SRI SHAKTHI

INSTITUTE OF ENGINEERING AND TECHNOLOGY,
(AUTONOMOUS)
L&T BYPASS ROAD, COIMBATORE - 62

DEPARTMENT OF CIVIL ENGINEERING

CURRICULUM AND SYLLABI

M.E - Structural Engineering

REGULATION 2021

SRI SHAKTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY, COIMBATORE
(AUTONOMOUS)
M.E. STRUCTURAL ENGINEERING
REGULATIONS – 2021

PROGRAMME EDUCATIONAL OBJECTIVES:

PEO1	:	Enable Graduates to gain knowledge and skills in structural engineering which will enable them to have a successful career in public and private sectors.
PEO2	:	Impart the practical knowledge related to structural engineering so that the students are able to understand and analyse the problems in various interdisciplinary fields of civil engineering.
PEO3	:	To inculcate ethical practices in students and to establish understanding of professionalism, safety of structures, sustainability, their duties and contribution to the society
PEO4	:	Provide students with academic environment that makes them aware of excellence and to enable them to understand the significance of life-long learning in global perspective.

PROGRAMME OUTCOMES:

Engineering Graduates will be able to:

PO1	a	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	b	**Problem analysis:** Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	c	**Design/development of solutions:** Design solutions for complex engineering problemsand design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	d	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	e	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, andmodern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PO6	f	**The engineer and society:** Apply reasoning informed by the contextual knowledge toassess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	g	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	h	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	i	**Individual and team work:** Function effectively as an individual, and as a member orleader in diverse teams, and in multidisciplinary settings.
PO10	j	**Communication:** Communicate effectively on complex engineering activities with theengineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

Approved by BoS Chairman

PO11	k	**Project management and finance:** Demonstrate knowledge and understanding of theengineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	l	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technologicalchange.

PROGRAM SPECIFIC OBJECTIVES (PSOs):

PSO1	:	To motivate the graduate students to address the societal needs by interdisciplinary approach in civil engineering field.
PSO2	:	Impart the ability of critical thinking based on in-depth knowledge in structural engineering to obtain optimal solutions to the complex engineering problems.
PSO3	:	The graduates will be able to work effectively as an individual or in a team having acquired leadership skills and manage projects in multidisciplinary environments.

MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVES WITH PROGRAMME OUTCOMES

A broad relation between the programme objective and the outcomes is given in the following table:

PROGRAMME EDUCATIONAL OBJECTIVES	PROGRAMME OUTCOMES											
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**
1	3		3	2		1	2	1			1	
2	3	3	3	3	2		1					1
3		2	3	2		3		3	1	1		
4	2										1	2

MAPPING OF PROGRAM SPECIFIC OBJECTIVES WITH PROGRAMME OUTCOMES

A broad relation between the Program Specific Objectives and the outcomes is given in the following table:

PROGRAMME SPECIFIC OBJECTIVES	PROGRAMME OUTCOMES											
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**
1	3	3	3	2	1	1		1				
2	3	3	3	3	3	1	1					1
3		1	1					2	3	2	2	

SRI SHAKTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY, COIMBATORE
(AUTONOMOUS)
M.E. STRUCTURAL ENGINEERING
REGULATIONS – 2021
CHOICE BASED CREDIT SYSTEM

MAPPING OF COURSE OUTCOMES WITH PROGRAMME OUTCOMES:

A broad relation between the Course Outcomes and Programme Outcomes is given in thefollowing table

COURSE OUTCOMES		PROGRAMME OUTCOMES											
Sem	**Course Name**	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**	**L**
I	Applied Mathematics for Structural Engineering	✓											
	Theory of Elasticity and Plasticity	✓	✓										
	Structural Dynamics	✓	✓	✓	✓								✓
	Structural Health Monitoring	✓	✓	✓									
	Special Concrete				✓	✓		✓					
	Experimental Techniques and Instrumentation	✓	✓	✓	✓	✓		✓					✓
	Structural Engineering Project – I	✓	✓	✓	✓	✓					✓	✓	✓
	Special Concrete Laboratory	✓	✓	✓			✓		✓				
	Technical Seminar - I					✓		✓			✓		
II	Design of Advanced Steel Structures	✓	✓	✓									✓
	Advanced Reinforced Concrete Design		✓		✓	✓							✓
	Finite Element Analysis using Ansys		✓	✓		✓							✓
	Earthquake resistant design of structures	✓			✓	✓							✓
	Research Methodology		✓		✓								
	Professional Elective – I												
	Structural Engineering Project – II	✓	✓	✓	✓	✓					✓	✓	✓
	Advanced Structural Engineering laboratory	✓	✓	✓			✓		✓				
III	Professional Elective – II												
	Professional Elective - III												
	Project Work Phase - I	✓	✓	✓	✓	✓					✓	✓	✓
	Technical Seminar - II					✓		✓			✓		
	Industrial Training		✓	✓									
IV	Project Work Phase - II	✓	✓	✓	✓	✓		✓			✓		✓

SRI SHAKTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY, COIMBATORE
(AUTONOMOUS)
B.E. CIVIL ENGINEERING
REGULATIONS – 2021
CHOICE BASED CREDIT SYSTEM
I - IV SEMESTERS CURRICULA AND SYLLABI

SEMESTER I

Semester	Course Code	Course Title	Category	Contact Period	L	T	P	C
Theory								
I	21MS104	Applied Mathematics for Structural Engineering	BS	4	3	1	0	4
I	21SE101	Theory of Elasticity and Plasticity	PC	4	3	1	0	4
I	21SE102	Structural Dynamics	PC	3	3	0	0	3
I	21SE103	Structural Health Monitoring	PC	3	3	0	0	3
I	21SE104	Special Concrete	PC	3	3	0	0	3
I	21SE105	Experimental Techniques and Instrumentation	PC	3	3	0	0	3
		Audit Courses – I	HS	2	2	0	0	0
Laboratory								
I	21SE111	Structural Engineering Project – I	EEC	6	0	0	6	3
I	21SE112	Special Concrete laboratory	PC	2	0	0	2	1
I	21SE113	Technical Seminar - I	EEC	2	0	0	2	1
Total Credits (Semester)				**32**	**21**	**2**	**10**	**25**

SEMESTER II

Semester	Course Code	Course Title	Category	Contact Period	L	T	P	C
Theory								
II	21SE201	Design of Advanced Steel Structures	PC	3	3	1	0	4
II	21SE202	Advanced Reinforced Concrete Design	PC	3	3	0	0	3
II	21SE203	Finite Element Analysis	PC	3	3	0	0	3
II	21SE204	Earthquake resistant design of structures	PC	3	3	0	0	3
II	21CC201	Research Methodology	CC	3	3	0	0	3
II		Professional Elective - I	PE	3	3	0	0	3
		Audit Courses - II	HS	2	2	0	0	0
Laboratory								
II	21SE211	Structural Engineering Project – II	EEC	6	0	0	6	3
II	21SE212	Advanced Structural Engineering laboratory	PC	2	0	0	4	2
Total Credits (Semester)				**28**	**20**	**1**	**10**	**24**

SEMESTER III

Semester	Course Code	Course Title	Category	Contact Period	L	T	P	C
Theory								
III		Professional Elective II	PE	3	3	0	0	3
III		Professional Elective III	PE	3	3	0	0	3
Laboratory								
III	21SE311	Project Work Phase - I	EEC	6	0	0	6	3
III	21SE312	Technical Seminar - II	EEC	2	0	0	2	1
III	21SE313	Industrial Training	EEC	0	0	0	0	1
Total Credits (Semester)				**11**	**6**	**0**	**7**	**11**

