GOVERNMENT COLLEGE OF ENGINEERING, SALEM – 636 011
(An Autonomous Institution affiliated to Anna University, Chennai)
CURRICULUM FOR 2018 REGULATIONS
M.E. DEGREE IN STRUCTURAL ENGINEERING – FULL TIME

FIRST SEMESTER

Sl. No.	Subject Code	Course Title	CAT	CA Marks	End Sem. Marks	Total Marks	Credits			
							L	T	P	C
		THEORY								
1	18STC11	Advanced Structural Analysis	PC	40	60	100	3	0	0	3
2	18STC12	Theory of Elasticity and Plasticity	PC	40	60	100	3	0	0	3
		ELECTIVE								
3	18STE1X	Elective –I	PE	40	60	100	3	0	0	3
4	18STE2X	Elective – II	PE	40	60	100	3	0	0	3
		PRACTICAL								
5	18STC13	Structural Design Lab	EEC	40	60	100	0	0	2	2
6	18STC14	Concrete and Experimental Stress Analysis Lab	PC	40	60	100	0	0	2	2
		MANDATORY COURSE								
7	18MLC01	Research Methodology and IPR	MLC	40	60	100	3	0	0	3
		AUDIT COURSE								
8	18ACX	Audit Course 1	AC				2	0	0	0
		TOTAL		280	420	**700**	17	0	4	**19**

SECOND SEMESTER

Sl. No.	Subject Code	Course Title	CAT	CA Marks	End Sem. Marks	Total Marks	Credits			
							L	T	P	C
		THEORY								
1	18STC21	Finite Element Method in Structural Engineering	PC	40	60	100	3	0	0	3
2	18STC22	Structural Dynamics	PC	40	60	100	3	0	0	3
		ELECTIVE								
3	18STE3X	Elective – III	PE	40	60	100	3	0	0	3
4	18STE4X	Elective – IV	PE	40	60	100	3	0	0	3
		PRACTICAL								
5	18ST**C**23	Advanced Concrete Lab	PC	40	60	100	0	0	2	2
6	18ST**C**24	Numerical Analysis Lab	EEC	40	60	100	0	0	2	2
7	18ST**C**25	Mini Project	EEC	40	60	100	0	0	4	2
		AUDIT COURSE								
8	18ACX	Audit Course 2	AC				2	0	0	0
		TOTAL		280	420	**700**	14	0	8	**18**

THIRD SEMESTER

Sl. No.	Subject Code	Course Title	CAT	CA Marks	End Sem. Marks	Total Marks	Credits			
							L	T	P	C
		ELECTIVE								
1	18STE5X	Elective – V	PE	40	60	100	3	0	0	3
2	18STE6X	Elective – VI	PE	40	60	100	3	0	0	3
		DISSERTATION								
3	18STC31	Dissertation Phase – I	EEC	80	120	200	0	0	20	10
		TOTAL		160	240	**400**	6	0	20	**16**

FOURTH SEMESTER

Sl. No.	Subject Code	Course Title	CAT	CA Marks	End Sem. Marks	Total Marks	Credits			
							L	T	P	C
		DISSERTATION								
1	18STC41	Dissertation Phase – II	EEC	160	240	400	0	0	32	16
		TOTAL		160	240	**400**	0	0	32	**16**

Total number of credits to be earned for the award of degree = 69(19+18+16+16)

List of Programme Electives (PE):

Sl. No.	Subject Code	Course Title	CAT	CA Marks	End Sem. Marks	Total Marks	Credits			
							L	T	P	C
Elective 1										
1	18STE11	Theory of Thin Plates and Shells	PE	40	60	100	3	0	0	3
2	18STE12	Theory and Applications of Cement Composites	PE	40	60	100	3	0	0	3
3	18STE13	Theory of Structural Stability	PE	40	60	100	3	0	0	3
4	18STE14	Corrosion and its Prevention	PE	40	60	100	3	0	0	3
Elective II										
5	18STE21	Analytical and Numerical Methods for Structural Engineering	PE	40	60	100	3	0	0	3
6	18STE22	Structural Health Monitoring	PE	40	60	100	3	0	0	3
7	18STE23	Structural Optimization	PE	40	60	100	3	0	0	3
8	18STE24	Experimental Techniques and Instrumentation	PE	40	60	100	3	0	0	3
Elective III										
9	18STE31	Advanced Steel Design	PE	40	60	100	3	0	0	3
10	18STE32	Design of Formwork	PE	40	60	100	3	0	0	3
11	18STE33	Design of High Rise Structures	PE	40	60	100	3	0	0	3
12	18STE34	Design of Masonry Structures	PE	40	60	100	3	0	0	3
13	18STE35	Design of Prefabricated Structures	PE	40	60	100	3	0	0	3
14	18STE36	Design of Steel - Concrete Composite Structures	PE	40	60	100	3	0	0	3
Elective – IV										
15	18STE41	Design of Advanced Concrete Structures	PE	40	60	100	3	0	0	3
16	18STE42	Advanced Design of Foundations	PE	40	60	100	3	0	0	3
17	18STE43	Soil Structure Interaction	PE	40	60	100	3	0	0	3
18	18STE44	Design of Industrial Structures	PE	40	60	100	3	0	0	3
19	18STE45	SubStructure Design	PE	40	60	100	3	0	0	3
20	18STE46	Design and Construction of Ferrocement Structures	PE	40	60	100	3	0	0	3

Elective –V										
21	18STE51	Design of Prestressed Concrete Structures	PE	40	60	100	3	0	0	3
22	18STE52	Analysis of Laminated Composite Plates	PE	40	60	100	3	0	0	3
23	18STE53	Fracture Mechanics of Concrete Structures	PE	40	60	100	3	0	0	3
24	18STE54	Design of Plates and Shells	PE	40	60	100	3	0	0	3
25	18STE55	Design of Bridges	PE	40	60	100	3	0	0	3
26	18STE56	Modern Construction Materials	PE	40	60	100	3	0	0	3
Elective –VI										
27	18STE61	Advanced Concrete Technology	PE	40	60	100	3	0	0	3
28	18STE62	Disaster Resistant Structures	PE	40	60	100	3	0	0	3
29	18STE63	Soil Structure Interaction	PE	40	60	100	3	0	0	3
30	18STE64	Environmental Engineering and Offshore Structures	PE	40	60	100	3	0	0	3
31	18STE65	Wind and Cyclone Effects on Structures	PE	40	60	100	3	0	0	3

Audit Courses (AC):

Sl. No.	Subject Code	Course Title	CAT	CA Marks	End Sem. Marks	Total Marks	Credits			
							L	T	P	C
1	18AC01	English for Research Paper Writing	AC	40	60	100	2	0	0	0
2	18AC02	Disaster Management	AC	40	60	100	2	0	0	0
3	18AC03	Sanskrit for Technical Knowledge	AC	40	60	100	2	0	0	0
4	18AC04	Value Addition	AC	40	60	100	2	0	0	0
5	18AC05	Constitution of India	AC	40	60	100	2	0	0	0
6	18AC06	Pedagogy Studies	AC	40	60	100	2	0	0	0
7	18AC07	Stress Management by Yoga	AC	40	60	100	2	0	0	0
8	18AC08	Personality Development through Life Enlightenment Skills	AC	40	60	100	2	0	0	0

GOVERNMENT COLLEGE OF ENGINEERING, SALEM – 636 011

Curriculum2018 - Autonomous Courses

(For Students Admitted from 2018 – 2019)

M.E.STRUCTURALENGINEERING – Part Time

FIRST SEMESTER

Sl. No.	Subject Code	Course Title	CAT	CA Marks	End Sem. Marks	Total Marks	Credits			
							L	T	P	C
		THEORY								
1	18STC11	Advanced Structural Analysis	PC	40	60	100	3	0	0	3
		ELECTIVE								
2	18STE1X	Elective –I	PE	40	60	100	3	0	0	3
		PRACTICAL								
3	18STC13	Structural Design Lab	EEC	40	60	100	0	0	2	2
		AUDIT COURSE								
4	18ACX	Audit Course 1	AC				2	0	0	0
		TOTAL		120	180	**300**	8	0	2	**8**

SECOND SEMESTER

Sl. No.	Subject Code	Course Title	CAT	CA Marks	End Sem. Marks	Total Marks	Credits			
							L	T	P	C
		THEORY								
1	18STC21	Finite Element Method in Structural Engineering	PC	40	60	100	3	0	0	3
		ELECTIVE								
2	18STE3X	Elective – III	PE	40	60	100	3	0	0	3
		PRACTICAL								
3	18STC23	Advanced Concrete Lab	PC	40	60	100	0	0	2	2
		AUDIT COURSE								
4	18ACX	Audit Course 2	AC				2	0	0	0
		TOTAL		120	180	**300**	8	0	2	**8**

THIRD SEMESTER

Sl. No.	Subject Code	Course Title	CAT	CA Marks	End Sem. Marks	Total Marks	Credits			
							L	T	P	C
		THEORY								
1	18STC22	Structural Dynamics	PC	40	60	100	3	0	0	3
		ELECTIVE								
2	18STE2X	Elective – II	PE	40	60	100	3	0	0	3
		PRACTICAL								
3	18STC14	Concrete and Experimental Stress Analysis Lab	PC	40	60	100	0	0	2	2
		MANDATORY COURSE								
4	18MLC01	Research Methodology and IPR	MLC	40	60	100	3	0	0	3
		TOTAL		160	240	**400**	9	0	2	**11**

FOURTH SEMESTER

Sl. No.	Subject Code	Course Title	CAT	CA Marks	End Sem. Marks	Total Marks	Credits			
							L	T	P	C
		THEORY								
1	18STC12	Theory of Elasticity and Plasticity	PC	40	60	100	3	0	0	3
		ELECTIVE								
2	18STE4X	Elective – IV	PE	40	60	100	3	0	0	3
		PRACTICAL								
3	18STC24	Numerical Analysis Lab	EEC	40	60	100	0	0	2	2
4	18STC25	Mini Project	EEC	40	60	100	3	0	0	2
		TOTAL		120	180	**300**	9	0	2	**10**

FIFTH SEMESTER

Sl. No.	Subject Code	Course Title	CAT	CA Marks	End Sem. Marks	Total Marks	Credits			
							L	T	P	C
		ELECTIVE								
1	18STE5X	Elective – V	PE	40	60	100	3	0	0	3
2	18STE6X	Elective – VI	PE	40	60	100	3	0	0	3
		DISSERTATION								
3	18STC31	Dissertation Phase – I	EEC	80	120	200	0	0	20	10
		TOTAL		160	240	**400**	6	0	20	**16**

SIXTH SEMESTER

Sl. No.	Subject Code	Course Title	CAT	CA Marks	End Sem. Marks	Total Marks	Credits			
							L	T	P	C
		DISSERTATION								
1	18STC41	Dissertation Phase – II	EEC	160	240	400	0	0	32	16
		TOTAL		160	240	**400**	0	0	32	**16**

List of Programme Electives (PE):

Sl. No.	Subject Code	Course Title	CAT	CA Marks	End Sem. Marks	Total Marks	Credits			
							L	T	P	C
Elective 1										
1	18STE11	Theory of Thin Plates and Shells	PE	40	60	100	3	0	0	3
2	18STE12	Theory and Applications of Cement Composites	PE	40	60	100	3	0	0	3
3	18STE13	Theory of Structural Stability	PE	40	60	100	3	0	0	3
4	18STE14	Corrosion and its Prevention	PE	40	60	100	3	0	0	3
Elective II										
5	18STE21	Analytical and Numerical Methods for Structural Engineering	PE	40	60	100	3	0	0	3
6	18STE22	Structural Health Monitoring	PE	40	60	100	3	0	0	3
7	18STE23	Structural Optimization	PE	40	60	100	3	0	0	3
8	18STE24	Experimental Techniques and Instrumentation	PE	40	60	100	3	0	0	3
Elective III										
9	18STE31	Advanced Steel Design	PE	40	60	100	3	0	0	3
10	18STE32	Design of Formwork	PE	40	60	100	3	0	0	3
11	18STE33	Design of High Rise Structures	PE	40	60	100	3	0	0	3
12	18STE34	Design of Masonry Structures	PE	40	60	100	3	0	0	3
13	18STE35	Design of Prefabricated Structures	PE	40	60	100	3	0	0	3
14	18STE36	Design of Steel - Concrete Composite Structures	PE	40	60	100	3	0	0	3
Elective – IV										
15	18STE41	Design of Advanced Concrete Structures	PE	40	60	100	3	0	0	3
16	18STE42	Advanced Design of Foundations	PE	40	60	100	3	0	0	3
17	18STE43	Soil Structure Interaction	PE	40	60	100	3	0	0	3
18	18STE44	Design of Industrial Structures	PE	40	60	100	3	0	0	3
19	18STE45	SubStructure Design	PE	40	60	100	3	0	0	3

20	18STE46	Design and Construction of Ferrocement Structures	PE	40	60	100	3	0	0	3
Elective –V										
21	18STE51	Design of Prestressed Concrete Structures	PE	40	60	100	3	0	0	3
22	18STE52	Analysis of Laminated Composite Plates	PE	40	60	100	3	0	0	3
23	18STE53	Fracture Mechanics of Concrete Structures	PE	40	60	100	3	0	0	3
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25	18STE55	Design of Bridges	PE	40	60	100	3	0	0	3
26	18STE56	Modern Construction Materials	PE	40	60	100	3	0	0	3
Elective –VI										
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31	18STE65	Wind and Cyclone Effects on Structures	PE	40	60	100	3	0	0	3

Audit Courses (AC):

Sl. No.	Subject Code	Course Title	CAT	CA Marks	End Sem. Marks	Total Marks	Credits			
							L	T	P	C
1	18AC01	English for Research Paper Writing	AC	40	60	100	2	0	0	0
2	18AC02	Disaster Management	AC	40	60	100	2	0	0	0
3	18AC03	Sanskrit for Technical Knowledge	AC	40	60	100	2	0	0	0
4	18AC04	Value Addition	AC	40	60	100	2	0	0	0
5	18AC05	Constitution of India	AC	40	60	100	2	0	0	0
6	18AC06	Pedagogy Studies	AC	40	60	100	2	0	0	0
7	18AC07	Stress Management by Yoga	AC	40	60	100	2	0	0	0
8	18AC08	Personality Development through Life Enlightenment Skills	AC	40	60	100	2	0	0	0

SEMESTER I

Core 1

18STC11	ADVANCED STRUCTURAL ANALYSIS	L	T	P	C
		3	0	0	3

Course Objectives:

To impart knowledge to the students with the modern methods like Flexibility method, Stiffness method. At the end of this course he will be in a position to use software packages to solve indeterminate structures.

Unit I	STRUCTURES- FUNDAMENTAL CONCEPTS	9	+	0

Introduction – Force and displacement measurement – Generalized or Independent measurement – Constrained or Dependent measurements- Principle of superposition-Methods of Structural analysis.

Characteristics of structures – stiffness and flexibility

Introduction- Structure with single coordinate- Two coordinates- Flexibility and stiffness matrices in n coordinates- Examples-symmetric nature of matrices- Stiffness and Flexibility matrices in constrained measurements- Stiffness and flexibility of systems and elements-Computing displacements and forces from virtual work- Computing stiffness and flexibility coefficients.

