30 PERIODS

OUTCOMES:

- On completion of the course, the student is expected to be able to
- CO1** Identify latest developments in the field of Structural Engineering
- CO2** Acquire technical writing abilities for seminars, conferences and journal publications
- CO3** Use modern tools to present the technical details

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OBJECTIVE:

- To study the concept of non-linear behaviour and analysis of elements and simple structures.

UNIT I INTRODUCTION TO NON-LINEAR ANALYSIS 9

Material non-linearity, geometric non-linearity; statically determinate and statically indeterminate bar systems of uniform and variable thickness.

UNIT II INELASTIC ANALYSIS OF FLEXURAL MEMBERS 9

Inelastic analysis of uniform and variable thickness members subjected to geometric and material non-linearity; inelastic analysis of bars of uniform and variable stiffness members with and without axial Restraints

UNIT III VIBRATION THEORY AND ANALYSIS OF FLEXURAL MEMBERS 9

Vibration theory and analysis of flexural members; hysteretic models and analysis of uniform and variable stiffness members under cyclic loading

UNIT IV ELASTIC AND INELASTIC ANALYSIS OF PLATES 9

Elastic and inelastic analysis of uniform and variable thickness plates.

UNIT V NON-LINEAR VIBRATION AND INSTABILITY 9

Nonlinear vibration and Instabilities of elastically supported beams.

TOTAL: 45 PERIODS**OUTCOME:**

- On completion of the course, the student is expected to be able to
 - CO1** Analyze bar system considering material and geometric nonlinearity
 - CO2** Perform inelastic analysis flexural members
 - CO3** Perform vibration analysis of flexural members
 - CO4** Perform elastic and inelastic analysis of Plates
 - CO5** Perform nonlinear and instability analysis of elastically supported beams

REFERENCES:

- Fertis, D.G, Non-linear Mechanics, CRC Press, 1999.
- Reddy.J.N, Non-linear Finite Element Analysis, Oxford University Press, 2008.
- Sathyamoorthy.M, Nonlinear Analysis of Structures, CRC Press, 2010.

OBJECTIVE:

- To study the concept of buckling and analysis of structural elements

UNIT I BUCKLING OF COLUMNS 9

States of equilibrium - concept of equilibrium, energy, imperfection and vibration approaches to stability analysis. Governing equation for column buckling - critical load using Equilibrium, Energy methods - Approximate methods - Rayleigh Ritz, Galerkins approach - Numerical Techniques - Finite difference method.

9

UNIT III TORSIONAL AND LATERAL BUCKLING

9

UNIT IV BUCKLING OF PLATES

9

UNIT V INELASTIC BUCKLING

9

TOTAL: 45 PERIODS

On completion of this course, the student is expected to be able to

- REFERENCES:**

1. Ashwini Kumar, "Stability Theory of Structures", Allied publishers Ltd., New Delhi, 2003.
2. Chajes, A. "Principles of Structures Stability Theory", Prentice Hall, 1974.
3. Gambhir.M.L, "Stability Analysis and Design of Structures", springer, New York, 2013.
4. Simitser.G.J and Hodges D.H, "Fundamentals of Structural Stability", Elsevier Ltd., 2006.
5. Timoshenko.S.P, and Gere.J.M, "Theory of Elastic Stability", McGraw Hill Book Company,1963

ST4003

WIND AND CYCLONE EFFECTS ON STRUCTURES

L T P C
3 0 0 3

- To study the concept of wind and cyclone effects for the analysis and design of structures.

9

UNIT II EFFECT OF WIND ON STRUCTURES

9

Classification of structures – Rigid and Flexible – Effect of wind on structures –Vortex shedding, translational vibration of structures - Static and dynamic effects on Tall buildings – Chimneys

UNIT III DESIGN OF SPECIAL STRUCTURES 9
Design of Structures for wind loading – as per IS, ASCE and NBC code provisions – Design of Industrial Structures– Tall Buildings – Chimneys – Transmission towers and steel monopoles

UNIT IV CYCLONE EFFECTS 9
Cyclone effect on – low rise structures – sloped roof structures - Tall buildings. Effect of cyclone on claddings – design of cladding – use of code provisions in cladding design – Analytical procedure and modeling of cladding.