SEMESTER IV

Semester	Course Code	Course Title	Category	Contact Period	L	T	P	C
IV	21SE411	Project Work Phase – II	EEC	24	0	0	24	12
Total Credits (Semester)				**24**	**0**	**0**	**24**	**12**

Total No. of credits: 72

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BASIC SCIENCES (BS)

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	21MS104	Applied Mathematics forStructural Engineering	BS	4	3	1	0	4

PROFESSIONAL CORE (PC)

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	21SE101	Theory of Elasticity And Plasticity	PC	4	3	1	0	4
2.	21SE102	Structural Dynamics	PC	3	3	0	0	3
3.	21SE103	Structural Health Monitoring	PC	3	3	0	0	3
4.	21SE104	Special Concrete	PC	3	3	0	0	3
5.	21SE105	Experimental Techniques and Instrumentation	PC	3	3	0	0	3
7.	21SE112	Special Concrete laboratory	PC	2	0	0	2	1
8.	21SE201	Design of Advanced Steel Structures	PC	3	3	1	0	4
9.	21SE202	Advanced Reinforced Concrete Design	PC	3	3	0	0	3
10.	21SE203	Finite Element Analysis	PC	3	3	0	0	3
11.	21SE204	Earthquake resistant Design of structures	PC	3	3	0	0	3
12.	21SE212	Advanced StructuralEngineering laboratory	PC	2	0	0	4	2

EMPLOYABILITY ENHANCEMENT COURSE (EEC)

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	21SE111	Structural Engineering Project – I	EEC	6	0	0	6	3
2.	21SE113	Technical Seminar	EEC	2	0	0	2	1
3.	21SE211	Structural Engineering Project – II	EEC	6	0	0	6	3
4.	21SE311	Project Work Phase – I	EEC	6	0	0	6	3
5.	21SE312	Technical Seminar	EEC	2	0	0	2	1
6.	21SE313	Industrial Training	EEC	0	0	0	0	1

PROFESSIONAL ELECTIVES (PE)

SEMESTER – II

ELECTIVE - I

S.No	Coursecode	Course Title	Category	Contact Periods	L	T	P	C
1.	21PSE01	Urban Planning and Sustainability	PE	3	3	0	0	3
2.	21PSE02	Internet of things (IoT) for Civil Engineering	PE	3	3	0	0	3
3.	21PSE03	Design of Structures for Dynamic loads	PE	3	3	0	0	3
5.	21PSE04	Substructure Design	PE	3	3	0	0	3
6.	21PSE05	Indsustrial Strutures	PE	3	3	0	0	3

SEMESTER – III

ELECTIVE - II

S.No	Coursecode	Course Title	Category	Contact Periods	L	T	P	C
1.	21PSE06	Advanced Concrete Technology	PE	3	3	0	0	3
2.	21PSE07	Energy efficient Building	PE	3	3	0	0	3
4.	21PSE08	Design of Bridges	PE	3	3	0	0	3
5.	21PSE09	Design of Steel Concrete Composite Structures	PE	3	3	0	0	3
6.	21PSE10	Soil Structure Interaction	PE	3	3	0	0	3

ELECTIVE - III

S.No	CourseCode	Course Title	Category	Contact Periods	L	T	P	C
1.	21PSE11	Design of Plates and Shells	PE	3	3	0	0	3
2.	21PSE12	Wind and Cyclone Effects on Structures	PE	3	3	0	0	3
3.	21PSE13	Design of Pre stressed Concrete elements	PE	3	3	0	0	3
4.	21PSE14	Computer Method of Structural Analysis	PE	3	3	0	0	3
5.	21PSE15	Bridge Maintenance and Management	PE	3	3	0	0	3

SEMESTER – IV

ELECTIVE - IV

S.No	CourseCode	Course Title	Category	Contact Periods	L	T	P	C
1.	21PSE16	Offshore Structures	PE	3	3	0	0	3
2.	21PSE17	Prefabricated Structures	PE	3	3	0	0	3
3.	21PSE18	Design of Tall Buildings	PE	3	3	0	0	3
4.	21PSE19	Geotechnical and Earthquake Engineering	PE	3	3	0	0	3
5.	21PSE20	Stability of Structures	PE	3	3	0	0	3

AUDIT COURSE

S.No	Course code	Course title	L	T	P	C
1.	21AC101	English for Research Paper Writing	2	0	0	0
2.	21AC102	Disaster Management	2	0	0	0
3.	21AC103	Stress Management by Yoga	0	0	2	0
4.	21AC104	Value Education	2	0	0	0

* Any two audit courses during I & II Semesters

SUMMARY

S.No	SUBJECT AREA	CREDIT DISTRIBUTION				CREDITS TOTAL	Percentage
		I	II	III	IV		
1.	**HS**						
2.	**BS**	4				4	5.47
3.	**ES**						
4.	**PC**	18	15			33	45.83
5.	**PE**		3			3	4.11
6.	**OE**			6		6	8.23
7.	**CC**		3			3	4.11
8.	**EEC**	3	3	5	12	23	31.94
Total		**25**	**24**	**11**	**12**	**72**	
	Non credit/ Mandatory	✓	✓				

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SEMESTER - I

		L	T	P	C
21MS104	**APPLIED MATHEMATICS FOR STRUCTURAL ENGINEEIRNG**	**3**	**1**	**0**	**4**

Course Objectives:

This course aims to provide the students,

- The main objective of this course is to enrich the knowledge in various analytical skills in applied mathematics, physics and engineering. This course covers a broad spectrum of mathematical techniques such as Matrix Theory, Laplace Transform, Fourier Transform, Calculus of Variations, Conformal Mapping and application of these topics are essential to the solution of problems encountered in physics and engineering.

Pre-Requisites:

- Nil.

UNIT I MATRIX THEORY 9+3

The Cholesky decomposition - Generalized Eigenvectors - Canonical basis - QR factorization - Least squares method -Singular value decomposition.

UNIT II LAPLACE TRANSFORM TECHNIQUES FOR PARTIAL DIFFERENTIAL EQUATIONS 9+3

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

UNIT III FOURIER TRANSFORM TECHNIQUES FOR PARTIAL DIFFERENTIAL EQUATIONS 9+3

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

UNIT IV CALCULUS OF VARIATION 9+3

Variation and its properties – Euler's equation – Functional's dependent on first and higher order derivatives – Functional's dependent on functions of several independent variables – problems with moving boundaries.

UNIT V CONFORMAL MAPPING AND APPLICATIONS 9+3

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

Theory:45 Hours Tutorial: 15 Hours Practical: 0 Project: 0 Total:60 Hours

Course Outcomes:

At the end of the course students should be able to

CO1 :	Apply the concepts of Matrix theory which is used in Civil engineering problems.
CO2 :	Acquire the knowledge in Laplace transforms to initial value, initial–boundary value and boundary value problems in Partial Differential Equations.
CO3 :	Understand mathematical tools for the solutions of partial differential equations by using Fourier transform techniques.

CO4 : Maximizing and minimizing the functional that occur in various branches of Engineering Disciplines.

CO5 : Construct conformal mappings between various domains and use of conformal Mapping in Studying problems in physics and engineering particularly to fluid flow and heat flow problems.

CO/PO MAPPING(S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair)													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3										2	2	
CO2	3	2	3										3	3	
CO3	3	2	2										2	2	
CO4	3	2	2										2	2	
CO5	3	3	2										3	3	

Reference Books:

R1 Andrews L.C. and Shivamoggi, B., "Integral Transforms for Engineers", Prentice Hall of India Pvt. Ltd., New Delhi, 2003.