Unit II	THE FLEXIBILITY METHOD	9	+	0

Statically determinate structures-Indeterminate structures-Choice of redundant leading to ill and well conditioned matrices-Transformation to one set of redundant to another- Internal forces due to Thermal expansion and lack of fit-Reducing the size of flexibility matrix- Application to pin-jointed plane truss-Continuous beams-Frames-Grids

Unit III	THE STIFFNESS METHOD	9	+	0

Introduction-Development of stiffness method-Stiffness matrix for structures with zero force at some coordinates-Analogy between flexibility and stiffness- lack of fit-Stiffness matrix with rigid motions-Application of Stiffness approach to pin jointed plane trusses-Continuous beams-Frames-Grids-Space trusses and frames-introduction only-Static condensation technique-choice of method-Stiffness or Flexibility.

Unit IV	BOUNDARY VALUE PROBLEMS (BVP)	9	+	0

Approximate Solution of Boundary Value Problems, Modified Galerkin Method for One-Dimensional BVP, Matrix Formulation of the Modified Galerkin Method.

Unit V	LINEAR ELEMENT	9	+	0

Shape Functions, Solution for Poisson's Equation, General One Dimensional Equilibrium Problem.

Total 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Analyze the skeleton structures using stiffness analysis code
CO2	:	Use direct stiffness method understanding its limitations.
CO3	:	To learn about the determinate and indeterminate structures
CO4	:	To understand the linear and dimensional properties of structures

Text Books:

1.	DevadasMenon, Advanced Structural Analysis, Narosa Publishing House,New Delhi, 2009
2.	Rajasekaran S and Sankarasubramanian G., Computational Structural Mechanics, Prentice-Hall of India Private limited, New Delhi, 2001.

Reference Books:

1.	Matrix Analysis of Framed Structures, Weaver and Gere. 3rd edition (2012)
2.	The Finite Element Method, Lewis P. E. and Ward J. P., Addison-Wesley Publication Co. (October 1, 1991)
3.	Computer Methods in Structural Analysis, Meek J. L., E and FN, Span Publication. 8 Aug 1991
4.	The Finite Element Method, Desai and Able, CBS Publication.(2005)
5.	Matrix computer methods of structural analysis, Rubinstein F.M., Prentice Hall, 1966

Core 2

18STC12	THEORY OF ELASTICITY AND PLASTICITY	L	T	P	C
		3	0	0	3

Course Objectives:

To impart knowledge to the students about the behaviour and stresses in elastic bodies subjected to various loadings and to obtain general solution, torsion of non-circular section and energy methods. Also behaviour of materials in elasto-plastic and plastic stages of loadings will be discussed

Unit I	ANALYSIS OF STRESS AND STRAIN	9	+	0

Elasticity approach – definition and notation of stress - components of stress and strain – Generalized Hooke's law- Principal stresses and strains for three dimensional element - equations of equilibrium and compatibility conditions for 3-D problems in Cartesian coordinates – Transformation of stresses and strains – Boundary conditions.

Unit II	TWO DIMENSIONAL PROBLEMS IN CARTESIAN CO-ORDINATES	9	+	0

Plane stress and plane strain problems with practical examples – Equations of equilibrium and compatibility conditions in Cartesian coordinates – Airy's stress function.

Unit III	TWO DIMENSIONAL PROBLEMS IN POLAR CO-ORDINATES	9	+	0

Equations of equilibrium and compatibility conditions in polar co-ordinates – axisymmetrical problems; thick cylinder under uniform pressure, shrink and force fits, circular arc beams subjected to pure bending – stress concentration due to circular hole in plate – effect of concentrated and uniformly distributed load on straight boundary of semi infinite plates, stresses in circular disc subjected to diametrically opposite concentrated loads.

Unit IV	TORSION	9	+	0

Torsion of various shaped bars, pure torsion of prismatic bars, Prandtl's membrane analogy, torsion of thin walled tubes and hollow shafts, Plastic torsion – elastic-plastic torsion analysis – circular section – sand heap analogy.

Unit V	THEORY OF PLASTICITY	9	+	0

Theory of Plasticity – Stress-strain diagram – Ideal plastic body – illustration of plastic analysis – yield criteria – Rankine's theory – St. Venant's theory – Tresca Criterion – Beltrami's theory – Von mises criterion – Mohr's theory of yielding – yield surface – Flow rule (stress-strain relationship for perfectly plastic flow) – PrandtlReuss equality – Plastic work – stress-strain relation based on Tresca – Plastic potential – uniqueness of a stress distribution – strain hardening.

Total 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Have Knowledge or thorough understanding of stress distribution in engineering structures
CO2	:	To learn the use to his advantage the more rigorous methods of stress analysis
CO3	:	Complex methods to understand stress distribution which is not possible using elementary methods.

Text Books:

1.	Timoshenko S.P and Goodier J.N, *Theory of Elasticity,* McGraw Hill Book Co., New York, 1988
2.	Sadhu Singh, *Theory of Plasticity,*Khanna Publishers, New Delhi. 2005

Reference Books:

1.	Prasantkumar, *Elements of Fracture Mechanics,*A.H.Wheeler&Co,New Delhi 1989
2.	Popov E, *Mechanics of Materials,* Prentice Hall reprinted Pearson education, 2003
3.	Hill R, *Mathematical theory of plasticity*, Oxford Publishers 1967
4.	Chakrabarthy, *Theory of Plasticity,* McGraw Hill Co., 1988
5.	Mendelson, *Plasticity: Theory and Application*, A McMillan and Co., New York 1968

Core Lab1

18STC13	STRUCTURAL DESIGN LAB	L	T	P	C
		0	0	2	2

EXPERIMENTS

Design and detailed drawing of G+3 Structural buildings (Domestic & Commercial) and Industrial structures with steel truss by individual student using latest relevant IS codes.
Analysis and design by using Software.

Course Outcomes:

After the successful completion of the practical session, the students will be able to

CO1	:	Design and Detail of all the Structural Components of Frame Buildings.
CO2	:	Design and Detail of Multi-Storey Frame Buildings.
CO3	:	Design and Detail of RCC/PSC bridges.
CO4	:	Design and Detail of an Industrial building with steel roof truss.

Core Lab 2

18STC14	CONCRETE AND EXPERIMENTAL STRESS ANALYSIS LAB	L	T	P	C
		0	0	2	2

Course Objectives:

To impart practical knowledge to the students about the tests on properties of concrete, design of concrete mix and also about the measuring devices.

EXPERIMENTS

1.	Determination of Modulus of Elasticity of concrete using Compressometer
2.	Mix Design
3.	Experimental stress analysis using photoelastic apparatus
4.	Study of Begg'sDeformator
5.	Study of mechanical strain gauges
6.	Study of optical and electrical strain gauges
7.	Load vs deflection characteristics of simply supported beam using load cell, LVDT and Data acquisition system
8.	Permeability test for concrete
9.	Experimental study on fresh properties of self compacting concrete

Course Outcomes:

After the successful completion of the practical session, the students will be able to

CO1	:	After completing all the experiments prescribed, students will be able to design concrete mixes
CO2	:	Measure the permeability of concrete, crack width etc and perform non-destructive tests
CO3	:	students will be gaining a thorough knowledge about the uses and applications of various strain gauges which will be helpful during their research thesis works

Mandatory Course

18MLC01	RESEARCH METHODOLOGY AND IPR	L	T	P	C
		3	0	0	3

Course Objectives:

To develop the subject of the research, encourage the formation of higher level of trained intellectual ability, critical analysis, rigor and independence of thought, foster individual judgment and skill in the application of research theory and methods and develop skills required in writing research proposals, reports and dissertation.

Unit I	INTRODUCTION TO RESEARCH	9	+	0

Meaning of research problem, sources of research problem, criteria characteristics of a good research problem, errors in selecting the research problem, scope and objectives of research problem, approaches of investigation of solutions for research problem, data collection, analysis, interpretation, necessary instrumentation.

Unit II	EFFECTIVE LITERATURE STUDIES APPROACHES, ANALYSIS	9	+	0

Developing the theoretical frame work of research- developing operational statements of the problem-criteria for evaluating research approach-hypothesis: parametric and non-parametric testing- establishing the reliability and validity of findings with literature review and experiments- documentation, plagiarism, research ethics

Unit III	EFFECTIVE TECHNICAL WRITING, HOW TO WRITE REPORT, PAPER	9	+	0

Developing a research proposal, format of research proposal, a presentation and assessment by a review committee

Unit IV	NATURE OF INTELLECTUAL PROPERTY	9	+	0

Patents, designs, trade and copyright, process of patenting and development: technological research, innovation, patenting, development. International scenario: international cooperation on intellectual property. Procedure grants of patents, patenting under PCT

Unit V	PATENT RIGHTS AND IPR	9	+	0

Scope of patent rights. Licensing and transfer of technology. Patent information and databases. Geographical indications. Administration of patents system. New developments in IPR; IPR of biological system, computer software etc., traditional knowledge case studies , IPR and IITs.

Total 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Understand research problem formulation
CO2	:	Analysis research related information
CO3	:	Follow research ethics.
CO4	:	Understand that today's world controlled by Computer, Information technology, but tomorrow world ruled by ideas, concept and creativity.
CO5		Understand that IPR production provides an incentive to inventors for further research work and investment in R&D, which leads to creation of new and better products, and in turnbrings about, economic growth and social benefits.

Text Books:

1.	Stuart melvile and waynegoddard "Rearch methodology an introduction for science & engineering students"
2.	Wayne Goddard and stuart Melville, "research methododlogy: An introduction"
3.	Ranjitkumar, second edition, "Rearch methodology : A step by step guide for beginners"
4.	Halbert, " Resisting intellectual property", Taylor and Francis Ltd, 2007

Reference Book,

1.	Mayall, "Industrial design" McGraw Hill, 1992
2.	Niebel, " Product design" McGraw Hill, 1974
P	Asimov, "Introduction to Design", Prentice Hall, 1962.
4.	Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age," 2016.
5.	T. Ramappa, "Intellectual Property Rights Under WTO". S. Chand 2008.

SEMESTER II
Core III

18STC21	FINITE ELEMENT METHOD IN STRUCTURAL ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives:

To impart knowledge to the students with the techniques which are best suited for computer operation, assessable to regimented computer procedures. At the end of this course he will be in a position to apply finite element method to complex problem.

Unit I	INTRODUCTION	9	+	0

History and Applications. Spring and Bar Elements, Minimum Potential Energy Principle, Direct Stiffness Method, Nodal Equilibrium equations, Assembly of Global Stiffness Matrix, Element Strain and Stress.

Unit II	BEAM ELEMENTS	9	+	0

Flexure Element, Element Stiffness Matrix, Element Load Vector.
Method of Weighted Residuals: Galerkin Finite Element Method, Application to Structural Elements, Interpolation Functions, Compatibility and Completeness Requirements, Polynomial Forms, Applications.

Unit III	TYPES	9	+	0

Triangular Elements, Rectangular Elements, Three-Dimensional Elements, Isoparametric Formulation, Axi-Symmetric Elements, Numerical Integration, Gaussian Quadrature.

Unit IV	APPLICATION TO SOLID MECHANICS	9	+	0

Plane Stress, CST Element, Plane Strain Rectangular Element, Isoparametric Formulation of the Plane Quadrilateral Element, Axi- Symmetric Stress Analysis, Strain and Stress Computations.

Unit V	COMPUTER IMPLEMENTATION	9	+	0

FEM procedure, Pre-Processing, Solution, Post-Processing, Use of Commercial FEA Software.

Total 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Use Finite Element Method for structural analysis.
CO2	:	Execute the Finite Element Program/ Software
CO3	:	Solve continuum problems using finite element analysis.

Text Books:

1.	Finite Element Analysis, Seshu P., Prentice-Hall of India,2005
2.	Concepts and Applications of Finite Element Analysis, Cook R. D., Wiley J., New York, fourth edition Oct 2001.

Reference Books:

1.	Fundamentals of Finite Element Analysis, Hutton David, Mc-Graw Hill, 2003
2.	Finite Element Analysis, Buchanan G.R., McGraw Hill Publications, New York, 1995.
3.	Integrated Matrix Analysis of Structures: Theory and Computation, Mario Paz, William Leigh, Springer Science & Business Media, 2012
4.	Finite Element Method, Zienkiewicz O.C. & Taylor R.L. Vol. I, II & III, Elsevier, fifth edition 2000.
5.	Finite Element Methods in Engineering, Belegundu A.D., Chandrupatla, T.R., Prentice Hall India, Third edition 2002.

Core IV

18STC22	STRUCTURAL DYNAMICS	L	T	P	C
		3	0	0	3

Course Objectives:

To impart the knowledge to the students about vibrations theory on stable structural systems, the response of a structure to a dynamic load.

Unit I	INTRODUCTION	9	+	0

Objectives, Importance of Vibration Analysis, Nature of Exciting Forces, Mathematical Modeling of Dynamic Systems.

Single Degree of Freedom System : Free and Forced Vibration with and without Damping,Response to Harmonic Loading, Response to General Dynamic Loading using Duhamel's Integral, Fourier Analysis for Periodic Loading, State Space Solution for Response.

Unit II	NUMERICAL SOLUTION	9	+	0

Numerical Solution to Response using Newmark Method and Wilson Method, Numerical Solution for State Space Response using Direct Integration.

Unit III	MULTIPLE DEGREE OF FREEDOM SYSTEM (LUMPED PARAMETER)	9	+	0

Two Degree of Freedom System, Multiple Degree of Freedom System, Inverse Iteration Method for Determination of Natural Frequencies and Mode Shapes, Dynamic Response by Modal Superposition Method, Direct Integration of Equation of Motion.

Unit IV	MULTIPLE DEGREE OF FREEDOM SYSTEM (DISTRIBUTED MASS AND LOAD)	9	+	0

Single Span Beams, Free and Forced Vibration, Generalized Single Degree of Freedom System.

Unit V	SPECIAL TOPICS IN STRUCTURAL DYNAMICS(CONCEPTS ONLY)	9	+	0

Dynamic Effects of Wind Loading, Moving Loads, Vibrations caused by Traffic, Blasting and Pile Driving, Foundations for Industrial Machinery, Base Isolation.

Total 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Analyze and study dynamics response of single degree freedom system using fundamental theory and equation of motion.
CO2	:	Analyze and study dynamics response of Multi degree freedom system using fundamental theory and equation of motion.
CO3	:	Use the available software for dynamic analysis.

Text Books:

1.	Dynamics of Structures, Clough R. W. and Penzien J., McGraw Hill.
2.	Structural Dynamics and Introduction to Earthquake Engineering, Chopra A. K., Pearson, 4 edition (December 16, 2011).

Reference Books:

1.	Vibration of Structures - Application in Civil Engineering Design, Smith J. W., Chapman and Hall.
2.	Dynamics of Structures, Humar J. L., Prentice Hall.
3.	Structural Dynamics - Theory and Computation, Paz Mario, CBS Publication.
4.	Dynamics of Structures, Hart and Wong.

Core Lab 3

18STC23	ADVANCED CONCRETE LAB	L	T	P	C
		0	0	2	2

Course Objectives:

To impart practical knowledge to the students to understand the behavior of concrete structures and about the Non destructive tests, their field applications by applying engineering principles.