UNIT V WIND TUNNEL STUDIES 9
Wind Tunnel Studies, Types of wind tunnels, Types of wind tunnel models - Modelling requirements - Aero dynamic and Aero-elastic models, Prediction of acceleration – Load combination factors – Wind tunnel data analysis – Calculation of Period and damping value for wind design

TOTAL: 45 PERIODS

OUTCOME:

- On completion of the course, the student is expected to be able to

- CO1** Explain the characteristics of wind
- CO2** Evaluate the intensity of wind on structures
- CO3** Design some special structures subjected to wind loading
- CO4** Design of structures for cyclone
- CO5** Model and analyse a structure in a wind tunnel

REFERENCES:

- Cook.N.J., "The Designer's Guide to Wind Loading of Building Structures", Butterworths, 1989.
- Kolousek.V, Pirner.M, Fischer.O and Naprstek.J, "Wind Effects on Civil Engineering Structures", Elsevier Publications, 1984
- Lawson T.V., "Wind Effects on Building Vol. I and II", Applied Science Publishers, London,1980.
- Peter Sachs, "Wind Forces in Engineering", Pergamon Press, New York, 1978.



ST4004

PREFABRICATED STRUCTURES

L T P C
3 0 0 3

OBJECTIVE:

- To study the design principles, analysis and design of Prefabricated structures.

UNIT I DESIGN PRINCIPLES 9
General Civil Engineering requirements, specific requirements for planning and layout of prefabrication plant. IS Code specifications. Modular co-ordination, standardization, Disuniting of Prefabricates, production, transportation, erection, stages of loading and code provisions, safety factors, material properties, Deflection control.

UNIT II REINFORCED CONCRETE**9**

Prefabricated structures - Long wall and cross-wall large panel buildings, one way and two way prefabricated slabs, Framed buildings with partial and curtain walls, -Connections – Beam to column and column to column.

UNIT III FLOORS, STAIRS AND ROOFS**9**

Types of floor slabs, analysis and design example of cored and panel types and two-way systems, Design analysis for product manufacture, handling and erection, staircase slab, types of roof slabs and insulation requirements, Description of joints, their behaviour and reinforcement requirements, Deflection control for short term and long term loads, Ultimate strength calculations in shear and flexure.

UNIT IV WALLS**9**

Types of wall panels, Blocks and large panels, Curtain, Partition and load bearing walls, Hoisting and placing, load transfer from floor to wall panels, vertical loads, Eccentricity and stability of wall panels, Design Curves, types of wall joints, their behaviour and design, Leak prevention, joint sealants, sandwich wall panels, Lateral load resistance, Location and types of shear walls, approximate design of shear walls.

UNIT V INDUSTRIAL BUILDINGS AND SHELL ROOFS**9**

Components of single-storey industrial sheds with crane gantry systems, R.C. Roof Trusses, Roof Panels, corbels and columns, wind bracing. Cylindrical, Folded plate and paraboloid shells, Erection and jointing of components in industrial buildings.

TOTAL: 45 PERIODS**OUTCOME:**

- On completion of the course, the student is expected to be able to

- CO1** Explain the design principles involved in prefabrication
- CO2** Detail the different types of connection
- CO3** Design for stripping forces during manufacture
- CO4** Determine the forces in shear walls
- CO5** Identify the different roof trusses used in industrial buildings

REFERENCES:

1. Hubert Bachmann and Alfred Steinle , Precast Concrete Structures, 2012.
2. Koncz.T. Manual of Precast Concrete Construction, Vol.I II and III & IV Bauverlag, GMBH, 1971.
3. Laszlo Mokka, Prefabricated Concrete for Industrial and Public Structures, Akademiai Kiado, Budapest, 2007.
4. Lewicki.B, Building with Large Prefabricates, Elsevier Publishing Company, 1988.
5. Structural Design manual, Precast concrete connection details, Society for studies in the use of Precast concrete, Netherland BetonVerlag, 2009.