R2 Elsgolc, L.D., "Calculus of Variations", Dover Publications Inc., New York, 2007.

R3 Mathews, J. H., and Howell, R.W., "Complex Analysis for Mathematics and Engineering", 5th Edition, Jones and Bartlett Publishers, 2006.

R4 Naveen Kumar, "An Elementary Course on Variational Problems in Calculus", Narosa Publishing House, 2005.

R5 Gupta, A.S., Calculus of variations with applications, Prentice-Hall of India, New Delhi, 1997.

R6 Saff, E.B and Snider, A.D, "Fundamentals of Complex Analysis with Applications in Engineering, Science and Mathematics", 3rdEdition, Pearson Education, New Delhi, 2014.

R7 Sankara Rao, K., "Introduction to Partial Differential Equations", Prentice Hall of India Pvt. Ltd., New Delhi, 1997.

R8 Spiegel, M.R., "Theory and Problems of Complex Variables and its applications", Schaum's Outline Series, McGraw Hill Book Co., 1981.

R9 Venkatraman, M. K., "Higher Mathematics for Engineering and Science", National Publishing Company, 1992.

		L	T	P	C
21SE101	**THEORY OF ELASTICITY AND PLASTICITY**	**3**	**1**	**0**	**4**

Course Objectives:

This course aims to provide students,

- To impart knowledge on elastic and plastic behaviour of systems in Cartesian coordinates subjected to stresses and strain.

Pre-requisites:

- Nil.

UNIT I ELASTICITY AND SOLUTIONS 9+3

Analysis of stress and strain, Equilibrium equations - Compatibility equations - stress strain relationship. Generalized Hooke's law. Plane stress and plane strain - Simple two-dimensional problems in Cartesian co-ordinates.

UNIT II TORSION OF NON-CIRCULAR SECTION 9+3

St.venant's approach - Prandtl's approach: Membrane analogy - Torsion of thin walled open and closed sections.

UNIT III ENERGY METHODS 9+3

Strain energy – Principle of virtual work – Energy theorems – Rayleigh Ritz method – Finite difference method – Application to elasticity problems.

UNIT IV PLASTICITY 9+3

Physical Assumptions – Yield criteria - Plastic stress strain relationship. Elastoplastic problems in bending.

UNIT V CONSTITUTIVE MODELS 9+3

Metal Plasticity – Concrete and Soil Plasticity – Failure criterion and Constitutive models for the above materials.

Theory:45 Hours Tutorial:15 Hours Practical: 0 Total:60 Hours

Course Outcomes:

At the end of the course students should be able to

CO1 : Understand the stress, deformation, constitutive relations and solve 2D problems in Cartesian coordinates.

CO2 : Analyse torsion of non-circular sections, thin walled sections and introduce the concept of energy methods for elasticity problems.

CO3 : Familiarize the concept of plasticity and constitutive models.

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair												CO/PSO Mapping		
COs	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	1	1	1		2						2	2	
CO2	2	3	1	1	1		2						2	2	
CO3	2	3	1	1	3		2						2	2	

Reference Books:

R1. Timeshenko.S.P and Goodier.J.N "Theory of Elasticity", McGraw Hill International edition, 2001.

R2. Mendelson "Plasticity: Theory and Application", A McMillan and co, NewYork 1968.

R3. Sadhu Singh "Theory of plasticity", Khanna publishers, 2005.

R4. Hill.R Mathematical "Theory of plasticity", Oxford Publishers 1967.

R5. Chakrabarthy J, "Theory of plasticity", Mc Graw Hill Co., 2012.

R6. Chen W.F, "Plasticity for Structural Engineers", J.Ross Publishing, 2007.

21SE102	STRUCTURAL DYNAMICS	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims to provide students,

- To impart knowledge on analysis of SDOF and MDOF systems subjected to dynamic loading by various techniques.

Pre-Requisites:

- Nil.

UNIT I SINGLE DEGREE OF FREEDOM SYSTEMS 9

Formulation of equation of motion, Free and forced vibrations, Response to dynamic loading, Effect of damping.

UNIT II MULTI DEGREE OF FREEDOM SYSTEMS 9

Free and forced vibration of un-damped and damped MDOF systems. Equation of motions, Evaluation of natural frequencies and mode shapes, Approximate methods, Mode superposition method, Numerical integration procedures.

UNIT III CONTINUOUS SYSTEMS 9

Dynamics of distributed parameter systems, Free and forced vibration of flexural beams, shear beams and columns.

UNIT IV TRANSIENT AND DYNAMIC RESPONSE OF STRUCTURES 9

Idealisation of structures to mathematical models, Mode superposition method, Numerical integration procedures.

UNIT V SPECIAL TOPICS 9

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

Theory:45 Periods Tutorial: 0 Practical: 0 Total:45 Periods

At the end of the course students should be able to

CO1 : Evaluate the response of SDOF and MDOF systems under dynamic loading.

CO2 : Analyse the continuous systems subjected to free and forced vibration.

CO3 : Familiarize with the various vibration processes and response of structures.

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair												CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	1	1				1		1		2	2	
CO2	3	3	2	1	2				1		1		2	2	
CO3	3	3	2	1	2				1		1		2	2	

Reference Books:

R1. Clough R.W, and Penzien J, Dynamics of Structures, Second Edition, McGraw - Hill International Edition, 2003.

R2. Mario Paz, Structural Dynamics – Theory and Computations, Third Edition, CBS Publishers, 2012.

R3. Manickaselvam, V.K., Elementary Structural Dynamics, Dhanpat Rai & Sons, 2001.

R4. Madhujit Mukhopadhyay, Structural Dynamics: Vibrations & Systems, Ane Books Pvt. Ltd, 2010.

R5. Anil K Chopra, "Dynamics of Structures", Pearson Publication, 2013.

21SE103	STRUCTURAL HEALTH MONITORING	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims to provide the students,

- To impart knowledge on design of connections, industrial structures, light gauge sections and industrial building.

Pre-Requisites:

- Nil

UNIT I INTRODUCTION TO STRUCTURAL HEALTH MONITORING 9

Definition of structural health monitoring (SHM), Motivation for SHM, SHM as a way of making materials and structures smart, SHM and biometrics, Process and pre-usage monitoring as a part of SHM, SHM as a part of system management, Passive and active SHM, NDE, SHM and NDECS, Variety and multi-disciplinary: the most remarkable characters of SHM, Birth of the SHM Community.

UNIT II VIBRATION-BASED TECHNIQUES FOR SHM 9

Basic vibration concepts for SHM, Local and global methods, Damage diagnosis as an inverse problem, Model-based damage assessment, Mathematical description of structural systems with damage, General dynamic behaviour, State-space description of mechanical systems, Modelling of damaged structural elements, Linking experimental and analytical data, Modal Assurance Criterion (MAC) for mode pairing, Modal Scaling Factor (MSF), Co-ordinate Modal Assurance Criterion (COMAC), MECE error localization technique.

UNIT III FIBER-OPTIC SENSORS 9

Classification of fibre-optic sensors, Intensity-based sensors, Phase modulated optical fibre sensors, or interferometers, Wavelength based sensors, Photo elasticity in a plane stress state, Orientation of the optical fibre optic with respect to the reinforcement fibres, Ingress/egress from the laminate, Measurement of strain and stress variations, Measurement of spectral perturbations associated with internal stress release resulting from damage spread, Examples of applications in civil engineering, Stiffened panels with embedded fibre Bragg gratings, Concrete beam repair.