EXPERIMENTS

1.	Determination of stress-strain curve of high strength concrete
2.	Determination of Correlation between cube strength, cylinder strength, split tensile strength and modulus of rupture of concrete.
3.	Cyclic loading test
4.	Non-Destructive testing on existing concrete members through i) Rebound hammer and ii) Ultrasonic pulse velocity test iii) Measurement of cracks
5.	Experimental study on the behavior of beam under flexure
6.	Experimental study on the behavior of beam under shear
7.	Corrosion study on reinforced concrete
8.	Rapid chloride penetration test (RCPT) on concrete
9.	Determination of density of hardened concrete using automated buoyancy balance
10.	Accelerated curing of concrete

Course Outcomes:

After the successful completion of the practical session, the students will be able to

CO1	:	After completing all the experiments prescribed, students will be able to design high grade concrete and study the parameters affecting its performance
CO2	:	Students will be able to conduct Non Destructive tests, corrosion test and RCPT on concrete
CO3	:	On completion of this laboratory course students will be able to cast and test RC beams for flexure and shear behavior
CO4	:	They will be able to test cyclic load testing on steel beams

Core Lab 4

18STC24	NUMERICAL ANALYSIS LAB	L	T	P	C
Course Objectives:		**0**	**0**	**2**	**2**

To obtain the numerical solution of non- linear system of equations by using Bisection and Newton's methods and To acquire the knowledge with Curve fitting by Least Square approximations. To find the solution of system of linear equations using Gauss Elimination, Gauss Seidal, Gauss Jordan methods. To familiarize with numerical integration using Trapezoidal and Simpson's rules. To familiarize with numerical solution of ordinary differential equations using Euler's and Runge-Kutta methods.

SYLLABUS CONTENTS	
1	Find the roots of Non- Linear equation using Bisection Method
2	Find the roots of Non- Linear equation using Newton's Method
3	Curve Fitting by Least Square Approximations
4	Solve the System of Linear equation using Gauss Elimination Method
5	Solve the System of Linear equation using Gauss Seidal Iteration Method
6	Solve the System of Linear equation using Gauss Jordan Method
7	Integrate numerically using Trapezoidal rule
8	Integrate numerically using Simpson's rule
9	Numerical Solution of Ordinary Differential equations by Euler's Method
10	Numerical Solution of Ordinary Differential equations by Runge- Kutta Method

Course Outcomes:		
On completion of the course, the students will be able to		
CO1	:	Obtain the numerical solutions of non-linear equations using Bisection and Newton's method
CO2	:	Do curve fitting by least square approximations
CO3	:	Solve the system of linear equations using Gauss -Elimination / Gauss -Seidal iteration / Gauss Jordan Method
CO4	:	Integrate numerically using Trapezoidal and Simpson's rules
CO5	:	Obtain the numerical solution of ordinary differential equations by Euler's and Runge-Kutta methods

Text books	
1	Fausett. L.V., "Applied Numerical Analysis Using MATLAB" , Pearson Education Pvt. Ltd., 2nd edition, 2007

References	
1	Chapra. S.C. and Canale. R.P, Numerical Methods for Engineers, Tata Mcgraw Hill Publications, 5th edition, 2006
2	Structural Dynamics by using MATLab
3	Introduction to MATLab

RELATED VIDEO COURSES	
1	**Computational Techniques:** http://nptel.ac.in/courses/103106074/
2	**Numerical Methods and Programming:** http://nptel.ac.in/courses/122106033

CORE

18STC25	MINI PROJECT	L	T	P	C
		0	0	4	2

Course Outcomes:

1.	Identify structural engineering problems reviewing available literature
2.	Study different techniques used to analyze complex structural systems
3.	work on the solutions given and present solution by using his/her technique applying engineering principles

Syllabus Contents

Mini Project will have mid semester presentation and end semester presentation. Mid semester presentation will include identification of the problem based on the literature review on the topic referring to latest literature available.

End semester presentation should be done along with the report on identification of topic for the work and the methodology adopted involving scientific research, collection and analysis of data, determining solutions highlighting individuals' contribution.Continuous assessment of Mini Project at Mid Sem and End Sem will be monitored by the departmental committee.

SEMESTER III

CORE

18STC41	DISSERTATION I	L	T	P	C
		0	0	20	10

Course Outcomes:

1.	Identify structural engineering problems reviewing available literature.
2.	Identify appropriate techniques to analyze complex structural systems.
3.	Apply engineering and management principles through efficient handling of project

Syllabus Contents

Dissertation-I will have mid semester presentation and end semester presentation. Mid semester presentation will include identification of the problem based on the literature review on the topic referring to latest literature available.

End semester presentation should be done along with the report on identification of topic for the work and the methodology adopted involving scientific research, collection and analysis of data, determining solutions and must bring out individuals contribution.

Continuous assessment of Dissertation – I and Dissertation – II at Mid Semester and End Semester will be monitored by the departmental committee.

SEMESTER IV
CORE

18STC41	DISSERTATION II	L	T	P	C
		0	0	32	16

Course Outcomes:

1.	Solve complex structural problems by applying appropriate techniques and tools
2.	Exhibit good communication skill to the engineering community and society
3.	Demonstrate professional ethics and work culture

Syllabus Contents

Dissertation – II will be extension of the to work on the topic identified in Dissertation –I. Continuous assessment should be done of the work done by adopting the methodology decided involving numerical analysis/ conduct experiments, collection and analysis of data, etc. There will be pre submission seminar at the end of academic term. After the approval the student has to submit the detail report and external examiner is called for the viva-voce to assess along with guide.

Program Elective I

18STE11	THEORY OF THIN PLATES AND SHELL	L	T	P	C
		3	0	0	3

Course Objectives:

To impart knowledge to the students about theory of plates, special and approximate methods of analysis of plates.

Unit I	INTRODUCTION	9	+	0

Space Curves, Surfaces, Shell Co-ordinates, Strain Displacement Relations, Assumptions in Shell Theory, Displacement Field Approximations, Stress Resultants, Equation of Equilibrium using Principle of Virtual Work, Boundary Conditions.

Unit II	STATIC ANALYSIS OF PLATES	9	+	0

Governing Equation for a Rectangular Plate, Navier Solution for Simply- Supported Rectangular Plate under Various Loadings, Levy solution for Rectangular Plate with other Boundary Conditions.

Unit III	CIRCULAR PLATES	9	+	0

Analysis under Axi- Symmetric Loading, Governing Differential Equation in Polar Co-ordinates. Approximate Methods of Analysis- Rayleigh-Ritz approach for Simple Cases in RectangularPlates.

Unit IV	STATIC ANALYSIS OF SHELLS	9	+	0

Membrane Theory of Shells - Cylindrical, Conical and Spherical Shells.

Unit V	SHELLS OF REVOLUTION	9	+	0

Shells of Revolution: with Bending Resistance - Cylindrical and Conical Shells, Application to Pipes and Pressure Vessels. Thermal Stresses in Plate and Shell.

Total 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	At the end of the course, students will be able to Use analytical methods for the solution of thin plates and shells.
CO2	:	Use analytical methods for the solution of shells.
CO3	:	Apply the numerical techniques and tools for the complex problems in thin plates.
CO4	:	Apply the numerical techniques and tools for the complex problems in shells.

Text Books:

1.	Theory of Plates and Shells, Timoshenko S. and KriegerW., McGraw Hill.2nd edition 1987.
2.	Stresses in Plates and Shells, UguralAnsel C., McGraw Hill. illustrated edition 1981

Reference Books:

1.	Thin Elastic Shells, Kraus H., John Wiley and Sons.1st edition1967.
2	Theory of Plates, ChandrashekharaK., Universities Press. 2001,Illustrated edition
3	Design and Construction of Concrete Shells, Ramaswamy G.S., R.E.Krieger 1984, 2nd edition

Program Elective I

18STE12	THEORY AND APPLICATIONS OF CEMENT COMPOSITES	L	T	P	C
		3	0	0	3

Course Objectives:

To impart knowledge on the material properties of ferrocement, analysis, design and construction of ferrocement structures.

Unit I	INTRODUCTION	9	+	0

Classification and Characteristics of Composite Materials- Basic Terminology ,Advantages. Stress-Strain Relations- Orthotropic and Anisotropic Materials, Engineering Constants for Orthotropic Materials, Restrictions on Elastic Constants, Plane Stress Problem, Biaxial Strength, Theories for an Orthotropic Lamina.

Unit II	MECHANICAL BEHAVIOUR	9	+	0

Mechanics of Materials Approach to Stiffness- Determination of Relations between Elastic Constants, Elasticity Approach to Stiffness- Bounding Techniques of Elasticity, Exact Solutions - Elasticity Solutions with Continuity, Halpin, Tsai Equations, Comparison of approaches to Stiffness.

Unit III	CEMENT COMPOSITES	9	+	0

Types of Cement Composites, Terminology, Constituent Materials and their Properties, Construction Techniques for Fibre Reinforced Concrete - Ferrocement, SIFCON, Polymer Concretes, Preparation of Reinforcement, Casting and Curing.

Unit IV	MECHANICAL PROPERTIES OF CEMENT COMPOSITES	9	+	0

Behavior of Ferrocement, Fiber Reinforced Concrete in Tension, Compression, Flexure, Shear, Fatigue and Impact, Durability and Corrosion.

Application Of Cement Composites: FRC and Ferrocement- Housing, Water Storage, Boats and Miscellaneous Structures. Composite Materials- Orthotropic and Anisotropic behaviour, Constitutive relationship, Elastic Constants.

Unit V	ANALYSIS AND DESIGN OF CEMENT COMPOSITE STRUCTURAL ELEMENTS	9	+	0

Ferrocement, SIFCON and Fibre Reinforced Concrete.

Total 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Formulate constitutive behaviour of composite materials – Ferrocement, SIFCON and Fibre Reinforced Concrete - by understanding their strain- stress behaviour
CO2	:	Classify the materials as per orthotropic and anisotropic behavior.
CO3	:	Estimate strain constants using theories applicable to composite materials.
CO4	:	Analyse and design structural elements made of cement composites.

Reference Books:

1.	Mechanics of Composite Materials, Jones R. M,, 2nd Ed., Taylor and Francis, BSP Books, 1998.
2	Ferrocement – Theory and Applications, Pama R. P., IFIC, 1980
3	New Concrete Materials, Swamy R.N., 1stEd., Blackie, Academic and Professional, Chapman & Hall, 1983.

Program Elective I

18STE13	THEORY OF STRUCTURAL STABILITY	L	T	P	C
		3	0	0	3

Course Objectives:

To impart knowledge to the students on the behaviour of structural elements under compression, the stability of columns and plates, lateral buckling of beam and column design formula.

Unit I	STABILITY OF COLUMNS	9	+	0

Concepts of Elastic Structural stability- Analytical approaches to stability - characteristics of stability analysis- Elastic Buckling of columns- Equilibrium; Energy and Imperfection approaches – Non-prismatic columns- Built up columns- Buckling modes- Effect of shear on buckling load - Large deflection theory.

Unit II	METHODS OF ANALYSIS AND IN ELASTIC BUCKLING	9	+	0

Approximate methods – Rayleigh and Galerkin methods – numerical methods – Finite difference and finite Element - analysis of columns – Experimental study of column behaviour – South well plot - Column curves - Derivation of Column design formula - Effective length of Columns - Inelastic behaviour- Tangent modulus and Double modulus theory.

Unit III	BEAM COLUMNS AND FRAMES	9	+	0

Beam column behaviour- standard cases- Continuous columns and beam columns – Columns on elastic foundation – Buckling of frames – Single storey portal frames with and without side sway – Classical and stiffness methods – Use of Wood's charts.

Unit IV	BUCKLING OF BEAMS	9	+	0

Lateral buckling of beams – Energy method- Application to Symmetric and single symmetric I beams – simply supported and Cantilever beams - Narrow rectangular cross sections- – Numerical solutions – Torsional buckling – Uniform and non-uniform Torsion on open cross section - Flexural torsional buckling – Equilibrium and energy approach.

Unit V	BUCKLING OF THIN PLATES	9	+	0

Isotropic rectangular plates - Governing Differential equations - Simply Supported on all edges – Use of Energy methods –Numerical Techniques.

Total 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Will have knowledge about the concepts of structural stability and analytical approaches
CO2	:	Will have an understanding of the methods of analysis and inelastic behaviour of columns, lateral and torsional buckling of beams and buckling of thin plates.
CO3	:	Will also be able to perform advanced experiments on beam columns and frames.
CO4	:	Publish papers in conferences and journals.

Text Books:

1.	Chajes A, *Principles of Structural Stability Theory,* Prentice Hall, Inc., New Jersey 1974
2.	Ashwinikumar, *Stability of Structures,* Allied Publishers Ltd, 1998

Reference Books:

1.	Iyengar N.G.R, *Structural Stability of Columns and Plates,* Affiliated East- West Press Pvt. Ltd., 1986
2.	Stephen P. Timoshenko and Gere, *Theory of Elastic Stability,* McGraw-Hill Company 1981
3.	Allen H.G and Bulson P.S., *Background to Buckling,* McGraw-Hill Book Company, 1980
4.	Smitses, *Elastic Stability of Structures,* Prentice Hall, 1973
5.	Brush and Almorth, *Buckling of Bars, Plates and Shells,* McGraw-Hill Book Company, 1975

Program Elective I

18STE14	CORROSION AND ITS PREVENTION	L	T	P	C
		3	0	0	3

Course Objectives:

To study the environmental effects on structures, corrosion, tests and prevention of corrosion.

Unit I	INTRODUCTION	9	+	0

Corrosion of steel reinforcement in concrete, definition of corrosion, forms of corrosion, phenomenon of corrosion, corrosion initiation-environment-cover thickness-quality of cover concrete-type of steel and critical chloride-presence of cracks, corrosion propagation-electrochemical process-physical process, theory of reinforcement corrosion-basic corrosion cell-anode and cathode-electrolyte-corrosion potential and rate of corrosion.

Unit II	IDENTIFICATION AND APPRAISAL OF CORROSION	9	+	0

Corrosion process and mechanism-approach to investigation-visual observation and documentation, insitu testing of concrete-rebound hammer test, cover meter survey-ultrasonic pulse velocity(UPV) test-core sampling and testing, insitu testing of steel rebar-carbonation test and pH value, chloride content-half cell potential survey-resistivity mapping-measurement of corrosion rate.

Unit III	MONITORING OF CORROSION	9	+	0

Methods used for monitoring corrosion-open circuit potential measurement, resistivity measurement, corrosion cell ratio, electrical resistance probe method, polarization resistance technique, impedance technique, guard ring technique, electrochemical noise analysis.

Unit IV	PROTECTIVE MEASURES	9	+	0

Coating to reinforcement- metallic coatings-epoxy coatings-cement based coatings-coating to prestressing steel,galvanized reinforcement, stainless steel, non-ferrous reinforcement and coating to concrete surface, improving the concrete, corrosion resistant steel.

Unit V	INHIBITORS FOR CONCRETE	9	+	0

Definition of inhibitor-anodic and cathodic inhibitors-rice husk ash, fly ash, electrochemical removal of chloride from concrete, non-metallic materials, carbon FRP, glass FRP, parafil tendons.

Total 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	To know about phenomenon of corrosion, its propagation and the methods to monitor corrosion.
CO2	:	To measure the rate of corrosion using Ultrasonic Pulse Velocity technique.
CO3	:	To understand different protective measures like coatings to concrete structures.

Reference Books:

1.	Fontanna, G,Mars,"Corrosion Engineering",ThirdEdition,McGraw-Hill Book Company.
2	Kumar Mehta,P.,"Concrete-Structure,Properties and Materials", Prentice-Hall, INC, Englewood Cliffs, New Jersey 07632.