AUDIT COURSES

AX4091

ENGLISH FOR RESEARCH PAPER WRITING

L T P C
2 0 0 0

OBJECTIVES

- Teach how to improve writing skills and level of readability
- Tell about what to write in each section
- Summarize the skills needed when writing a Title
- Infer the skills needed when writing the Conclusion
- Ensure the quality of paper at very first-time submission

UNIT I INTRODUCTION TO RESEARCH PAPER WRITING 6

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

UNIT II PRESENTATION SKILLS 6

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts, Introduction

UNIT III TITLE WRITING SKILLS 6

Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check

UNIT IV RESULT WRITING SKILLS 6

Skills are needed when writing the Methods, skills are needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions

UNIT V VERIFICATION SKILLS 6

Useful phrases, checking Plagiarism, how to ensure paper is as good as it could possibly be the first-time submission

TOTAL: 30 PERIODS

OUTCOMES

CO1 – Understand that how to improve your writing skills and level of readability
CO2 – Learn about what to write in each section
CO3 – Understand the skills needed when writing a Title
CO4 – Understand the skills needed when writing the Conclusion
CO5 – Ensure the good quality of paper at very first-time submission

REFERENCES

1. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011
2. Day R How to Write and Publish a Scientific Paper, Cambridge University Press 2006
3. Goldbort R Writing for Science, Yale University Press (available on Google Books) 2006
4. Highman N, Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book 1998.

OBJECTIVES

- Summarize basics of disaster
- Explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- Illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- Describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- Develop the strengths and weaknesses of disaster management approaches

UNIT I INTRODUCTION**6**

Disaster: Definition, Factors and Significance; Difference between Hazard And Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

UNIT II REPERCUSSIONS OF DISASTERS AND HAZARDS**6**

Economic Damage, Loss of Human and Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

UNIT III DISASTER PRONE AREAS IN INDIA**6**

Study of Seismic Zones; Areas Prone To Floods and Droughts, Landslides And Avalanches; Areas Prone To Cyclonic and Coastal Hazards with Special Reference To Tsunami; Post-Disaster Diseases and Epidemics

UNIT IV DISASTER PREPAREDNESS AND MANAGEMENT**6**

Preparedness: Monitoring Of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological And Other Agencies, Media Reports: Governmental and Community Preparedness.

UNIT V RISK ASSESSMENT**6**

Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival

TOTAL : 30 PERIODS**OUTCOMES**

- CO1: Ability to summarize basics of disaster
- CO2: Ability to explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- CO3: Ability to illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- CO4: Ability to describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- CO5: Ability to develop the strengths and weaknesses of disaster management approaches

REFERENCES

1. Goel S. L., Disaster Administration And Management Text And Case Studies", Deep & Deep Publication Pvt. Ltd., New Delhi, 2009.
2. Nishitha Rai, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "NewRoyal book Company, 2007.
3. Sahni, Pardeep Et. Al. , " Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi, 2001.

OBJECTIVES

Students will be able to:

- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional Role and entitlement to civil and economic rights as well as the emergence nation hood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

UNIT I HISTORY OF MAKING OF THE INDIAN CONSTITUTION

History, Drafting Committee, (Composition & Working)

UNIT II PHILOSOPHY OF THE INDIAN CONSTITUTION

Preamble, Salient Features

UNIT III CONTOURS OF CONSTITUTIONAL RIGHTS AND DUTIES

Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

UNIT IV ORGANS OF GOVERNANCE

Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions.

UNIT V LOCAL ADMINISTRATION

District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO, Municipal Corporation. Panchayati raj: Introduction, PRI: Zila Panchayat. Elected officials and their roles, CEO Zila Panchayat: Position and role. Block level: Organizational Hierarchy(Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.

UNIT VI ELECTION COMMISSION

Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners - Institute and Bodies for the welfare of SC/ST/OBC and women.

TOTAL: 30 PERIODS

OUTCOMES

Students will be able to:

- Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
- Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
- Discuss the circumstances surrounding the foundation of the Congress Socialist Party[CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
- Discuss the passage of the Hindu Code Bill of 1956.