UNIT IV SHM WITH PIEZOELECTRIC SENSORS 9

The use of embedded sensors as acoustic emission (AE) detectors, Algorithms for damage localization, Algorithms for damage characterization, Available industrial AE systems, New concepts in acoustic emission, Sensor technology, Acousto-ultrasonic signal and data reduction methods, Available industrial acousto-ultrasonic systems with piezoelectric sensors, Electromechanical impedance, E/M impedance for defect detection in metallic and composite parts,

The piezoelectric implant method applied to the evaluation and monitoring of visco-elastic properties.

UNIT V SHM USING ELECTRICAL RESISTANCE 9

Composite damage, Electrical resistance of unloaded composite, Percolation concept, Anisotropic conduction properties in continuous fibre reinforced polymer, Influence of temperature, Composite strain and damage monitoring by electrical resistance, uni-directional laminates, Multidirectional laminates, Randomly distributed fibre reinforced polymers, Damage localization.

Theory: 45 Hours Tutorial: 0 Practical: 0 Project: 0 Total:45 Hours

Course Outcomes

At the end of the course students should be able to

CO1 : Diagnose for serviceability and durability aspects of concrete.

CO2 : Suggest the materials and techniques used for repair of structures.

CO3 : Decide the appropriate repair, strengthening, rehabilitation and retrofitting technique required for a case study building.

CO4: Recommend an appropriate health monitoring technique and demolition technique.

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair)													CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs		
CO s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3					2							3	2	
CO2	3	3				3							3	2	
CO3	3	3				3							3	2	
CO4	3	3				2							3	2	

Reference Books:

R1 Daniel Balageas, Claus-Peter Fritzen, Alfredo Güemes, "Structural Health Monitoring", Wiley ISTE, 2006.

R2 Douglas E Adams, "Health Monitoring of Structural Materials and Components-Methods with Applications", John Wiley and Sons, 2007.

R3 J.P. Ou, H.Li and Z.D. Duan, "Structural Health Monitoring and Intelligent Infrastructure", Vol-1, Taylor and Francis Group, London, U.K, 2006.

R4 Victor Giurglutiu, "Structural Health Monitoring with Wafer Active Sensors", Academic Press Inc, 2007.

21SE104 SPECIAL CONCRETE

L	T	P	C
3	0	0	3

Course Objectives:

The course aims to provide the students,

- To learn principles of Concrete mix design, to differentiate between different types of concrete.
- To characterize the high-performance concrete.

Pre-requisites:

- Nil

UNIT I CONCRETE ADMIXTURES 9

Components of modern concrete and developments in the process and constituent materials: Role of constituents - Development in cements and cement replacement materials - pozzolana, fly ash, silica fume, rice husk ash, recycled aggregates, chemical admixtures. Mix proportioning of Concrete: Principles and methods.

UNIT II LIGHT WEIGHT CONCRETE 9

Light Weight concrete: Introduction, classification, properties, strength and durability, mix proportioning and problems. High density concrete: Radiation shielding ability of concrete, materials for high density concrete, mix proportioning, properties in fresh and hardened state, placement methods.

UNIT III FERRO CEMENT 9

Ferro cement: Ferrocement materials, mechanical properties, cracking of ferrocement, strength and behaviour in tension, compression and flexure, Design of ferrocement in tension, ferrocement constructions, durability, and applications.

UNIT IV FIBRE REINFORCED CONCRETE 9

Fibre materials, mix proportioning, distribution and orientation, interfacial bond, properties in fresh state, strength and behaviour in tension, compression and flexure of steel fibre reinforced concrete, mechanical properties, crack arrest and toughening mechanism, applications.

UNIT V HIGH PERFORMANCE CONCRETE 9

Constituents, mix proportioning, properties in fresh and hardened states, applications and limitations. Ready Mixed Concrete-QCI-RMCPC scheme requirements, Self Compacting Concrete, Reactive powder concrete, and bacterial concrete.

Theory: 45 Hours Tutorial: 0 Practical: 0 Project: 0 Total: 45 Hours

Course Outcomes:

At the end of the course students should be able to

CO1: To choose a suitable concrete admixture.

CO2: To design steel-concrete composite elements.

CO3: To design fibre reinforced concrete mix as per ACI standards.

CO4: To suggest composition of Geopolymer and Ferro cement.

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping		
COs	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		2	2			1	1						2	1	
CO2		2	2			1	1						2	1	
CO3		2	2			1	1						2	1	
CO4		2	2			1	1						2	1	

Reference Books:

R1. A.M Paillere, "Applications of Admixtures in Concrete", Taylor & Francis, 2007.

R2. D. J. Oehlers and M. A. Bradford, "Composite Steel and Concrete Structural Members: Fundamental Behaviour", Pergamon, 1995.

R3. Harvinder Singh, "Steel Fibre Reinforced Concrete", Springer, 2017.

R4. J. L. Provis and J. S. J. van Deventer, "Geopolymers: Structures, Processing, Properties and Industrial Applications", CRC Press, 2009

R5. Stanley Abercrombie, "Ferrocement: Building with cement, sand, and wire mesh", Hill Family Books, 2008

21SE105	EXPERIMENTAL TECHNIQUES AND INSTRUMENTATION	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims to provides the students,

- To learn the principles of measurements of static and dynamic response of structures and carryout the analysis of results.

Pre-Requisites:

- Nil.

UNIT I FORCES AND STRAIN MEASUREMENT 9

Choice of Experimental stress analysis methods, Errors in measurements - Strain gauge, principle, types, performance and uses. Photo elasticity - principle and applications - Hydraulic jacks and pressure gauges – Electronic load cells – Proving Rings – Calibration of Testing Machines – Long term monitoring – vibrating wire sensors – Fibre optic sensors.

UNIT II MEASUREMENT OF VIBRATION AND WIND FLOW 9

Characteristics of Structural Vibrations – Linear Variable Differential Transformer (LVDT) – Transducers for velocity and acceleration measurements. Vibration meter – Seismographs – Vibration Analyzer – Display and recording of signals – Cathode Ray Oscilloscope – XY Plotter – wind tunnels – Flow meters – Venturi meter – Digital data Acquisition systems.

UNIT III DISTRESS MEASUREMENTS AND CONTROL 9

Diagnosis of distress in structures – Crack observation and measurements – corrosion of reinforcement in concrete – Half cell, construction and use – damage assessment – controlled blasting for demolition – Techniques for residual stress measurements – Structural Health Monitoring.

UNIT IV NON-DESTRUCTIVE TESTING METHODS 9

Load testing on structures, buildings, bridges and towers – Rebound Hammer – acoustic emission – ultrasonic testing principles and application – Holography – use of laser for structural testing – Brittle coating, Advanced NDT methods – Ultrasonic pulse echo, Impact echo, impulse radar techniques, GECOR , Ground penetrating radar (GPR).

UNIT V MODEL ANALYSIS 9

Model Laws – Laws of similitude – Model materials – Necessity for Model analysis – Advantages – Applications – Types of similitude – Scale effect in models – Indirect model study – Direct model study - Limitations of models – investigations – structural problems –Usage of influence lines in model studies.

Theory: 45 Hours Tutorial: 0 Practical: 0 Project: 0 Total:45 Hours

Course Outcomes:

At the end of the course students should be able to

CO1 : Know about measurement of strain, vibrations and wind blow.

CO2 : Analyse the structure by non-destructive testing methods and model analysis.

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair)													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3											2	
CO2	3	3	3											2	

Reference Books:

R1 Dalley .J. W and Riley. W. F, "Experimental Stress Analysis", McGraw Hill Book Company, N.Y. 1991.

R2 Ganesan.T.P, "Model Analysis of Structures", University Press, India, 2000.