Program Elective II

18STE21	ANALYTICAL AND NUMERICAL METHODS FOR STRUCTURAL ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives:

To familiarize the numerical solution of linear system of equations and acquire the knowledge with interpolation and curve fitting by least squares.to impart the knowledge in solving initial value problems for ordinary differential equations. To obtain the finite difference solution of one dimensional wave equation and two dimensional Laplace and Poisson equations

Unit I	SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS	9	+	0

Method of false position , Iterative method , Newton Raphson method-Solutions of linear system of equations by Gauss Elimination, Gauss Jordan, Gauss Jacobi and Gauss Seidal methods-Eigen value of a matrix by Power method.

Unit II	INTERPOLATION AND APPROXIMATION	9	+	0

Interpolation with Newton's divided difference, Lagrangian polynomial, Newton Forward and Backward differences- Least Square polynomial approximations (Curve fitting)

Unit III	NUMERICAL DIFFERENTIATION AND INTEGRATION	9	+	0

Numerical differentiation with interpolation polynomials, Numerical integration by Trapezoidal rule-Simpson's 1/3 rule, Simpson's 3/8 rule –Double integrals using by Trapezoidal rule and Simpson's rule

Unit IV	INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS	9	+	0

Single step methods: Taylor series method-Euler and modified Euler method-Fourth order Runge-Kutta method for first and second order differential equations- Multistep method: Milne and Adam's-Bashforth predictor and corrector methods

Unit V	BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFRENTIAL EQUATIONS	9	+	0

Finite difference solution of second order ordinary differential equations-Finite difference solutions of one dimensional heat equation by explicit and implicit methods-One dimensional wave equation and two dimensional Laplace and Poisson equations.

Total 45 Periods

Course Outcomes:

On completion of the course, the students will be able to

CO1	:	Obtain the numerical solutions of linear and non-linear equations
CO2	:	Acquire the techniques of interpolation and approximations
CO3	:	Familiarize with the numerical differentiation and integration.
CO4	:	Solve the initial value problems for ordinary differential equations
CO5	:	Good knowledge about different concreting methods

Text Books:

1. Veerarajan. T and Ramachandran, "Numerical methods with Programs in C and C^{++} ",Tata McGraw Hill, New Delhi,2006
2. Kandasamy.P, Thilagavathy.K, Gunavathi.K, "Numerical Methods" S.Chand& Co., New Delhi, 2005

Reference Books:

1. Gerald, C. F. and Wheatley, P.O.," Applied Numerical Analysis" , Sixth Edition , Pearson Education Asia , New Delhi – 2002
2. M.K.Venkataraman, "Numerical Methods", National Publishing Company,2000
3. Jain M.K.Iyengar, K & Jain R.K., "Numerical Methods for Scientific and Engineering Computation ", New Age International (P) Ltd, Publishers 2003
4. Manish Goyal, "Numerical Methods and Statistical techniques Using 'C' ", 1st Edition, Laxmi Publications (P) Ltd, 2009

Program Elective II

18STE22	STRUCTURAL HEALTH MONITORING	L	T	P	C
		3	0	0	3

Course Objectives:

To diagnose the distress in the structure understanding the causes and factors and Assess the health of structure using static field methods. To Assess the health of structure using dynamic field tests and Suggest repairs and rehabilitation measures of the structure

Unit I	STRUCTURAL HEALTH	9	+	0

Philosophy for design to resist earthquake, cyclone and flood – National and international codes of practice – Bye law of urban and semi-urban area – Traditional and modern structures

Unit II	STRUCTURAL HEALTH MONITORING	9	+	0

Concepts, Various Measures, Structural Safety in Alteration

Unit III	STRUCTURAL AUDIT	9	+	0

Assessment of Health of Structure, Collapse and Investigation, Investigation Management, SHM Procedures, Issue of Stability certificate

Unit IV	FIELD TESTING	9	+	0

Static Field Testing: Types of Static Tests, Simulation and Loading Methods, sensor systems and hardware requirements, Static Response Measurement, Issue of stability certificate.
Dynamic Field Testing: Types of Dynamic Field Test, Stress History Data, Dynamic Response Methods, Hardware for Remote Data Acquisition Systems, Remote Structural Health Monitoring.

Unit V	INTRODUCTION TO REPAIRS AND REHABILITATIONS OF STRUCTURES	9	+	0

Case Studies (Site Visits), piezo–electric materials and other smart materials, electro–mechanical impedance (EMI) technique, adaptations of EMI technique.

Total 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Able to demonstrate the condition of structures
CO2	:	Will able to inspect and evaluate the damaged structures
CO3	:	Will able to implement the repairing techniques of a structure
CO4	:	Will demonstrate the dismantling and demolishing structures

Text Books:

1.	Structural Health Monitoring, Daniel Balageas, Claus Peter Fritzen, Alfredo Güemes, John Wiley and Sons, 2006.
2.	Health Monitoring of Structural Materials and Components Methods with Applications, Douglas E Adams, John Wiley and Sons, 2007

Reference Books:

1.	Structural Health Monitoring and Intelligent Infrastructure, Vol1, J. P. Ou, H. Li and Z. D. Duan, Taylor and Francis Group, London, UK, 2006
2	Structural Health Monitoring with Wafer Active Sensors, Victor Giurglutiu, Academic Press Inc, 2nd Edition 2014
3	Handbook on Repair and Rehabilitation of RCC Buildings, Central Public Works Department, Government of India.

Program Elective II

18STE23	STRUCTURAL OPTIMIZATION	L	T	P	C
		3	0	0	3

Course Objectives:

To impart knowledge to the students on structural optimization techniques, computer search methods and optimization theorems

Unit I	BASIC PRINCIPLES, CLASSICAL OPTIMIZATION TECHNIQUES	9	+	0

Definition – Objective function, Constraints – Equality and inequality – Linear and non-linear, Side, Non-negativity, Behaviour and other constraints – Design space – Feasible and infeasible – Convex and Concave – Active constraint – Local and global optima. Differential calculus – Optimality criteria – Single variable optimization – Multivariable optimization with no constraints – Lagrange Multiplier Method with equality constraints – Khun-Tucker Criteria with inequality constraints.

Unit II	LINEAR PROGRAMMING	9	+	0

Formulation of problems – Graphical solution – Analytical methods – Standard form – Slack, Surplus and Artificial variables – Canonical form – Basic feasible solution – Simplex Method – Two phase method – Penalty method – Duality theory – Primal-Dual algorithm

Unit III	NON-LINEAR PROGRAMMING	9	+	0

One dimensional minimization methods: Unidimensional – Unimodal function – Exhaustive and Unrestricted search – Dichotomous search – Fibonacci Method – Golden Section Method – Interpolation methods. Unconstrained optimization techniques.
Multivariables: Unconstrained multivariable functions – Univariate method – Cauchy's steepest descent method – Conjugate gradient method (Fletcher Reeves) – Variable metric method (Davidon Fletcher Powell).

Unit IV	GEOMETRIC & DYNAMIC PROGRAMMING	9	+	0

Posynomial – degree of difficulty – reducing GPP to a set of simultaneous equations – Unconstrained and constrained problems with zero degree of difficulty – Concept of solving problems with one degree of difficulty. Bellman's principle of optimality – Representation of a multistage decision problem – Concept of sub-optimization problems using classical and tabular methods.

Unit V	STRUCTURAL APPLICATIONS	9	+	0

Methods for optimal design of structural elements, continuous beams and single storeyed frames using plastic theory – Minimum weight design for truss members – Fully stressed design

Total 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Use Variational principle for optimization, apply optimization techniques in structural members
CO2	:	Designs using frequent constrain

Text Books:

1.	Rao S.S, Optimization Theory and Applications, Wiley Eastern Limited, New Delhi, 1984
2.	Uri Krish, Optimum Structural Design, McGraw-Hill Book Co. 1981

Reference Books:

1.	Gupta P.K. &Hira D.S, Operations Research and Quantitative Analysis, S.Chand& Company Ltd., New Delhi 1993
2.	Spunt, Optimization in Structural Design, Prentice-Hall, New Jersey 1971
3.	Majid, Optimum Design of Structures, Neuness- Butt Stark and Nicholls, Mathematical Foundations for Design, McGraw Hill Book Co, -1972.

Program Elective II

18STE24	EXPERIMENTAL TECHNIQUES AND INSTRUMENTATION	L	T	P	C
		3	0	0	3

Course Objectives:

To impart knowledge about the measurement of force, strain, vibration, wind flow, distress and nondestructive testing techniques

Unit I	FORCE AND STRIN MEASUREMENTS	9	+	0

Strain gauges, Principle, Types, Performance and Uses-Photo elasticity, Principle and applications – Hydraulic jack and pressure gauges – Electronic load cell – Proving rings – Calibration of testing machines

Unit II	VIBRATION MEASUREMENTS	9	+	0

Characteristics of structural vibrations – Linear Variable Differential Transducer (LVDT) – Transducers for velocity and acceleration measurements – Vibration meter – Seismographs – Vibration analyzer – Electro dynamic exciters – Display and recording of signals – Cathode Ray Oscilloscope – XY plotters – Chart plotters – Digital and Acquisition systems - Principles and Applications.

Unit III	ACOUSTICS AND WIND FLOW MEASUREMENTS	9	+	0

Principles of pressure and flow measurements – Pressure transducer – Sound level meter – Venturimeter and Flow meters – Wind tunnel and its use in structural analysis – structural modeling - Direct and indirect model analysis

Unit IV	DISTRESS MEASUREMENTS	9	+	0

Diagnosis of distress in structures- Crack observation and measurement – Corrosion of reinforcement in concrete – Half cell , construction and use – damage assessment – Controlled blasting for demolition

Unit V	NON DESTRUCTIVE TESTING METHODS	9	+	0

Load testing of structures, buildings, bridges and towers – Rebound hammer – Ultra sonic testing, principle and applications – Moiré fringes – brittle coatings – Holography – Use of lasers for structural testing

Total 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Familiarize with various types of measuring devices and their working principles
CO2	:	Able to select a measuring device for a specific experimental work
CO3	:	Able to conduct experiments, observe and interpretation of data.

Text Books:

1. *Sadhu Singh, "Experimental Stress Analysis",* Khanna Publishers, New Delhi, 1996.

Reference Books:

1. *Dalley.J.W.andRiley.W.F., "Experimental Stress Analysis",* Tata McGraw Hill Book Co.
2. *Srinath L.S., et al, Experimental Stress Analysis,* Tata McGraw Hill Co., New Delhi, 1984.
3. *Sironi R.S and Radha Krishna H.C.,Mechanical Measurements,* New Age International (P) Ltd.

Program Elective III

18STE31	ADVANCED STEEL DESIGN	L	T	P	C
		3	0	0	3

Course Objectives:

To understand the property of structural steel and gain knowledge of design of steel structures. To understand about connections and the knowledge about design of beam columns and study about the light gauge steel structures

Unit I	INTRODUCTION	9	+	0

Properties of Structural Steel: Mechanical Properties, Hysteresis, Ductility.
Hot Rolled Sections: Compactness and non compactness, slenderness, residual stresses.
Design of Steel Structures: Inelastic bending curvature, plastic moments, design criteria stability, strength, drift.
Methods of Designs: Allowable stress design, Plastic Design, Load and Resistance factor design

Unit II	ECCENTRIC AND MOMENT CONNECTIONS	9	+	0

Introduction – Beam-Column Connections- Connections Subjected to Eccentric Shear – Moment Resistant Connections – Bolted & Welded - Framed Connections- Seated Connections –Bracket Connections.

Unit III	DESIGN OF BEAM COLUMNS	9	+	0

Introduction – General behavior of beam-columns – codal provision for local capacity check and overall buckling check – Design of beam-columns.

Unit IV	PRE-ENGINEERED BUILDINGS	9	+	0

Introduction – connection details – design of typical portal frame from Industrial shed using IS: 800-2007.

Unit V	LIGHT GAUGE STEEL STRUCTURES	9	+	0

Types of cross sections - local buckling and lateral buckling - concepts of elastic width – design of compression and tension members, beams, deflection of beams and design of beam webs.

Total 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	They acquire knowledge to analysis and design of eccentric connections.
CO2	:	To acquire the knowledge of stability behavior of beam and column sections
CO3	:	To learn the behavior of light gauge steel sections.

Text Books:

1. *Duggal S.K., Limit State Design of Steel Structures,TataMcGraw Hill Education Private Ltd.,New Delhi , 2010*
2. *Subramanian N, Design of Steel Structures, Oxford University Press, 2008*
3. *Ramchandra S and VirendraGehlot, Limit State Design of Steel Structures, Standard Publication, New Delhi, 2009*
4. *M.R. Sheyekar "Limit state design in Structural Steel", 1st Edition, PHI Publications, 2010.*

Reference Books:

1. *Gaylord E.H, Gaylord N.C. and Stallmeyer, J.E, Design of Steel Structures, 3rd edition, McGraw-Hill Publications, 1992.*
2. *IS:875(part-III)-1987, Code of for design loads(other than earthquake for building and structures)*
3. *Teaching Resources for Structural Steel Design – Vol.I& II, INSDAG, Kolkatta.*
4. *IS: 811-1987, Cold Formed Light Gauge Structural Steel Sections*
5. *IS: 800-2007, Code of practice for general construction in steel*
6. *SP: 6(5) ISI Hand book for Structural Engineers – Cold-Formed Light gauge steel structures*
7. *IS: 801-1967, Code of practice for use of cold-formed light gauge steel structural members in general building construction*

Program Elective III

18STE32	DESIGN OF FORMWORK	L	T	P	C
		3	0	0	3

Course Objectives:

To gain knowledge of formwork and its materials and the various methods of design of formwork.
To study the design of special formwork structures and gain knowledge of flying formwork and understand about the failure of formwork.

Unit I	INTRODUCTION	9	+	0

Requirements and Selection of Formwork.

Formwork Materials- Timber, Plywood, Steel, Aluminium, Plastic, and Accessories. Horizontal and Vertical Formwork Supports.

Unit II	FORMWORK DESIGN	9	+	0

Concepts, Formwork Systems and Design for Foundations, Walls, Columns, Slab and Beams

Unit III	FORMWORK DESIGN FOR SPECIAL STRUCTURES	9	+	0

Shells, Domes, Folded Plates, OverheadWater Tanks, Natural Draft Cooling Tower, Bridges.

Unit IV	FLYING FORMWORK	9	+	0

Table Form, Tunnel Form, Slip Form, Formwork for Precast Concrete, Formwork Management Issues –Pre- and Post-Award.

Unit V	FORMWORK FAILURES	9	+	0

Causes and Case studies in Formwork Failure, Formwork Issues in Multi-Story Building Construction.

Total 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Select proper formwork, accessories and material.
CO2	:	Design the form work for Beams, Slabs, columns, Walls and Foundations.
CO3	:	Design the form work for Special Structures.
CO4	:	Understand the working of flying formwork.
CO5	:	Judge the formwork failures through case studies.

Reference Books:

1. *Formwork for Concrete Structures, Peurify, McGraw Hill India, 2015.*
2. *Formwork for Concrete Structures, Kumar NeerajJha, Tata McGraw Hill Education, 2012.*
3. *IS 14687: 1999, False work for Concrete Structures - Guidelines, BIS*

Program Elective III

18STE33	DESIGN OF HIGH RISE STRUCTURES	L	T	P	C
		3	0	0	3

Course Objectives:

The student is expected to understand the design of high rise structures and incorporate this in the design of structures to achieve both safety and economy.