SUGGESTED READING

- The Constitution of India, 1950(Bare Act), Government Publication.
- Dr.S.N.Busi, Dr.B. R.Ambedkar framing of Indian Constitution, 1st Edition, 2015.
- M.P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
- D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

UNIT I	சங்க இலக்கியம்	6
	<ol style="list-style-type: none"> 1. தமிழின் துவக்க நூல் தொல்காப்பியம் - எழுத்து, சொல், பொருள் 2. அகநானூறு (82) - இயற்கை இன்னிசை அரங்கம் 3. குறிஞ்சிப் பாட்டின் மலர்க்காட்சி 4. புறநானூறு (95,195) - போரை நிறுத்திய ஔவையார் 	
UNIT II	அறநெறித் தமிழ்	6
	<ol style="list-style-type: none"> 1. அறநெறி வகுத்த திருவள்ளுவர் - அறம் வலியுறுத்தல், அன்புடைமை, ஒப்புறவு அறிதல், ஈகை, புகழ் 2. பிற அறநூல்கள் - இலக்கிய மருந்து - ஏலாதி, சிறுபஞ்சமூலம், திரிகடுகம், ஆசாரக்கோவை (தூய்மையை வலியுறுத்தும் நூல்) 	
UNIT III	இரட்டைக் காப்பியங்கள்	6
	<ol style="list-style-type: none"> 1. கண்ணகியின் புரட்சி - சிலப்பதிகார வழக்குரை காதை சமூகசேவை இலக்கியம் மணிமேகலை - சிறைக்கோட்டம் அறக்கோட்டமாகிய காதை 	
UNIT IV	அருள்நெறித் தமிழ்	6
	<ol style="list-style-type: none"> 1. சிறுபாணாற்றுப்படை - பாரி முல்லைக்குத் தேர் கொடுத்தது, பேகன் மயிலுக்குத் போர்வை கொடுத்தது, அதியமான் ஔவைக்கு நெல்லிக்கனி கொடுத்தது, அரசர் பண்புகள் 2. நற்றிணை - அன்னைக்குரிய புன்னை சிறப்பு 3. திருமந்திரம் (617, 618) - இயமம் நியமம் விதிகள் 4. தர்மச்சாலையை நிறுவிய வள்ளலார் 5. புறநானூறு - சிறுவனே வள்ளலானான் 6. அகநானூறு (4) - வண்டு நற்றிணை (11) - நண்டு கலித்தொகை (11) - யானை, புறா ஐந்திணை 50 (27) - மான் ஆகியவை பற்றிய செய்திகள் 	

1. உரைநடைத் தமிழ்,
 - தமிழின் முதல் புதினம்,
 - தமிழின் முதல் சிறுகதை,
 - கட்டுரை இலக்கியம்,
 - பயண இலக்கியம்,
 - நாடகம்,
2. நாட்டு விடுதலை போராட்டமும் தமிழ் இலக்கியமும்,
3. சமுதாய விடுதலையும் தமிழ் இலக்கியமும்,
4. பெண் விடுதலையும் விளிம்பு நிலையினரின் மேம்பாட்டில் தமிழ் இலக்கியமும்,
5. அறிவியல் தமிழ்,
6. இணையத்தில் தமிழ்,
7. சுற்றுச்சூழல் மேம்பாட்டில் தமிழ் இலக்கியம்.

TOTAL: 30 PERIODS

தமிழ் இலக்கிய வெளியீடுகள் / புத்தகங்கள்

1. தமிழ் இணைய கல்விக்கழகம் (Tamil Virtual University) - www.tamilvu.org
2. தமிழ் விக்கிப்பீடியா (Tamil Wikipedia) - <https://ta.wikipedia.org>
3. தர்மபுர ஆதின வெளியீடு
4. வாழ்வியல் களஞ்சியம் - தமிழ்ப் பல்கலைக்கழகம், தஞ்சாவூர்
5. தமிழ்கலைக் களஞ்சியம் - தமிழ் வளர்ச்சித் துறை (thamilvalarchithurai.com)
6. அறிவியல் களஞ்சியம் - தமிழ்ப் பல்கலைக்கழகம், தஞ்சாவூர்