R3 Ravisankar.K. and Chellappan.A., "Advanced course on Non-Destructive Testing and Evaluation of Concrete Structures", SERC, Chennai, 2007.

R4 Sadhu Singh, "Experimental Stress Analysis", Khanna Publishers, New Delhi, 2006.

R5 Sirohi.R.S., Radhakrishna.H.C, "Mechanical Measurements", New Age International (P) Ltd. 1997.

21SE111	STRUCTURAL ENGINEERING PROJECT	L	T	P	C
		0	0	6	3

Course Objectives:

This course aims to provide the students,

- To solve the identified problem based on the formulated methodology.
- To develop skills to analyse and discuss the test results, and make conclusions.

Strategy:

The student should continue project work on the selected topic as per the formulated methodology. At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report should be prepared and submitted to the head of the department. The students will be evaluated through based on the report and the viva-voce examination by a panel of examiners including one external examiner.

Course Outcome:

On completion of the project work students will be in a position to take up any challenging practical problem and find better solutions.

Theory: 15 hours Tutorial: 0 Practical: 60 Hours Project: 0 Total: 75 Hours

21SE112	SPECIAL CONCRETE LABORATORY	L	T	P	C
		0	0	2	1

Course Objectives:

This course aims to provide the students,

-

List of Experiments:

1. Mix proportion for Fibre reinforced Concrete.
2. Slump test on Fibre reinforced concrete.
3. Compaction factor test on Fibre reinforced concrete.
4. Flow table test for Fibre reinforced concrete.
5. Mix proportion for Geopolymer Concrete.
6. Preparation of Geopolymer and cube casting.
7. Find alkalinity of Geopolymer concrete.
8. Compressive strength of Geopolymer Concrete.

Course Outcome:

- On completion of this laboratory course students will be able to analyse the properties of various types of concrete.

Theory: 0 **Tutorial: 0** **Practical: 30 Hours** **Project: 0** **Total: 30 Hours**

21SE113	TECHNICAL SEMINAR	L	T	P	C
		0	0	2	1

Course Objectives:

This course aims to provide the students,

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

Guidelines and Evaluation Pattern:

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

- Technical Presentation and Report : **80 marks**
- Interaction during seminar **: 20 marks**
- Total Marks **: 100 marks**

Course Outcome: The students will be trained to face an audience and to tackle any problem during group discussion in the Interviews.				
Theory: 0	**Tutorial: 0**	**Practical: 30 Hours**	**Project: 0**	**Total: 30 Hours**

SEMESTER – II

21SE201	**DESIGN OF ADVANCED STEEL STRUCTURES**	**L**	**T**	**P**	**C**
		3	**1**	**0**	**4**

Course Objectives:

This course aims to provide the students,

- To impart knowledge on design of connections, industrial structures, light gauge sections and industrial building.

Pre-Requisites:

- Nil.

UNIT I REVIEW OF DESIGN PHILOSOPHIES 9+3

Introduction – Properties of steel - Advantages and disadvantages of steel structures - Types of steel structures – Section Classification – Type of Loads on Structures and Load combinations as per National Standards – Philosophies of Limits State Design, WSD and LRFD - Concepts of Plastic design.

UNIT II BEHAVIOUR AND DESIGN OF CONNECTIONS 9+3

Introduction – Bolted connection – Classification of bolted connections – types of bolts – Design of bearing type of connections – Tension resistance of HSFG bolt - Shear connection using HSFG bolts – Moment Resistant connection. Welded connection – Fundamentals of welding – types of joints and welds – Design of welds – Design of plug and slot welds – Welded connections vs Bolted connection.

UNIT III ANALYSIS AND DESIGN OF INDUSTRIAL BUILDING 9+3

Review of loads on structures – Structural Frame work on Industrial Buildings - Design of Bracing of Industrial building - Analysis and Design of Industrial buildings and bents - Design of Industrial Building - Design of Roof trusses and Purlin – Design of Girder.

UNIT IV ANALYSIS AND DESIGN OF COLD-FORMED STEEL STRUCTURES 9+3

Introduction – Advantages of Cold formed steel sections – Types of Cold formed sections – Types of stiffened and Unstiffened Connections – Load buckling – Codal Provisions on Load buckling of Compressed plates – Treatment of elements with stiffeners – Effective section properties – Proportioning of Stiffeners – Beams – Beams failure criteria – Lateral buckling – Compression of Hot rolled and Cold formed Sections.

UNIT V PLASTIC ANALYSIS OF STRCUTURES 9+3

Basics of Plastic theory – Bending of beams Symmetrical about both axis – Requirement for utilising plastic Design concepts – shape factor – Plastic hinges – Fundamental conditions for Plastic Analysis – Kinematic method applied to frames.

Theory: 45 Hours Tutorial: 15 Hours Practical: 0 Project: 0 Total:60 Hours

Course Outcomes:

At the end of the course students should be able to

CO1 : Understand various design philosophies and design of different types of eccentric bolted and welded connections.

CO2 : Analyse and design of components of industrial buildings and cold formed steel structures.

CO3 : Understand the Plastic Behaviour of Steel structures.

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair)													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2				2		2		3	1	
CO2	1	3	3	3	2				2		2		3	1	
CO3	2	3	3	3	2				2		2		3	1	

Reference Books:

R1 Duggal S.K, Limit State Design of Steel Structures, Tata McGraw Hill, 2010.

R2 Shiyekar M.R, Limit State Design in Structural Steel, Prentice Hall of India, 2011.

R3 Gregory J. Hancock, Thomas Murray, Duane S. Ellifrit, "Cold-Formed Steel Structures to the AISI Specification", CRC Press, 2001.

R4 Subramanian.N, Design of Steel Structures, Oxford University press, 2008.

21SE202	DESIGN OF ADVANCED REINFORCED CONCRETE STRUCTURES	L	T	P	C
		3	0	0	3

Course Objectives:

The course aims to provide the students,

- To impart knowledge on the limit state design of RCC Structural components and to inculcate design methodologies of special structures as per Indian standard code of practice.

Pre-Requisites:

- Nil

UNIT I SERVICEABILITY CRITERIA FOR RC BEAMS AND SLABS 9

Deflection: Introduction– Short Term and Long-Term Deflection of Beams Slabs, Continuous slabs as per IS456 – Deflection due to Imposed Loads. Crack Width: Introduction - Factors affecting Crack width in Beams – Mechanism of Flexural Cracking – Estimation of Crack width in Beams by IS456 and BS8110 – Shrinkage, Creep and Thermal Cracking.

UNIT II DESIGN OF DEEP BEAMS AND CORBEL 9

Introduction to Deep beam – Design of Deep beam by IS 456 – 2000 – Check for failures – Detailing of deep beam. Introduction to corbel – Design of Corbel – Check for failures – Detailing of Corbels.

UNIT III DESIGN OF RIBBED SLABS 9

Introduction – Specification regarding the slabs – Analysis of the Slabs for Moment and Shears – Ultimate Moment of Resistance – Design of Shear – Deflection– Arrangement of Reinforcements.

UNIT IV DESIGN OF FLAT SLABS 9

Yield line theory of slabs – Hiller berg method of design of slabs- Design of Flat slabs and flat Plates according to BIS method-Shear in Flat Slabs and Flat Plates.

UNIT V DESIGN OF SPECIAL STRUCTURES 9

Introduction - Difference between bunker and silo - Design of Bunkers – Design of Silo – Design of RC walls.

Theory: 45 Hours Tutorial: 0 Practical: 0 Project: 0 Total: 45 Hours

Course Outcomes:

At the end of the course students should be able to

CO1 : Calculate short term and long-term deflections for structural elements.