Unit I	INTRODUCTION	9	+	0

Design Philosophy - History - advantages and disadvantages - Vertical city concepts - essential amenities - fire safety - water supply - drainage and garbage disposal - service systems - structural and foundation systems. Factors affecting height, growth and form - Human comfort criteria.

Unit II	DESIGN OF TRANSMISSION / TV TOWER	9	+	0

Mast and trestles: Configuration, bracing system, analysis and design for vertical transverse and longitudinal loads.

Unit III	ANALYSIS AND DESIGN OF RC CHIMNEY	9	+	0

RC Chimney-analysis and design, Foundation design for varied soil strata.

Unit IV	ANALYSIS OF TALL BUILDINGS	9	+	0

Structural Concept, Configurations, various systems, Wind and Seismic loads, Dynamic approach

Unit V	DESIGN OF TALL BUILDINGS	9	+	0

Structural design considerations and IS code provisions. Firefighting design provisions. Research needs in tall building materials, systems and designs.

Total 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Analyze, design and detail Transmission/ TV tower, Mast and Trestles with different loading conditions
CO2	:	Analyze, design and detail the RC Chimney.
CO3	:	Analyze. design and detail the tall buildings subjected to different loading conditions using relevant codes.

Reference Books:

1.	*Structural Design of Multi-storeyed Buildings, Varyani U. H., 2nd Ed., SouthAsian Publishers, New Delhi, 2002.*
2.	*Structural Analysis and Design of Tall Buildings, Taranath B. S., McGraw Hill, 1988.*
3.	*Illustrated Design of Reinforced Concrete Buildings(GF+3storeyed), Shah V. L. &Karve S. R., Structures Publications, Pune, 2013.*
4.	*Design of Multi Storeyed Buildings, Vol. 1 & 2, CPWD Publications, 1976.*
5.	*Tall Building Structures, Smith Byran S. and Coull Alex, Wiley India. 1991.*
6.	*High Rise Building Structures, Wolfgang Schueller, Wiley., 1971.*

Program Elective III

18STE34	DESIGN OF MASONRY STRUCTURES	L	T	P	C
		3	0	0	3

Course Objectives:

To impart knowledge to the students about masonry materials and to gain knowledge in determining the flexural and shear strength of the structure. This also guides to know its behavior and to study its modeling techniques.

Unit I	INTRODUCTION	9	+	0

Introduction Historical Perspective, Masonry Materials, Masonry Design Approaches, Overview of Load Conditions, Compression Behaviour of Masonry, Masonry Wall Configurations, Distribution of Lateral Forces.

Unit II	FLEXURAL STRENGTH	9	+	0

Flexural strength of Reinforced Masonry Members: In plane and Out-of-plane Loading.

Unit III	INTERACTIONS	9	+	0

Structural Wall, Columns and Pilasters, Retaining Wall, Pier and Foundation.

Unit IV	SHEAR STRENGTH	9	+	0

Shear Strength and Ductility of Reinforced Masonry Members.
Prestressed Masonry **-** Stability of Walls, Coupling of Masonry Walls, Openings, Columns, Beams.

Unit V	ELASTIC AND INELASTIC ANALYSIS	9	+	0

Modeling Techniques, Static Push Over Analysis and use of Capacity Design Spectra.

Total 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Understand the masonry design approaches.
CO2	:	Analyze Reinforced Masonry Members.
CO3	:	Determine interactions between members.
CO4	:	Check the stability of walls
CO5	:	Perform elastic and Inelastic analysis of masonry walls.

Reference Books:

1.	*Design of Reinforced Masonry Structures, NarendraTaly, ICC, 2nd Edn,*
2.	*Masonry Structures: Behavior and Design, Hamid Ahmad A. and Drysdale Robert G., Pearson College Div; 2nd edition (May 1, 1993).*
3.	*Mechanics of Masonry Structures, Editor: Maurizio Angelillo, Springer; 2014 edition (March 21, 2014).India, 1986.*
4.	*Earthquake-resistant Design of Masonry Buildings, TomaeviMiha, Imperial College Press, 1999.*

Program Elective III

18STE35	DESIGN OF PREFABRICATED STRUCTURES	L	T	P	C
		3	0	0	3

Course Objectives:

To impart knowledge to the students about structural design of prefabricated structures, industrial buildings and shell roof structures.

Unit I	INTRODUCTION AND DESIGN PRINCIPLES	9	+	0

General civil engineering requirements, specific requirements for planning and layout of prefabricating plant - IS Codal specifications - Modular co- ordinations, standardizations, Disuniting of Prefabricates, productions, transportations, erection, stages of loading and codal provisions, safety factor, material properties, deflection control, lateral load resistance.

Unit II	REINFORCED CONCRETE PREFARICATED STRUCTURAL ELEMENTS	9	+	0

Prefabricated Structures – long wall, cross- wall, large panel buildings, one way and two way prefabricated slabs, framed buildings with partials and curtain walls, single storey industrial buildings with trusses, shells, crane- gantry systems.

Unit III	FLOORS, STAIRS, ROOFS AND WALLS	9	+	0

Types of floor slabs, analysis and design example of cored and panel types and two- way systems, staircase slabs design, types of roof slabs and insulation requirements, description of joints, their behavior and reinforcement requirements, deflection control for short term and long term loads, ultimate strength calculations in shear and flexure. Types of wall panels, blocks and large panels, shear walls, curtain, partition and bearing walls, load transfer from floor to wall panels, vertical loads, eccentricity and stability of wall panels.

Unit IV	DESIGN OF INDUSTRIAL BUILDINGS	9	+	0

Components of single- storey industrial sheds with crane gantry systems, design of R.C Roof trusses, roof panels, design of R.C. crane gantry girders, corbels and columns, wind bracing design.

Unit V	DESIGN OF SHELL ROOFS FOR INDUSTRIAL SHEDS	9	+	0

Cylindrical, folded plate and hyper- prefabricated shells, erection and jointing, joint design, hand book based design.

Total 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Able to gain knowledge about the requirements for planning and layout of prefabricating plant
CO2	:	Will be familiar with the IS codal provisions, for prefabrication of structural elements
CO3	:	Will be able to design large panel walls, one way and two way prefabricated slabs, curtain walls, single storey industrial buildings with trusses, and gantry systems

Text Books:

1. *Lewicki B, Building with large Prefabricates,* Elsevier Publishing Company, Amsterdam/ London/ New York, 1966.
2. *Koncz T, Manual of Precast Concrete Constructions, Vol. I, II and III,* Bauverlag, GMBH, 1971.

Reference Books:

1. *Structural Design Manual, Precast Concrete Connections & Details,* Society for the Studies in the use of Precast Concrete, NeatherlandBetorVerlag, 1978.
2. *LassloMokk, Prefabricated Concrete for Industrial and Public Sectors,* AkademiaiKiado, Budapest, 1964.
3. *Murashev V, Sigalov E and Bailov V, Design of Reinforced Concrete Structures,* Mir Publishers, 1968.
4. *CBRI, Building Materials and Components,* 1990, India
5. *Gerostiza C.Z, Hendrikson C, Rehat D.R, Knowledge Based Process Planning for Construction and Manufacturing,* Academic Press, Inc., 1989.
6. *Warzawski A, Industrializations and Robotics in Building – AManagerial Approach,* Harper & Row, 1990.

Program Elective III

18STE36	DESIGN OF STEEL CONCRETE COMPOSITE STRUTURES	L	T	P	C
		3	0	0	3

Course Objectives:

To impart knowledge to the students about design of composite members, behavior of box girders and its design concepts. The case studies were investigated to know the seismic behavior of the structures.

Unit I	INTRODUCTION	9	+	0

Introduction to steel-concrete composite construction – Theory of composite structures – Introduction to steel-concrete-steel sandwich construction

Unit II	DESIGN OF COMPOSITE MEMBERS	9	+	0

Behaviour of composite beams, columns – Design of composite beams, steel-concrete composite columns – Design of composite trusses

Unit III	DESIGN OF CONNCTIONS IN COMPOSITE MEMBERS	9	+	0

Introduction – Types of connections – Design of connections in composite structures – Shear connection, Design of connections in composite trusses.

Unit IV	DESIGN OF COMPOSITE BRIDGES	9	+	0

Introduction to Composite Box Girder Bridges – Behaviour of box girder bridges – design concepts

Unit V	CASE STUDIES	9	+	0

General case studies on steel-concrete composite construction in buildings – Seismic behaviour of composite structures.

Total 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Have a thorough understanding of the behavior of steel concrete composite structure components – slabs, beams, columns and trusses.
CO2	:	Design the meeting out the desired specifications and requirements.
CO3	:	Have the ability to solve Structural engineering problems.
CO4	:	Have the knowledge to conduct advanced experiments on steel concrete composite structural components.

Text Books:

1. *Johnson R.P., Composite structures of steel and concrete,* Blackwell Scientific Publications, 2nd edition, U.K., 1994.
2. *Owens G.W and Knowels P., Steel Designers manual,5th edition,* Steel Concrete Institute (UK), Oxford Blackwell Scientific Publications, 1992.

Reference Books:

1. *Arya, A.S., Design of Steel Structures,* New Chand & Brothers, New Delhi 1982.
2. *Workshop on Steel concrete composite structures* conducted at Anna University 2000.
3. Necessary *Indian &Eurocodes*
4. *INSDAG teaching resources for structural steel design, Vol.2,* INSDAG, IspanNiketan, Calcutta.

Program Elective IV

18STE41	DESIGN OF ADVANCED CONCRETE STRUCTURES	L	T	P	C
		3	0	0	3

Course Objectives:

To impart knowledge to the students with regard to the design of special R.C. members. Also learn about Elastic behaviour of structural members and expose them to the concepts of ductile detailing of R.C. members as per I.S. codes.

Unit I	DESIGN OF BEAMS CURVED IN PLAN AND DEEP BEAMS	9	+	0

Design for limit state of collapse – Design for limit state of serviceability – Calculation of deflection and crack width – design of beams for combined effect of shear, bending moment and torsion – Analysis and design of beams curved in plan and spandrel beams- design of deep beams.

Unit II	DESIGN OF SPECIAL R.C. ELEMENTS	9	+	0

Design of slender columns – Design of RC walls – shear walls –Classification and design principles – Design of rectangular and flanged shear walls – design of corbels.

Unit III	DESIGN OF FLAT SLAB AND GRID FLOORS	9	+	0

Yield line theory of slabs – Hillerberg's method of design of slab – Design of flat slab - Equivalent frame method of design – approximate analysis – and design of grid floors.

Unit IV	INELASTIC BEHAVIOUR OF R.C. BEAMS	9	+	0

Inelastic behaviour of concrete beams – moment rotation curves – Moment redistribution – Baker's method of analysis and design – Design of cast in situ joints in frame.

Unit V	DETAILING REQUIREMENTS	9	+	0

Design and detailing of structural members using seismic design – Reinforcement detailing of structural members as per SP:34& IS:5525 – Earthquake resistant Design – Detailing requirements for Ductility as per IS:13920 – Fire resistance of buildings.

Total 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Analyse the special structures by understanding their behaviour
CO2	:	Design and prepare detail structural drawings for execution citing relevant to IS Codes.

Text Books:

1.	Varghese P.C., Advanced Reinforced Concrete Design, Prentice Hall of India, 2002
2.	KirshnaRaju N., Advanced Reinforced Concrete Design, CBS Publishers and Distribuors , 1986

Reference Books:

1.	Purushothaman P., Reinforced Concrete Structural Elements. Behaviour Analysis and Design, Tata Mcgraw Hill,1986
2.	Park R. and Pauly T., Reinforced Concrete Structures, John Wiley & Sons,1987.

Program Elective IV

18STE42	ADVANCED DESIGN OF FOUNDATIONS	L	T	P	C
		3	0	0	3

Course Objectives:

To understand the basic philosophy of planning of Soil Exploration for Different Projects and gain knowledge about the Settlement of Footings and Rafts. To estimate Load Transfer of Piles, Settlement of Pile Foundations and Pile Groups. To understand the provision of IS and IRC Design Code and gain knowledge of Sheeting and Bracing Systems.

Unit I	SOIL EXPLORATION	9	+	0

Planning of Soil Exploration for Different Projects, Methods of Subsurface Exploration, Methods of Borings along with Various Penetration Tests.

Unit II	SHALLOW FOUNDATIONS	9	+	0

Requirements for Satisfactory Performance of Foundations, Methods of Estimating Bearing Capacity, Settlements of Footings and Rafts, Proportioning of Foundations using Field Test Data, Pressure - Settlement Characteristics from Constitutive Laws.

Unit III	PILE FOUNDATIONS	9	+	0

Methods of Estimating Load Transfer of Piles, Settlements of Pile Foundations, Pile Group Capacity and Settlement, Design of pile group & pile cap, Laterally Loaded Piles, Pile Load Tests, Analytical Estimation of Load-Settlement Behavior of Piles, Proportioning of Pile Foundations, Lateral and Uplift Capacity of Piles.

Unit IV	WELL FOUNDATION	9	+	0

IS and IRC Design Code Provisions, Elastic Theory and Ultimate Resistance Methods.
Tunnels and Arching in Soils, Pressure Computations around Tunnels.

Unit V	OPEN CUTS	9	+	0

Sheeting and Bracing Systems in Shallow and Deep Open Cuts in Different Soil Types.
Coffer Dams, Various Types, Analysis and Design, Foundations under uplifting loads, Soil-structure interaction

Total 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Decide the suitability of soil strata for different projects.
CO2	:	Design shallow foundations deciding the bearing capacity of soil.
CO3	:	Analyze and design the pile foundation
CO4	:	Understand analysis methods for well foundation.

Text Books:

1.	Design of foundation system, N.P. Kurian, Narosa Publishing House
2.	Foundation Analysis and Design, J. E. Bowles, Tata McGraw Hill New York

Reference Books:

1.	Design of foundation system, N.P. Kurian, Narosa Publishing House
2.	Foundation Analysis and Design, J. E. Bowles, Tata McGraw Hill New York

Program Elective IV

18STE43	SOIL STRUCTURE INTERACTION	L	T	P	C
		3	0	0	3

Course Objectives:

The student is expected to understand the importance and significance of soil structure interaction and incorporate this in the design of structures to achieve both safety and economy.

Unit I	SOIL-FOUNDATION INTERACTION	9	+	0

Introduction to Soil-foundation interaction problems – Soil behaviour, Foundation behaviour, Interface behaviour, Scope of soil foundation interaction analysis, Soil response models, Winkler, Elastic continuum, Two parameter elastic models, Elastic plastic behaviour and Time dependent behaviour.

Unit II	BEAM ON ELASTIC FOUNDATION- SOIL MODELS	9	+	0

Infinite beam, two parameters, Isotropic elastic half-space, Analysis of beams of finite length, Classification of finite beams in relation to their stiffness.

Unit III	PLATE ON ELASTIC MEDIUM	9	+	0

Infinite plate, Winkler, Two parameters, Isotropic elastic medium, Thin and thick plates, Analysis of finite plates, Rectangular and Circular plates, Numerical analysis of finite plates, Simple solutions.