CO2 : Design and detail deep beams, corbel, and flat slabs in accordance with relevant IS code and standards.

CO3 : Design bunkers and silos.

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1		1						1		2	2	
CO2	3	3	1		2						1		2	2	
CO3	3	3	1		2						1		2	2	

Reference Books:

R1. Varghese P.C., "Advanced Reinforced Concrete", Prentice Hall of India, New Delhi, 2009.

R2. Krishna Raju, N., "Advanced Reinforced Concrete Design", CBS Publishers and Distributers, 2008.

R3. Unnikrishnan Pillai S and Menon D., "Reinforced concrete Design", Tata McGraw Hill Book Co., New Delhi, 2003.

R4. N.Subramanian, "Design of Reinforced Concrete Structures" Oxford Publishers, 2013.

R5. Shah V.L., & Karve S.R. "Limit state theory and Design of Reinforced Concrete", Structures Publications, Pune (2003).

R6. Arthur H Nilson, Design of Concrete Structures, Tata McGraw Hill Book Co., 2009.

21SE203 FINITE ELEMENT ANALYSIS

L	T	P	C
3	0	0	3

Course Objectives:

The course aims to provide the students,

- To provide the fundamental concepts of the theory of the finite element method.
- To enable the students to formulate the problems into FEA.
- To introduce basic aspects of finite element technology, including domain discretization, polynomial interpolation, application of boundary conditions, assembly of global arrays, and solution of the resulting algebraic systems.

Pre-Requisites:

- Nil

UNIT I INTRODUCTION TO ELASTICITY 9

Basic equation of solid mechanics – Review of equilibrium conditions – Strain displacement relations – stress strain relations – Equilibrium – Compatibility – Principle of Virtual work and stationary, Potential energy principles – variation principles – Rayleigh Ritz method.

UNIT II DIRECT METHOD 9

Direct method – Element stiffness matrix – Global stiffness matrix – Boundary conditions problems on bars, simple beams, Trusses and frames.

UNIT III ELEMENT PROPERTIES 9

Discretization – Displacement model – Element properties – convergence and compatibility requirements – Node Numbering procedure – Natural coordinate system – Generalized Coordinates – Shape function – Lagrange, elements –stiffness matrix – Nodal load vector - elements in plane stress and plane strain– Static condensation – Simple problems only

UNIT IV ISOPARAMETRIC ELEMENTS 9

Basic principles of Shape Functions - Mapping – Uniqueness of mapping - Sub – Iso – super parametric elements – Numerical integration using Gaussian Quadrature - Examples in one dimension and two dimension implant method applied to the evaluation and monitoring of viscoelastic properties.

UNIT V AXISYMMETRIC STRESS ANALYSIS & NONLINEAR ANALYSIS 9

Analysis of solids of revolution under axisymmetric loading – Formulation of axisymmetric solid element – Simple examples - Types of nonlinearities – Geometric nonlinearity – Material nonlinearity – Introduction to nonlinear solution techniques – Newton Raphson and Modified Newton Raphson methods.

Theory: 45 Hours Tutorial: 0 Practical: 0 Project: 0 Total: 45 Hours

Course Outcomes:

At the end of the course students should be able to

CO1 : Apply the knowledge of fundamentals of elasticity, principles of virtual work and Variational principles.

CO2 : Develop knowledge on element properties to analyse bars, beams, trusses and frames using direct element method and solve problems involving isoparametric elements.

CO3 : To learn about different types of non-linearities and non-linear solution techniques and axisymmetric stress analysis.

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3				2							3	2	
CO2	3	3				3							3	2	
CO3	3	3				3							3	2	

Reference Books:

R1. Krishnamurthy C.S, Finite Element Analysis – Theory and programming, Second edition, Tata McGraw Hill Publishing, 1995.

R2. Desai C.S., Elementary Finite Element Method, Prentice Hall, INC 1979.

R3. N.Subramanian, "Design of Reinforced Concrete Structures" Oxford Publishers, 2013.

R4. Rajasekaran S ., Finite Element Analysis in Engineering Design, Wheeler publishing,2008

R5. Chandrapatla Tirupathi.R and Belegundu, Ashok. D., Introduction to Finite Elements in Engineering, Second edition, Prentice Hall of India, 2014

21SE204	DESIGN OF EARTHQUAKE RESISTANT STRUCTURES	L	T	P	C
		3	0	0	3

Course Objectives:

The course aims to provide the students,

- To study the effect of earthquakes, analysis and design of earthquake resistant Structures.

Pre-Requisites:

- Nil

UNIT I SEISMOLOGY AND EARTHQUAKE 9

Internal structure of the earth, continental drift and plate tectonics, Faults, Elastic rebound theory, seismic waves and characteristics, earthquake size, strong ground motion, seismic zoning map of India, Seismic hazard assessment.

UNIT II EARTHQUAKE RESPONSE 9

Cyclic Behavior of PCC, RCC, Steel and PSC Elements, Earthquake Response to Elastic and Inelastic Buildings – Response Spectrum Theory – Design spectrum – Design principles, Capacity based design, Strong column – weak beam concept, Ductility – Definition, Types, Importance and Requirements.

UNIT III BIS SPECIFICATIONS & SEISMIC ANALYSIS 9

Code Provisions of Design of Buildings as per IS1893 and IS4326 – Behaviour and Design of Masonry Structures as Per IS 13827 and IS13828. Methods of Seismic Analysis: Equivalent static analysis – Response Spectrum method – Time history method – Pushover Analysis.

UNIT IV DUCTILE & DESIGN DETAILING 9

Code Provisions of Ductile Detailing of Structures as per IS13920 – Design of RC beams, columns, Beam column joints and shear walls.

UNIT V SPECIAL TOPICS 9

Base isolation technique, Active and passive control devices, Seismic retrofitting strategies for RC and masonry buildings. Soil Liquefaction.

Theory: 45 Hours Tutorial: 0 Practical: 0 Project: 0 Total: 45 Hours

Course Outcomes:

At the end of the course students should be able to

CO1 : Understand the causes and response of earthquake.

CO2 : Able to design RC beam column joints as per IS Codal provisions.

CO3 : Gain knowledge on retrofitting strategies for RC building and isolation techniques.

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3

CO1	3					2							3	2	
CO2	3	3				3							3	2	
CO3	3	3				3							3	2	
CO4	3	3				2							3	2	

Reference Books:

R1. Pankaj Agarwal and Manish Shrikhande., (2010), Earthquake resistant design of structures, Prentice-Hall India Pvt Ltd., New Delhi.

R2. Duggal S K "Earthquake Resistant Design of Structures", Oxford University Press, 2007.

R3. Mohiuddin Ali Khan "Earthquake-Resistant Structures: Design, Build and Retrofit", Elsevier Science & Technology, 2012.

R4. Bruce A Bolt, "Earthquakes" W H Freeman and Company, New York, 2004.

R5. Paulay,T and Priestley, M.J.N., "Seismic Design of Reinforced Concrete and Masonry buildings", John Wiley and Sons, 1992.

21CC201	**RESEARCH METHODOLGY**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

This course aims to provide the students,

- Ability to critically evaluate current research and propose possible alternate methods for further work.
- Ability to develop hypothesis / Problem Statement and methodology for research.
- Ability to comprehend and deal with complex research issues in order to communicate their scientific results clearly for peer review.