Unit IV	PLATE ON ELASTIC MEDIUM	9	+	0

Elastic analysis of single pile, Theoretical solutions for settlement and load distributions, Analysis of pile group, Interaction analysis, Load distribution in groups with rigid cap.

Unit V	PLATE ON ELASTIC MEDIUM	9	+	0

Load deflection prediction for laterally loaded piles, Sub grade reaction and elastic analysis, Interaction analysis, Pile raft system, Solutions through influence charts.

Total 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	The students will be able to understand various applications to soil structure interaction.
CO2	:	The students will able to calculate contact pressure and settlement under foundation
CO3	:	The student will able to calculate earth pressure on different retaining structures

Text Books:

1. *Selvadurai, A.P.S., Elastic Analysis of Soil Foundation Interaction,* Elsevier, 1979.
2. *Poulos, H.G., and Davis, E.H., Pile Foundation Analysis and Design,* John Wiley, 1980.

Reference Books:

1. *Scott R.F., Foundation Analysis,* Prentice Hall, 1981.
2. *Structure-Soil Interaction - State of Art Report",* Institution of Structural Engineers, 1978.
3. *ACI 336, Suggested Analysis and Design Procedures for combined footings and Mats,* American Concrete Institute, Delhi, 1988.

Program Elective IV

18STE44	DESIGN OF INDUSTRIAL STRUCTURES	L	T	P	C
		3	0	0	3

Course Objectives:

To impart knowledge to the students about industrial design of built-up girders, portal frames, steel bunkers and silos, steel chimneys and water tanks.

Unit I	BUILT-UP GIRDERS	9	+	0

Introduction, loads acting on gantry girder, permissible stress, types of gantry girders and crane rails, crane data, maximum moments and shears, construction details, design procedure.- Plate girder – elements of plate girder – flexural strength – shear strength of web – stiffeners – Connection – design procedure.

Unit II	PORTAL FRAMES	9	+	0

Design of portal frame with hinged base, design of portal frame with fixed base – Gable structures – light weight structures.

Unit III	STEEL BUNKERS AND SILOS	9	+	0

Design of square bunker – Jansen's and Airy's theories – IS code provisions – Design of side plates – stiffeners – Hooper – Longitudinal beams – Design of cylindrical silo – side plates – ring girder - stiffeners.

Unit IV	STEEL CHIMNEYS	9	+	0

Introduction – Types - dimensions of steel stacks, chimney lining, breech openings and access girder, loading and load combinations, design considerations, stability considerations, design of base plate, design of foundations bolts, design of foundation.

Unit V	WATER TANKS	9	+	0

Design of rectangular steel water tank – Tee covers – plates- stays – longitudinal and transverse beams – design of staging – base plates –foundation and anchor bolts – Design of pressed steel water tanks – Design of stays – Joints –side plates – bottom plates – joints – design of staging and foundation.

Total 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Acquire knowledge about functions requirements
CO2	:	Design of component of industrial structure both concrete and steel.

Text Books:

1.	Procs. of advanced course on Industrial Structures, Structural Engineering Research Centre, 1982.
2.	Design of steel structures, Bunmia P.c.., Jain Ashok Kr., Jain Arun Kr., 2nd edition, Lakshmi publishers, 2005.
3.	Design of steel structures, Rama Chandra, 12th Ed., Standard Publishers, 2009

Reference Books:

1.	Manohar S.N, Tall Chimneys – Design and Construction, Tata McGrawHill,1985.
2.	*Subramanian N, Design of Steel Structures, Oxford University Press, 2008*
3.	Rajagopalan Dr. K, Storage Structures, Oxford IBH Publishing Company Ltd 1989.
4.	IS: 875(part-III)-1987, Code of for design loads (other than earthquake for building and structures)
5.	IS: 4995(part-I)-1974, Criteria for design of Reinforced concrete bins for the storage of granular and powdery materials.
6.	Hand book on functional requirements of Industrial buildings, SP-32-1986, Bureau of Indian Standards, New Delhi, 1990.
7.	IS: 800-1984, Code of practice for general construction in steel.
8.	SP(6) Steel tables ; IS: 804-1967,Specifications for rectangular pressed steel tanks

Program Elective IV

18STE45	SUBSTRUCTURE DESIGN	L	T	P	C
		3	0	0	3

Course Objectives:

To impart knowledge about the design of shallow foundation, deep foundation, foundation for bridges, machine foundation and tower foundation.

Unit I	INTRODUCTION	9	+	0

Design of soil investigation report for design of foundation structure-Types-Selection of foundation-Basic requirement of Foundation-Computation of loads-General principle of design of reinforced concrete shallow and deep foundation.

Unit II	DESIGN OF SHALLOW FOUNDATION	9	+	0

Shallow foundation-bearing capacity of footings-floating raft-Capacity of footing-Beams on Elastic foundation-Design of raft and buoyancy-Rail and basement design.

Unit III	DESIGN OF DEEP FOUNDATION	9	+	0

Deep foundation-Load carrying capacity of different types of piles and detailing of reinforcement according to IS 2911-Design of pile caps-Uplift capacity of piles-Lateral pile load test.

Unit IV	FOUNDATION FOR BRIDGES AND MACHINES	9	+	0

Foundation for bridges – Well and caisson foundation – Design of pier cap –Design of pier-General principles, planning and design of machine foundation.

Unit V	TOWER FOUNDATIONS	9	+	0

Introduction- Design of foundation for towers – forces on tower foundation – General design criteria – Structural design of supports for foundation excavation – Design of ground anchors.

Total 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	Able to adopt a suitable foundation based on the soil condition and the type of structure.
CO2	Familiarize with principles, planning and design of various types of foundation as per IS codal specifications and requirements.
CO3	Able to design and present the detailing of reinforcement for foundations.

Text Books:

1.	Tomlinson M.J and Boorman R, Foundation design and construction, ELBS longman VI Edition, 1995.
2.	Swamisaran, Analysis and design of substructures, Limit state design, Oxford and IBH Publishing Co. Pvt. Lt, NewDelhi, 1996.

Reference Books:

1.	Nayak N.V, Foundation design manual for practicing engineers, DhanpatRai& sons,1982.

Program Elective IV

18STE46	DESIGN AND CONSTRUCTION OF FERROCEMENT STRUCTURES	L	T	P	C
		3	0	0	3

Course Objectives:

To impart knowledge on the material properties of ferrocement, analysis, design and construction of ferrocement structures.

Unit I	FERROCEMENT AS A STRUCTURAL MATERIAL	9	+	0

Ferrocement – definition, constituent materials of ferrocement, Distinct characteristics of ferrocement versus reinforced concrete, similarities between ferrocement and reinforced concrete, Mechanical properties, advantages of ferrocement as a construction material, ferrocement for structural applications, Construction methods, design parameters.

Unit II	ANALYSIS METHODS	9	+	0

Effective area of reinforcement, Typical moment curvature response, Analysis methods for bending under service loads – Flexure formula for uncracked section, Transformed area method for the cracked section, Analysis methods for nominal bending resistance – compatibility method, simplified method based on all tensile reinforcement yielding, simplified method using plastic moment, simplified method using design chart or prediction equation, Computation of deflection.

Unit III	DESIGN METHODS THROUGH CRACK WIDTH AND DUCTILITY	9	+	0

Design based on crack width- Relationship between crack width -its spacing and stress in steelwire.. Equation establishing relationships between crack width, spacing of cracks, modular ratio, modulus of elasticity and tensile stress of mortar. Crack control method of design- applied to pipes, silos, water tanks and waterproofing systems. Design of ductility -Strain energy absorbed per unit volume of ferrocement. Its use in design of structures subjected to dynamic loading-earthquake, wind, machine foundations.

Unit IV	DESIGN THROUGH SHAPE AND COMPOSITE CONSTRUCTION	9	+	0

Shaping ferrocement to gain strength, stress pattern changed due to shaping, Different shapes and stress Patterns like flexure to compression, different ways of giving forms, boxing, corrugating, folding, ribbing, stiffening, arching, waffling. Giving shapes
in three dimensions. Analysis of various forms for stress pattern under loading- cavity walls, hollow floors, hollow columns and beams, stiffened plates in compression and flexure, built in sections like H, U, T, +, L. Shells of translation and rotation, domes, pyramids, folded plates.
Design of composite structures of ferrocement with RCC, steel and masonry. Precast ferrocement elements with in-built RCC framework. Joints of precast members as structural members their design and construction, Confining and strengthening damaged structures, retrofitting.

Unit V	FERROCEMENT CONSTRUCTIONS	9	+	0

Applications in building construction: Parabolic foundations, under-reamed piles, Panelled cavity walls and box-sectioned hollow floors, hollow beams. Stiffened plates as slabs. Design and construction of multi-storied buildings and mass scale housing using in-situ mortaring method and method of joining precast walling and floor panels. Water and soil retaining structures: Applications in water treatment and effluent treatment plants and in Irrigation, Highways and Bridges.

Total 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

1.	On completion of the course the student will be able to understand the concepts of ferrocement technology.
2.	The student will be in a position to analyse and design ferrocement structures.
3.	The student will gain the knowledge of the method of construction of the structures.

Text Books:

1.	Ferrocement, Authors: B R Paul and R P Pama, Published by International Ferrocement Information Centre. A.I.T.Bangkok, Thailand.

2.	Ferrocement and laminated cementitious composites, Author: A E Naaman, Publisher: Techno-press, Ann Arbor, Michigan, U S A.
Reference Books:	
1.	State-of-the-art report and guide for Design, Construction and Repairs of Ferrocement; ACI committee Report. No ACI-549R- 88 and ACI 549.1R.88, Published by American Concrete Institute, Detroit, USA.
2.	Ferrocement, Authors: B R Paul and R P Pama, Published by International Ferrocement Information Centre. A.I.T.Bangkok, Thailand.
3.	Chapter 1 titled ‘Ferrocement’ by S P Shah and P N Balaguru, in book ‘Concrete Technology and Design Vol II Editor; R N Swamy.

Program Elective V

18STE51	DESIGN OF PRESTRESSED CONCRETE STRUCTURES	L	T	P	C
		3	0	0	3

Course Objectives:

This course covers the principles analysis and design of prestressed concrete elements and other structures. In addition to the BIS codal provisions, ACI and British code, FIB specifications shall also be compared.

Unit I	PRINCIPLES AND ANALYSIS FOR FLEXURE	9	+	0

Principles of Prestressing – Types of prestressing systems – Materials – Systems and devices – Analysis and design for flexure- Behaviour of prestressed concrete elements – General concept of prestress – Force transmitted by pretensioned and post tensioned systems - losses in prestress – analysis for Ultimate strength – Comparison of codal provisions - at service load and Magnel's approach.

Unit II	DESIGN FOR FLEXURE	9	+	0

Concept of Limit State design – Limit state of Collapse and serviceability – Design using allowable stresses – Stress range approach - Lin's approach – Magnel's approach.

Unit III	DESIGN FOR SHEAR, TORSION AND ANCHORAGE ZONE	9	+	0

Shear resistance in beams – Design for shear in rectangular and flanged beams – Behaviour under torsion – Modes of failure - Design for torsion, shear and bending Anchorage Zone – analysis and design of pretensioned and post tensioned end blocks - IS code provisions – Comparison of other codes.

Unit IV	STATICALLY INDETERMINATE STRUCTURES	9	+	0

Analysis of indeterminate structures – Continuous beams – Concept of concordance and linear transformations – Single storied rigid frames – Choice of cable profiles.

Unit V	PRESTRESSED CONCRETE SPECIAL STRUCTURES	9	+	0

Concept of circular prestressing – Design of prestressed concrete pipes and cylindrical water tanks - Composite construction- types, behaviour, flexural stresses, longitudinal shear transfer, transverse shear – Compression members – Design of poles and piles - Partial prestressing – Principles, analysis and design concepts

Total 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Students will able to find out the basics and losses in prestressed concrete structures
CO2	:	Understand the basic concept of pre and post-tensioning processes, analyse prestressed concrete members
CO3	:	Design prestressed concrete deck slab and end blocks

Text Books:

1.	Rajagopalan N, Prestressed Concrete, Narosa Publishing House, 2002.
2.	Krishnaraju N, Prestressed Concrete, Tata McGraw-Hill Publishing Company,3rd Ed 1985.

Reference Books:

1.	Lin.T.Y&Nedbhurns, Design of Prestressed Concrete Structures, 3rd edition,John Wiley & Sons, 1982.
2.	Sinha N.C& Roy S.K, Fundamentals of Prestressed Concrete, S.Chand& Co, New Delhi 1985.

Program Elective V

18STE52	ANALYSIS OF LAMINATED COMPOSITE PLATES	L	T	P	C
		3	0	0	3

Course Objectives:

To impart knowledge to the students about theory of plates, laminated, composite plates and approximate methods of analysis of plates.

Unit I	**INTRODUCTION**	**9**	**+**	**0**

Displacement Field Approximations for Classical Laminated Plate Theory (CLPT) and First Order Shear Deformation Theory (FSDT), Analytical Solutions for Bending of Rectangular Laminated Plates using CLPT.

Unit II	**GOVERNING EQUATIONS**	**9**	**+**	**0**

Navier Solutions of Cross-Ply and Angle-Ply Laminated Simply-Supported Plates, Determination of Stresses.

Unit III	**ANALYTICAL SOLUTIONS**	**9**	**+**	**0**

Levy Solutions for Plates with Other Boundary Conditions. Analytical Solutions for Bending of Rectangular Laminated Plates Using FSDT.

Unit IV	**FINITE ELEMENT SOLUTIONS USING CLPT**	**9**	**+**	**0**

Finite Element Solutions for Bending of Rectangular Laminated Plates using CLPT. Introduction to Finite Element Method, Rectangular Elements, Formation of Stiffness Matrix, Formation of Load Vector, Numerical Integration, Post Computation of Stresses.

Unit V	**FINITE ELEMENT SOLUTIONS USING FSDT**	**9**	**+**	**0**

Finite Element Solutions for Bending of Rectangular Laminated Plates using FSDT. Finite Element Model, C^0Element Formulation, Post Computation of Stresses. Analysis of Rectangular Composite Plates using Analytical Methods.

Total 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Analyse the rectangular composite plates using the analytical methods.
CO2	:	Analyse the composite plates using advanced finite element method.
CO3	:	Develop the computer programs for the analysis of composite plates.

Text Books:

1. Mechanics of Laminated Composites Plates and Shells, Reddy J. N.,2nd edition CRC Press.

Program Elective V

18STE53	FRACTURE MECHANICS OF CONCRETE STRUCTURES	L	T	P	C
		3	0	0	3

Course Objectives:

To impart knowledge on various fracture mechanisms, the occurrence of cracks and its properties. To analyse and study the failure modes with models of concrete structures, special structures.

Unit I	**INTRODUCTION**	**9**	**+**	**0**

Basic Fracture Mechanics, Crack in a Structure, Mechanisms of Fracture and CrackGrowth.

Unit II	**TYPES OF FRACTURE**	**9**	**+**	**0**

Cleavage Fracture, Ductile Fracture, Fatigue Cracking, Environment assisted Cracking, Service Failure Analysis.

Unit III	**STRESS AT CRACK TIP**	**9**	**+**	**0**

Stress at Crack Tip, Linear Elastic Fracture Mechanics, Griffith's Criteria, Stress Intensity Factors, Crack Tip Plastic Zone, Erwin's Plastic Zone Correction, R curves, Compliance, J Integral, Concept of CTOD and CMD.

Unit IV	**MATERIAL MODELS**	**9**	**+**	**0**

General Concepts, Crack Models, Band Models, Models based on Continuum Damage Mechanics.

Unit V	**APPLICATION ON SPECIAL CONCRETE AND NUMERICAL MODELING**	**9**	**+**	**0**

Applications to High Strength Concrete, Fibre Reinforced Concrete, Crack Concepts and Numerical Modeling.

Total 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Identify and classify cracking of concrete structures based on fracture mechanics.
CO2	:	Implement stress intensity factor for notched members
CO3	:	Apply fracture mechanics models to high strength concrete and FRC structures.
CO4	:	Compute J-integral for various sections understanding the concepts of LEFM.

Text Books:

1. Fracture Mechanics, Sun C. T. and Jin Z.H., 1st Edition, Elsevier Academic Press, 2012.
2. Elementary Engineering Fracture Mechanics, BroekDavid, 3rd Rev. Ed. Springer, 1982.

Reference Books:

1. Fracture Mechanics of Concrete Structures – Theory and Applications, ElfgreenL., RILEM Report, Chapman and Hall, 1989.
2. Fracture Mechanics – Applications to Concrete, Victor, Li C., Bazant Z. P., ACI SP 118, ACI Detroit, 1989.

Program Elective V

18STE54	DESIGN OF PLATES AND SHELLS	L	T	P	C
		3	0	0	3

Course Objectives:

To impart knowledge to the students about design of plates, shells, folded plates and the analysis of these structures.

Unit I	LATERALLY LOADED PLATES	9	+	0

Thin plates with small deflection. Laterally loaded thin plates, governing differential equation, boundary conditions.

Unit II	DESIGN OF FOLDED PLATES	9	+	0

Folded plate structures - Structural behavior - Types - Design by ACI-ASCE Task Committee method.

Unit III	MEMBRANE AND BENDING THEORY OF SHELLS	9	+	0

Classification of shells - Types of shells - Structural action - Membrane theory - Shells of revolution and shells of translation- Examples- Limitations of membrane theory.

Unit IV	DESIGN OF CYLINDRICAL SHELLS	9	+	0

Analysis and design of cylindrical shells and their structural behaviour

Unit V	DESIGN OF DOUBLY CURVED SHELLS	9	+	0

Membrane theory for general shells of double curvature - Synclastic and anticlastic shells - Approximate bending theory of shallow shells - Design of cooling tower shells - Hperbolicparaboloid roofs - Determination of forces in shells and edge members - Design of conoidal shells - New shell forms - Funicular shells.

Total 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Analyze and design prismatic folded plate systems
CO2	:	Analyze and design shells using approximate solutions
CO3	:	Analyze and Design Cylindrical Shells
CO4	:	Design Doubly Curved Shells using Approximate Solutions.

Text Books:

1. Theory of Plates and Shells, Timoshenko and Woinowsky-Krieger S., Tata McGraw Hill Edition, 2010.
2. Design and Construction of Concrete Shell Roofs, Ramaswamy G. S., 1st Edition, 2005.

Reference Books:

1. Design of Reinforced Concrete Shells & Folded Plate, Varghese P. C., 1st Edition, PHI.
2. Design of Plate and Shell Structures, JawadMaan H., Springer Science.

Program Elective V

18STE55	DESIGN OF BRIDGES	L	T	P	C
		3	0	0	3

Course Objectives:

At the end of the course the students shall have knowledge about design of long and short span bridges, prestressed concrete bridges and also about bearing, substructures and footings for bridges.

Unit I	INTRODUCTION	9	+	0

Components of bridge - Classification - Need for investigation Data collection - design discharge - linear waterway - economical span scour depth - traffic projection - choice of bridge type.

Unit II	LOADS ON BRIDGES	9	+	0

Indian Road Congress (IRC) bridge codes - dimensions - dead and live loads - impact effect - wind and seismic forces - longitudinal and centrifugal forces - hydraulic forces - earth pressure - temperature effect and secondary stresses.

Unit III	SLAB AND T-BEAM BRIDGES	9	+	0

Design of slab bridges - skew slab culverts - box culverts. T - Pigeaud curves - Courbon's theory - Hendry Jaegar method design of T - beam bridges.

Unit IV	LONG SPAN GIRDER BRIDGES	9	+	0

Design principles of continuous bridges, box girder bridges, and balanced cantilever bridges.

Unit V	BEARINGS, SUBSTRUCTURES AND FOOTINGS FOR BRIDGES	9	+	0

Design of bearings for slab, girder, skew bridges - Design of piers abutments - trestles, Joints - expansion joints.

Total 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Have a complete knowledge about the substructure and superstructure of bridge structures
CO2	:	To design of components of long and short span bridges
CO3	:	To design prestressed concrete bridges and their bearings, footings
CO4	:	To analyze the various types of bridge structures

Text Books:

1. *Raina V.K. "Concrete Bridge Practice",* Tata McGraw-Hill Publishing Company, New Delhi, 1991.
2. *Krishnaraju N, "Design of Bridges",* Oxford and IBH Publishing Co., Bombay, Calcutta, New Delhi 1988
3. *Ponnuswamy S, "Bridge Engineering",* Tata McGraw-Hill, 1989

Reference Books:

1. *Bakht, B. and Jaegar, L.G., "Bridge Analysis Simplified",* McGraw-Hill,1985.
2. *Derrick Beckett, "An Introduction to Structural Design of Concrete Bridges",* Surrey University Press, Henley Thomes, Oxford Shire, 1973
3. *Taylor F.W, Thomson S.E. and Smulski E, "Reinforced Concrete Bridges",* John Wiley and Sons, New York, 1955.
4. *Edwin H.Gaylord Jr., Charles N.Gaylord, James E. Stallmeyer "Design of Steel Structures",* McGraw-Hill International Editions, 1992.

Program Elective V

18STE56	MODERN CONSTRUCTION MATERIALS	L	T	P	C
		3	0	0	3

Course Objectives:

At the end of this course the student shall have a good knowledge about the recent materials and types used in construction and their significance.

Unit I	SPECIAL CONCRETES	9	+	0

Concretes, Behaviour of concretes - High Strength and High Performance Concrete - Fibre Reinforced Concrete, Self compacting concrete, Alternate Materials to concrete - Aerocon blocks - Self Curing Concrete.

Unit II	METALS	9	+	0

Steels - New Alloy Steels - Aluminum and its Products - Coatings to reinforcement – Applications - Galvalium roofing sheets - M2 panels for wall panels.

Unit III	COMPOSITES	9	+	0

Plastics - Reinforced Polymers - Fibre Reinforced Concrete - Steel Fibre-reinforced cement composites - Fibre reinforced plastic composites - carbon fibres and composite reinforcement - Applications

Unit IV	OTHER MATERIALS	9	+	0

Water Proofing Compounds - Non-weathering Materials - Flooring and Façade Materials

Unit V	SMART AND INTELLIGENT MATERIALS	9	+	0

Smart and Intelligent Materials for intelligent buildings - Special features

Total 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Acquire good knowledge about the recent construction materials, their construction and their significance.
CO2	:	Able to use modern materials based on their requirements.
CO3	:	Able to find new construction materials.

Text Books:

1.	Santhakumar A.R., *Concrete Technology*, Oxford University press, New Delhi. 2007
2.	Shetty M.S, *Concrete Technology: Theory and Practice*, S.Chand& Company Ltd., 2005

Reference Books:

1.	Mamlouk M.S. and Zaniewski J.P., *Materials for Civil and Construction Engineers*, Prentice Hall Inc., 1999
2.	Ashby M.F. and Jones D.R.H.H. *Engineering Materials 1: An introduction to Properties, applications and designs*, Elsevier Publications, 2005
3.	Shan Somayaji, *Civil Engineering Materials*, Prentice Hall Inc., 2001
4.	Aitkens , *High Performance Concrete*, McGraw Hill, 1999
5.	Deucher K.N, Korfiatis G.P and Ezeldin A.S, *Materials for civil and Highway Engineers*, Prentice Hall Inc., 1998.
6.	ACI Report 440.2R-02, *Guide for the design and construction of externally bonded RP systems for strengthening concrete structures*, American Concrete Institute, 2002

Program Elective VI

18STE61	ADVANCED CONCRETE TECHNOLOGY	L	T	P	C
		3	0	0	3

Course Objectives:

At the end of this course,
The student shall have a good knowledge about constituents materials.to know about the types of special concrete. To understand the concept and procedure for concrete mix design as per IS code standards. To get awareness about the strength properties of concrete and type of admixture. To know about the concreting methods.

Unit I	CONCRETE	9	+	0

Properties of fresh concrete- Hardened concrete- Thermal expansion- Permeability-Water tightness and crack control-Elastic properties - Creep and shrinkage-Variability of Concrete strength.

Unit II	MIX DESIGN	9	+	0

Principles of Concrete mix design- Methods of Concrete mix design – I.S. Method, ACI Method and DOE Method-Testing of Concrete.

Unit III	STRENGTH OF CONCRETE AND ADMIXTURES	9	+	0

Strength Under Uniaxial and Multiaxial Stresses – Failure Modes – Strength –Density Relationship- Parameters affecting strength – Accelerating and Retarding admixtures-Super plasticizers -Water proofing agents - Chemical admixtures, Mineral admixtures.

Unit IV	SPECIAL CONCRETES	9	+	0

Light Weight Concrete-Fly Ash Concrete- Fibre Reinforced Concrete- Polymer Concrete, Super Plasticized Concrete- Epoxy Resins and Screeds for Rehabilitation – Properties and applications – High Performance Concrete- Ready mixed concrete

Unit V	CONCRETING METHODS	9	+	0

Process of Manufacturing of Concrete - Methods of Transportation, Placing and Curing – Extreme Weather concreting - Special Concreting methods - Vacuum concrete – Shotcrete - Under water concrete, Special form work.

Total 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Know about the properties of concrete
CO2	:	Design the concrete mix using ACI + IS code methods
CO3	:	Know about the role of various types of admixtures in concrete
CO4	:	Design special concretes for specific applications
CO5	:	Apply various types of concreting methods in the field

Text Books:

1. Shetty M.S., *Concrete Technology,* S.Chand and Company Ltd., Delhi. 2005
2. Santhakumar A.R, *Concrete Technology,* Oxford University Press, 2007

Reference Books:

1. Rudhani G, *Light Weight Concrete,Hungaraian Academy of science 1963*
2. Gambhir M.L, *Concrete Technology, 3rd Edition,* The Tata McGraw Hill Co.,2004
3. *Neville, A.M., Properties of Concrete,* Pitman publishing limited, London.2004
4. Krishnasamy K.T , KamasundaraRao A and Khandekar A.A, *Concrete technology,DhanpatRai and sons ,Delhi 2001*
5. Orchard D.F., *Concrete Technology, Vol - 1 and Vol – 2,* Asia Publishing House, Delhi 2001.

Program Elective VI

18STE62	DISASTER RESISTANT STRUCTURES	L	T	P	C
		3	0	0	3

Course Objectives:

To understand the basic philosophy of design of disaster resistant structures and gain knowledge about repair and rehabilitation of disturbed structures,design structures with modern materials and advanced techniques and understand the provision of relevant standard specification, requirements and usage. Also gain knowledge about ability to conduct damage assessments and writing reports.

Unit I	BEHAVIOUR OF LIFE-LINE STRUCTURES	9	+	0

Philosophy for design to resist earthquake, cyclone and flood – National and international codes of practice – Bye law of urban and semi-urban area – Traditional and modern structures

Unit II	COMMUNITY STRUCTURE	9	+	0

Response of dams, bridges, buildings – Strengthening measures – Safety analysis and rating – Reliability assessment

Unit III	REHABILITATION AND RETROFITTING	9	+	0

Testing and evaluation – Classification of structures for safety point of view – Methods of strengthening for different disasters – Qualification test

Unit IV	DETAILING OF STRUCTURES AND COMPOSITES	9	+	0

Use of modern materials and their impact on disaster reduction – Use of modern analysis, Design and construction techniques - Optimization for performance

Unit V	DAMAGE ASSESSMENT OF STRUCTURES	9	+	0

Damage surveys – Maintenance and modifications to improve hazard resistance- Different types of foundation and its impact on safety – Ground improvement techniques.

Total 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Will understand the basic philosophy of design of disaster resistant structures
CO2	:	Will demonstrate the ability of identifying, formulating and understanding repair and rehabilitation of disturbed structures.
CO3	:	Will demonstrates the ability in designing structures with modern materials and techniques for disaster effect reduction.
CO4	:	Will understand the provision of relevant standard specification, requirements and usage.
CO5	:	Will demonstrate the ability to conduct damage assessments and writing reports.

Text Books:

1. *Proceedings of IABSE 14th Congress "Civilization through Civil Engineering"* New Delhi, May 1992.
2. *Raiker R.N., Learning from failures - Deficiencies in design, construction and service,* R&D center (SDCPL) RaikerBhavan, Bombay, 1987.

Reference Books:

1. *Moskwin V. et al, "Concrete and Reinforced Concrete – Deterioration and Protection,* Mir publishers, Moscow, 1980.
2. *Allen R.T and Edwards S.C, Repair of Concrete Structures,* Blakie and Sons, U.K., 1987.

Program Elective VI

18STE63	SOIL STRUCTURE INTERACTION	L	T	P	C
		3	0	0	3

Course Objectives:

The student is expected to understand the importance and significance of soil structure interaction and incorporate this in the design of structures to achieve both safety and economy.

Unit I	SOIL-FOUNDATION INTERACTION	9	+	0

Introduction to Soil-foundation interaction problems – Soil behaviour, Foundation behaviour, Interface behaviour, Scope of soil foundation interaction analysis, Soil response models, Winkler, Elastic continuum, Two parameter elastic models, Elastic plastic behaviour and Time dependent behaviour.

Unit II	BEAM ON ELASTIC FOUNDATION- SOIL MODELS	9	+	0

Infinite beam, two parameters, Isotropic elastic half-space, Analysis of beams of finite length, Classification of finite beams in relation to their stiffness.

Unit III	PLATE ON ELASTIC MEDIUM	9	+	0

Infinite plate, Winkler, Two parameters, Isotropic elastic medium, Thin and thick plates, Analysis of finite plates, Rectangular and Circular plates, Numerical analysis of finite plates, Simple solutions.

Unit IV	PLATE ON ELASTIC MEDIUM	9	+	0

Elastic analysis of single pile, Theoretical solutions for settlement and load distributions, Analysis of pile group, Interaction analysis, Load distribution in groups with rigid cap.

Unit V	PLATE ON ELASTIC MEDIUM	9	+	0

Load deflection prediction for laterally loaded piles, Sub grade reaction and elastic analysis, Interaction analysis, Pile raft system, Solutions through influence charts.

Total 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	The students will be able to understand various applications to soil structure interaction.
CO2	:	The students will able to calculate contact pressure and settlement under foundation
CO3	:	The student will able to calculate earth pressure on different retaining structures

Text Books:

1. *Selvadurai, A.P.S., Elastic Analysis of Soil Foundation Interaction,* Elsevier, 1979.
2. *Poulos, H.G., and Davis, E.H., Pile Foundation Analysis and Design,* John Wiley, 1980.