Pre-Requisites:

- Nil

UNIT I INTRODUCTION TO RESEARCH METHODOLOGY 9

Meaning of Research, Types of Research, Research Process, Problem definition, Objectives of Research, Research Questions, Research design, Approaches to Research, Quantitative vs. Qualitative Approach, Understanding Theory, Building and Validating Theoretical Models, Exploratory vs. Confirmatory Research, Experimental vs Theoretical Research, Importance of reasoning in research

UNIT II LITERATURE REVIEW 9

Problem Formulation, Understanding Modelling & Simulation, Conducting Literature Review, Referencing, Information Sources, Information Retrieval, Role of libraries in Information Retrieval, Tools for identifying literatures, Indexing and abstracting services, Citation indexes.

UNIT III DATA COLLECTION AND SAMPLING DESIGN 9

Experimental Research: Cause effect relationship, Development of Hypothesis, Measurement Systems Analysis, Error Propagation, Validity of experiments, Statistical Design of Experiments, Field Experiments, Data/Variable Types & Classification, Data collection, Numerical and Graphical Data Analysis: Sampling, Observation, Surveys, Inferential Statistics, and Interpretation of Results.

UNIT IV RESEARCH REPORTS 9

Preparation of Dissertation and Research Papers, Tables and illustrations, Guidelines for writing the

abstract, introduction, methodology, results and discussion, conclusion sections of a manuscript. References, Citation and listing system of documents.

UNIT V INTELLECTUAL PROPERTY RIGHTS (IPR) AND PATENTS 9

Intellectual property rights (IPR) - patents-copyrights –Trademarks - Industrial design geographical indication. Ethics of Research - Scientific Misconduct - Forms of Scientific Misconduct. Plagiarism, Unscientific practices in thesis work, Ethics in science.

Theory: 45 Hours Tutorial: 0 Practical: 0 Project: 0 Total:45 Hours

Course Outcomes:

At the end of the course students should be able to

CO1 : Recognize the importance of literature review.

CO2 : Identify the different types of research.

CO3 : Formulate problem statement and develop mathematical models for different problems.

CO4 : Formulate methodology of research and experimental analysis.

CO5 : Analyse the results using statistical methods, interpretation of results with reference to similar research outcomes.

CO6: Prepare technical reports and research papers.

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3			1			2					3	1	1	
CO2	1			1								3	1	1	
CO3	1						2					3	1	1	
CO4				1			2					3	1	1	
CO5	1						2					3	1	1	
CO6	1			1			2					3	1	1	

Reference Books:

R1. C.R. Kothari, Research Methodology Methods and Techniques, 2nd Revised edition, New Age.

R2. R. Panneerselvam, “Research Methodology”, PHI 2004.

R3. Deepak Chawla, Neena Sodhi, “Research Methodology concepts and cases” 2nd edition, Vikas Publishing house Pvt ltd.

21SE211 STRUCTURAL ENGINEERING PROJECT

L	T	P	C
0	0	6	3

Course Objectives:

This course aims to provide the students,

- To solve the identified problem based on the formulated methodology.
- To develop skills to analyse and discuss the test results, and make conclusions.

Strategy:

The student should continue project work on the selected topic as per the formulated methodology. At the end of the semester, after completing the work to the satisfaction of the

supervisor and review committee, a detailed report should be prepared and submitted to the head of the department. The students will be evaluated through based on the report and the viva-voce examination by a panel of examiners including one external examiner.

Course Outcome:
On completion of the project work students will be in a position to take up any challenging practical problem and find better solutions.

Theory: 15 hours **Tutorial: 0** **Practical: 60 Hours** **Project: 0** **Total: 75 Hours**

		L	T	P	C
21SE212	**ADVANCED STRUCTURAL ENGINEERING LABORATORY**	**0**	**0**	**4**	**2**

List of Experiments:

1. Fabrication, casting and testing of simply supported reinforced concrete beam for strength and deflection behave Viour.

2. Testing of simply supported steel beam for strength and deflection behaviour.

3. Fabrication, casting and testing of reinforced concrete column subjected to concentric and eccentric loading.

4. **Non-destructive Test on Concrete:**
1. Rebound Hammer test.
2. Ultrasonic Pulse Velocity Tester.

Course Outcome:

- On completion of this laboratory course students will be able to cast and test RC beams for strength and deformation behaviour.
- They will be able to test dynamic testing on steel beams, static cyclic load testing of RC frames and non-destruction testing on concrete.

Theory: 0 **Tutorial: 0** **Practical: 60 Hours** **Project: 0** **Total: 60 Hours**

SEMESTER – III

		L	T	P	C
21SE311	**PROJECT WORK PHASE – I**	**0**	**0**	**12**	**6**

Course Objectives:

This course aims to provide the students,

- To identify a specific problem for the current need of the society and collecting information related to the same through detailed review of literature.
- To develop the methodology to solve the identified problem.
- To train the students in preparing project reports and to face reviews and viva-voce examination.

Strategy:

The student individually works on a specific topic approved by faculty member who is familiar in this area of interest. The student can select any topic which is relevant to his/her specialization of the programme. The topic may be experimental or analytical or case studies. At the end of the semester, a detailed report on the work done should be submitted which contains clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work. The students will be evaluated through a viva-voce examination by a panel of examiners including one external examiner.

Course Outcome:

At the end of the course the students will have a clear idea of his/her area of work and they are in a position to carry out the remaining phase II work in a systematic way.

Theory: 0 Tutorial: 0 Practical: 180 Hours Project: 0 Total: 180 Hours

		L	T	P	C
21SE312	**TECHNICAL SEMINAR**	**0**	**0**	**2**	**1**

Course Objectives:

This course aims to provide the students,

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

Strategy:

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

- Technical Presentation and Report : **80 marks**
- Interaction during seminar **: 20 marks**

- Total Marks **: 100 marks**

Course Outcome:

The students will be trained to face an audience and to tackle any problem during group discussion in the Interviews.

Theory: 0 Tutorial: 0 Practical: 30 Hours Project: 0 Total: 30 Hours

		L	T	P	C
21SE313	**INDUSTRIAL TRAINING**	**0**	**0**	**0**	**1**

Course Objectives:

This course aims to provide the students,

- The students in industry so as to have a first-hand knowledge of practical problems in carrying out engineering tasks. To develop skills in facing and solving the field problems.

Evaluation Procedure:

This course is mandatory and a student has to pass the course to become eligible for the award of degree. The student shall make a presentation before a committee constituted by the department which will assess the student based on the report submitted and the presentation made.

The method of evaluation will be as follows:

- Continuous Assessment (Duration of Training, Report) - 80 marks
- End Semester (Presentation/Viva voce) - 20 marks.

Strategy:

Students have to undergo minimum of one-week practical training in Civil Engineering related organizations of their choice with the approval of the department. At the end of the training student will submit a report as per the prescribed format to the department.

Course Outcome:

Upon the completion of courses, the students will be able to,

CO1 : The intricacies of implementation textbook knowledge into practice

CO2 : The concepts of developments and implementation of new techniques.

SEMESTER - IV

		L	T	P	C
21SE411	**PROJECT WORK PHASE - II**	**0**	**0**	**24**	**12**

Course Objectives:

This course aims to provide the students,

- To solve the identified problem based on the formulated methodology.
- To develop skills to analyse and discuss the test results, and make conclusions.

Strategy:

The student should continue the phase I work on the selected topic as per the formulated methodology. At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report should be prepared and submitted to the head of the department. The students will be evaluated through based on the report and the viva-voce examination by a panel of examiners including one external examiner.

Course Outcome:

On completion of the project work students will be in a position to take up any challenging practical problem and find better solutions.