Reference Books:

1. *Scott R.F., Foundation Analysis,* Prentice Hall, 1981.
2. *Structure-Soil Interaction - State of Art Report",* Institution of Structural Engineers, 1978.
3. *ACI 336, Suggested Analysis and Design Procedures for combined footings and Mats,* American Concrete Institute, Delhi, 1988.

Program Elective VI

18STE64	ENVIRONMENTAL ENGINEERING AND OFFSHORE STRUCTURES	L	T	P	C
		3	0	0	3

Course Objectives:

To impart knowledge to the students about structural design of concrete pipes, special purpose structures, wave theories and forces related to offshore structures, analysis and design of offshore structures,

Unit I	**DESIGN OF PIPES**	**9**	**+**	**0**

Structural design of Concrete, Prestressed Concrete, Steel and Cast Iron piping mains, sewerage tanks design.

Unit II	**DESIGN OF SPECIAL PURPOSE STRUCTURES**	**9**	**+**	**0**

Underground reservoirs and swimming pools, Intake towers, Structural design including foundation of water retaining structures such as settling tanks, clariflocculators, aeration tanks and Imhoff tanks.

Unit III	**SEWERAGE WORKS**	**9**	**+**	**0**

Design of steel, lattice structures used in water and sewerage treatment works – protection methods of both RC and steel structures.

Unit IV	**WAVE THEORIES, FORCES ON OFFSHORE STRUCTURES**	**9**	**+**	**0**

Design of steel, lattice structures used in water and sewerage works – protection methods of both RC and steel structures.

Unit V	**ANALYSIS AND DESIGN OF OFFSHORE STRUCTURES**	**9**	**+**	**0**

Static method of analysis, foundation analysis and dynamics of offshore structures. Design of platforms, helipads, jacket tower and mooring cables and pipe lines.

Total 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Recognizing the needs sorting out its importance and implementing practically the construction of essential environmental structures and special structures through analysis and design.
CO2	:	understand about the waves, force exerted by wave on coastal and offshore structures
CO3	:	Will be able to design small offshore structures like platforms, submerged pipelines etc

Text Books:

1.	*Dayaratnam P., Design of Reinforced concrete structures,* OXFORD and IBH Publishing Co., New Delhi. 2003.
2.	*Krishna Raju, Prestressed Concrete,* Tata McGraw Hill Publishing Co. 2nd Edition 1988.
3.	*Chakrabarti S.K, Hydrodynamics of offshore structures,* Computational Mechanics Publications, 1987
4.	*Thomas H.Dawson, Offshore Structural Engineering,* Prentice Hall Inc., Englewood Cliffs, N.J 1983.

Reference Books:

1.	*Sinha N.C. and Roy S. K., Reinforced concrete*by S.Chand and Co. 1985.
2.	*Hulse R.K and Mosley, W.H., Reinforced Concrete Design by Computer,* Macmillan Education Ltd., 1986.
3.	*Ramaswamy, G. S, Design and construction of Concrete shell roofs,*CBSPublishers, India, 1986.
4.	*Green, J.K and Perkins, P.H., Concrete liquid retaining structures,* AppliedScience Publishers, 1981
5.	*API, Recommended Practice for Planning, Designing and Constructing Fixed Offshore Platforms, American Petroleum Institute Publication, RP2A, Dalls,Texas.*
6.	*Wiegel R.L, Oceanographical Engineering, Prentice Hall Inc, Englewood Cliffs, N.J.1964.*
7.	*Brebia C.A, & Walker S, Dynamic Analysis of Offshore Structures, New-nesButterworths, U.K.1979.*
8.	*Reddy D.V. and Arockiasamy M, Offshore structures, Vol.-1, Krieger Publishing Company Malabar, Florida, 1991.*
9.	*Metcalf And Eddy, "Wastewater Engineering Treatment & Reuse", IV Edition, Tata McGraw Hill Publishing Co.2003*

Program Elective VI

18STE65	WIND AND CYCLONE EFFECTS ON STRUCTURES	L	T	P	C
		3	0	0	3

Course Objectives:

To impart knowledge to the students about wind and cyclone effects on structures and the design of buildings and structural components as per I.S. codes.

Unit I	INTRODUCTION	9	+	0

Introduction, Spectral studies, Gust factor, Wind velocity, Methods of measurements, variation of speed with height, shape factor, aspect ratio and drag effects.

Unit II	WIND TUNNEL STUDIES	9	+	0

Wind Tunnel Studies, Types of tunnels, Modelling requirements, Interpretation of results, Aero-elastic models.

Unit III	WIND EFFECT	9	+	0

Wind on structures, Rigid structures, Flexible structures, Static and Dynamic effects, Tall buildings, chimneys.

Unit IV	DESIGN PRINCIPLES	9	+	0

Application to design, IS 875 code method, Buildings, Chimneys, Roof Shelters

Unit V	CYCLONE EFFECT AND DESIGN OF CLADING	9	+	0

Cyclone effect on structures, cladding design, window glass design

Total 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Have a clear understanding about wind effects and performance of wind tunnel studies.
CO2	:	To understand about the wind loads , their effects with codal specifications
CO3	:	To analyze and design structures to resist extreme wind forces and cyclones.

Text Books:

1. *Cook.N.J., The Designer's Guide to Wind Loading of Building Structures,* Butterworth's, 1989
2. *Kolousek., et.al., Wind Effects on Civil Engineering Structures,* Elsevier Publications, 1984.

Reference Books:

1. *Peter Sachs, Wind Forces in Engineering,* Pergamon Press, New York, 1972
2. *Lawson T.V., Wind Effects on Building Vol. I and II,* Applied Science Publishers, London, 1980.

AUDIT COURSE 1

18AC01	ENGLISH FOR RESEARCH PAPER WRITING	L	T	P	C
		2	0	0	0

Course Objectives:

To understand the importance of writing skills in a Research paper. To Learn how to write different sections in a research paper and skills of writing a good research paper

Unit I		**4**	**+**	**0**

Research paper and its importance – Structure of a research paper – Planning and Preparation

Unit II		**4**	**+**	**0**

English in research papers – Basic word order – Collocation – Concord – Breaking up of long sentences – Ambiguity and Redundancy

Unit III		**4**	**+**	**0**

Key factors that determine the style of a paper – Journal's background – Passive form – Right tense – Cohesion and Coherence.

Unit IV		**4**	**+**	**0**

Highlighting you findings – Hedging and Criticizing – Paraphrasing and Plagiarism.

Unit V		**4**	**+**	**0**

Key skills in writing Title – Abstract – Introduction – Review of Literature – Methods – Discussion and Conclusion – useful phrases – Ensuring quality of the paper.

Total 20 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Understand and appreciate the process of a good research paper
CO2	:	Apply their gained knowledge in writing a research paper
CO3	:	Analyse and assess the quality of their research paper

Suggested Reading:

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

AUDIT COURSE 2

18AC02	DISASTER MANAGEMENT	L	T	P	C
		2	0	0	0

Course Objectives:

To have a critical understanding of key concepts in disaster risk reduction and humanitarian response and critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations and evaluate the strengths and weaknesses of disaster management approaches.Planning and programming in different countries, particularly their home country or the countries they work in.

Unit I	INTRODUCTION	4	+	0

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

Disaster Prone Areas In India : 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 II	REPERCUSSIONS OF DISASTERS AND HAZARDS	4	+	0

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 PREPAREDNESS AND MANAGEMENT	4	+	0

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 IV	RISK ASSESSMENT	4	+	0

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.

Unit V	DISASTER MITIGATION	4	+	0

Meaning, Concept And Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation And Non-Structural Mitigation, Programs Of Disaster Mitigation In India.

Total 20 Periods

Course Outcomes:

On completion of the course, the students will be able to

CO1	:	Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
CO2	:	Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives
CO3	:	Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations
CO4	:	Critically understand the strengths and weaknesses of disaster management approaches

Reference

1.	R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company.
2.	Sahni, PardeepEt.Al. (Eds.)," Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi

AUDIT COURSE 3

18AC03	SANSKRIT FOR TECHNICAL KNOWLEDGE	L	T	P	C
		2	0	0	0

Course Objectives:

To get a working knowledge in illustrious Sanskrit, the scientific language in the world. Learning of Sanskrit to improve brain functioning. Learning of Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power. The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature.

Unit I		**8**	**+**	**0**

Alphabets in Sanskrit-Past/Present/Future Tense-Simple Sentences

Unit II		**8**	**+**	**0**

Order-Introduction of roots-Technical information about Sanskrit Literature

Unit III		**8**	**+**	**0**

Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics

Total 24 periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Understanding basic Sanskrit language
CO2	:	Ancient Sanskrit literature about science & technology can be understood
CO3	:	Being a logical language will help to develop logic in students

Suggested Reading:

1.	À ᵀ Ā □ Ā □ “Abhyaspustakam” – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi
2.	À ᵀ Ā □ Ā □ “Teach Yourself Sanskrit” PrathamaDeeksha-VempatiKutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication
3.	À ᵀ Ā □ Ā □ India’s Glorious Scientific Tradition” Suresh Soni, Ocean books (P) Ltd., New Delhi.

AUDIT COURSE 4

18AC04	VALUE EDUCATION	L	T	P	C
		2	0	0	0

Course Objectives:

To understand the importance of value education and self-development. To imbibe good values in students and also know about the importance of character.

Unit I		4	+	0

Values and self-development – Social values and individual attitudes - Work ethics, Indian vision of Humanism- Moral and non-moral valuation - Standards and principles - Value judgements.

Unit II		6	+	0

Importance of cultivation of values - Sense of duty-Devotion - Self-reliance – Confidence – Concentration – Truthfulness – Cleanliness – Honesty – Humanity -Power of faith - National Unity – Patriotism - Love for nature – Discipline

Unit III		6	+	0

Personality and Behavior Development - Soul and Scientific attitude – Positive – Thinking - Integrity and discipline-Punctuality - Love and Kindness - Avoid fault Thinking - Free from anger - Dignity of labor - Universal brotherhood and religious tolerance - True friendship-Happiness Vs suffering - love for truth - Aware of self-destructive habits-Association and Cooperation - Doing best for saving nature

Unit IV		6	+	0

Character and Competence – Holy books vs Blind faith - Self-management and Good health -Science of reincarnation-Equality – Nonviolence – Humility - Role of Women - All religions and same message - Mind your Mind - Self-control – Honesty - Studying effectively

Total 22 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Knowledge of self-development
CO2	:	Learn the importance of Human values
CO3	:	Developing the overall personality

Suggested Reading:

1. Chakraborty, S.K. “Values and Ethics for organizations Theory and practice”, Oxford University Press, New Delhi,1998.

AUDIT COURSE 5

18AC05	CONSTITUTION OF INDIA	L	T	P	C
		2	0	0	0

Course Objectives:

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 of nationhood 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	4	+	0

History, Drafting Committee, (Composition & Working)

Unit II	PHILOSOPHY OF THE INDIAN CONSTITUTION	4	+	0

Preamble, Salient Features

Unit III	CONTOURS OF CONSTITUTIONAL RIGHTS & DUTIES	4	+	0

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	4	+	0

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	4	+	0

Districts administration head: role and importance, municipalities: introduction, mayor and role of elected representative, CEO of municipal corporation. Panchayati raj: introduction, PRI: zilapanchayat. Elected officials and their roles, CEO zilapanchayat: 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	4	+	0

Election Commission: role and functioning. Chief election commissioner and election commissioners. State election commission: role and functioning. Institute and bodies for the welfare of SC/ST/OBC and women

Total 24 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics
CO2	:	Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
CO3	:	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
CO4	:	Discuss the passage of the Hindu Code Bill of 1956.

Suggested Reading:

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

AUDIT COURSE 6

18AC06	PEDAGOGY STUDIES	L	T	P	C
		2	0	0	0

Course Objectives:

To Review existing evidence on the review topic to inform programme design and policy making undertaken by the DFID, other agencies and researchers. Identify critical evidence gaps to guide the development.

Unit I 4 + 0

Aims and rationale, Policy background, Conceptual framework and terminology, Theories of learning, Curriculum, Teacher education, Conceptual framework, Research questions**,** Overview of methodology and Searching

Unit II 2 + 0

Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries, Curriculum, Teacher education.

Unit III 4 + 0

Evidence on the effectiveness of pedagogical practices, Methodology for the in depth stage: quality assessment of included studies, How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? Theory of change.
Strength and nature of the body of evidence for effective pedagogical practices, Pedagogic theory and pedagogical approaches, Teachers' attitudes and beliefs and Pedagogic strategies.

Unit IV 4 + 0

Professional development: alignment with classroom practices and follow-up support, Peer support, Support from the head teacher and the community, Curriculum and assessment, Barriers to learning: limited resources and large class sizes.

Unit V 2 + 0

Research gaps and future directions, Research design, Contexts, pedagogy, teacher education, curriculum and assessment, dissemination and research impact

Total 16 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?
CO2	:	What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?
CO3	:	How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

Suggested Reading:

1.	Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
2.	Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
3.	Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
4.	Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
5.	Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.

AUDIT COURSE 7

18AC07	STRESS MANAGEMENT BY YOGA	L	T	P	C
		2	0	0	0

Course Objectives:

To achieve overall health of body and mind, To overcome stress

Unit I		8	+	0

Definitions of Eight parts of yoga.

Unit II		8	+	0

Yam and Niyam.
Do`s and Don't's in life.
1.Ahinsa, satya, astheya, bramhacharya and aparigraha
2.Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

Unit III		8	+	0

Asan and Pranayam
1. Various yog poses and their benefits for mind & body
2. Regularization of breathing techniques and its effects-Types of pranayama

Total 24 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Develop healthy mind in a healthy body thus improving social health also
CO2	:	Improve efficiency

Suggested Reading:

1. Yogic Asanas for Group Tarining-Part-I" :Janardan Swami YogabhyasiMandal, Nagpur
"Rajayoga or conquering the Internal Nature" by Swami Vivekananda, AdvaitaAshrama (Publication Department), Kolkata

AUDIT COURSE 8

18AC08	PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS	L	T	P	C
		2	0	0	0

Course Objectives:

To learn to achieve the highest goal happily, To become a person with stable mind, pleasing personality and determination, To awaken wisdom in students.

Unit I **8 + 0**

Neetisatakam-Holistic development of personality
Verses- 19,20,21,22 (wisdom)
Verses- 29,31,32 (pride & heroism)
Verses- 26,28,63,65 (virtue)
Verses- 52,53,59 (dont's)
Verses- 71,73,75,78 (do's)

Unit II **8 + 0**

Approach to day to day work and duties.
ShrimadBhagwadGeeta: Chapter 2-Verses 41, 47,48,
Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17,23, 35,
Chapter 18-Verses 45, 46, 48.

Unit III **8 + 0**

Statements of basic knowledge.
ShrimadBhagwadGeeta: Chapter2-Verses 56, 62, 68
Chapter 12 -Verses 13, 14, 15, 16,17, 18
Personality of Role model. ShrimadBhagwadGeeta:
Chapter2-Verses 17, Chapter 3-Verses 36,37,42
Chapter 4-Verses 18, 38,39
Chapter18 – Verses 37,38,63

Total 24 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life
CO2	:	The person who has studied Geeta will lead the nation and mankind to peace and prosperity
CO3	:	Study of Neetishatakam will help in developing versatile personality of students.

Suggested Reading:

1. "Srimad Bhagavad Gita" by Swami SwarupanandaAdvaita Ashram (Publication Department), Kolkata.
2. Bhartrihari's Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.