Theory: 0 Tutorial: 0 Practical: 360 Hours Project: 0 Total:360 Hours

PROFESSIONAL ELECTIVE

ELECTIVE – I

		L	T	P	C
21PSE01	**URBAN PLANNING AND SUSTAINABILITY**	**3**	**0**	**0**	**3**

Course Objectives:

This course aims to provides the students,

- The course aims to give an overall understanding of urban planning, infrastructure planning, Industrialization and various aspects involved in the planning and development of smart cities.

Pre-Requisites:

- Nil.

UNIT I INTRODUCTION TO CITY PLANNING **9**

Overview of planning from prehistory to current - Industrialization and the transformation of Urban Space - Detailed case studies of planned cities - Introduction of Remote sensing, GIS and GPS in urban planning. Smart City Planning.

UNIT II ECONOMY AND ENVIRONMENT **9**

Indian cities and challenges involved in planning -Urban Renewal and Suburbanization - Downtown Redevelopment - Planning for Disaster risk reduction - Energy and Sustainability - Global Sustainability Issues and Climate Change - Concepts of EIA and LCA.

UNIT III PLANNING THEORIES **9**

Theory of city form: normative models –cosmic, machine, organic; Concentric Zone Theory, Sector Theory, Multiple Nuclei Theory - Modes of planning -Land use and land value -Emerging Concepts and Environmental Planning.

UNIT IV **INSTITUTIONAL MECHANISMS** **9**

Planning system in India and changes in institutional provisions over time - authorities and mechanisms for planning, implementation and evaluation - levels of hierarchy. Types of plans – master plans, development plans. Digital Data Integration with Sustainable Smart Cities.

UNIT V **SMART CITIES AND SUSTAINABLE DEVELOPMENT** **9**

Human development and sustainability - Rights of future generations -Climate Change and development - Leveraging recent technologies in enhancing urban living: internet of things (IoT) – Concept of smart cities.

Theory: 45 Hours Tutorial: 0 Practical: 0 Project: 0 Total:45 Hours

Course Outcomes:

At the end of the course students should be able to

CO1 : Understand the concept of urban planning and planning theories.

CO2 : Get a thorough knowledge about various types of plans and techniques for sustainable smart city infrastructure development.

CO3 : Get an idea of recent technologies in urban planning and development.

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair)													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1			2	1						3	1	
CO2	1	1	1			2	1						3	1	
CO3	1	1	1			2	1						3	1	

Reference Books:

R1 Peter Hall, Mark Tewdwr-Jones. (2010), Urban and Regional Planning, Taylor & Francis.

R2 Randall Crane and Rachel Weber (2012), The Oxford Handbook of Urban Planning, Oxford University Press.

R3 Ian Bracken (2009), Urban Planning Methods, Research and Policy Analysis, Routledge, Taylor & Francis.

R4 Eddie N. Laboy-Nieves, Fred C. Schaffner, Ahmed Abdelhadi, Mattheus F.A. Goosen (2008), Environmental Management, Sustainable Development and Human Health, CRC Press, Taylor & Francis.

21PSE02 **INTERNET OF THINGS (IoT) FOR CIVIL ENGINEERING**

L	T	P	C
3	0	0	3

Course Objectives:

This course aims to provides the students,

- To discuss the architecture of IoT, sensors used in IoT and the role of IoT in Environmental Engineering.

Pre-Requisites:

- Nil.

UNIT I **INTRODUCTION** **10**

Definition and functional Requirements – Motivation - Architecture - Web3.0 View of IoT-Ubiquitous IoT applications - Four pillars of IoT - DNA of IoT - The Toolkit approach for End - user participation in the Internet of Things. Middleware for IoT: Overview - Communication middleware for IoT-IoT Information Security.

UNIT II WEB OF THINGS 10

Web of things versus Internet of things - Two pillars of the web - Architecture Standardization for WoT - Unified Multitier WoT Architecture. Cloud of Things: Grid/SOA and cloud computing – Mobile Cloud computing - The cloud of things.

UNIT III IOT SENSORS 9

Introduction – Detectable phenomena - conversion methods - commonly measured quantities - Physical Principles - Selection of sensor - Need for sensor – role of sensor. Types of sensor: Requirements, Advantages, disadvantages and application - Pressures Sensor - Temperature sensor - Humidity sensor - chemical sensor - Accelerometer and gyroscope.

UNIT IV SMART CITY APPLICATION 9

Smart transportation – Intelligent parking - Autonomous Vehicle network. Smart buildings – Energy aware - inter building Navigation. Environmental sensing - Sustainable cities - City insights. Health monitoring of structures - Case studies

UNIT V ENVIRONMENTAL MONITORING 8

Water management – Process – application. Air pollution-Methods - advantages. Water monitoring - quality standards. Indication of calamities - alert systems - applications. Smart irrigation-case study. Micro climate monitoring.

Theory: 45 Hours Tutorial: 0 Practical: 0 Project: 0 Total:45 Hours

Course Outcomes:

At the end of the course students should be able to,

CO1 : Know about sensors used in IoT.

CO2 : Acquire knowledge the role of IoT in smart Cities and Environmental Monitoring.

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair)												CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)											PSOs		
CO s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1		1					1		3	1	
CO2	1	1	1	1		1					1		3	1	

Reference Books:

R1 The Internet of Things in the Cloud: A Middleware Perspective - Honbo Zhou – CRC Press – 2012.

R2 Architecting the Internet of Things - Dieter Uckelmann; Mark Harrison; Florian Michahelles-(Eds.) – Springer – 2011.

R3 Networks, Crowds, and Markets: Reasoning About a Highly Connected World - David Easley and Jon Kleinberg, Cambridge University Press – 2010.

R4 The Internet of Things: Applications to the Smart Grid and Building Automation by - Olivier Hersent, Omar Elloumi and David Boswarthick - Wiley - 2012.

R5 Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things – Key applications and Protocols", Wiley, 2012.

21PSE03	DESIGN OF STRUCTURES FOR DYNAMIC LOADS	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims to provides the students,

- To impart knowledge on behaviour and design concepts for dynamic loads as per codal provisions and to learn about ductile detailing.

Pre-Requisites:

- Nil.

UNIT I GENERAL 9

Design philosophy to resist earthquake, cyclone, flood, blast and impact - National and International codes of practice – Behaviour of concrete, steel, masonry and soil under impact and cyclic loads- Energy absorption capacity – Ductility of material and the structure.

DESIGN AGAINST CYCLONE AND FLOOD: Effect of cyclones on buildings and special structures – safety and precautionary steps in design.

UNIT II DESIGN AGAINST EARTH-QUAKES 9

Characteristics of internal and external blast - Impact and impulse loads- Explosions- Threats – wave scaling law – Fire loading – restraints – Pressure distribution on buildings above ground due to external blast – underground explosion - Design of buildings for blast , fire and impact as per BIS code of practice.

UNIT III DESIGN AGAINST BLAST AND IMPACT 9

Characteristics of internal and external blast - Impact and impulse loads- Explosions- Threats – wave scaling law – Fire loading – restraints – Pressure distribution on buildings above ground due to external blast – underground explosion - Design of buildings for blast , fire and impact as per BIS code of practice.

UNIT IV DESIGN AGAINST WIND 9

Characteristics of wind – Basic and design wind speeds Aeroelastic and Aerodynamic effect - Design as per BIS code of practice including Gust factor approach-along wind and across wind response- effect on tall buildings, towers, chimneys, roofs, window glass, Cladding and slender structures - vibration of cable supported bridges and power lines due to wind effects- tornado effects.

UNIT V SPECIAL CONSIDERATIONS 9

Detailing for ductility – Passive and active control of vibrations – New and favourable materials - Response of dams, bridges, buildings- strengthening measures-safety analysis- methods of strengthening for different disasters - Maintenance and modifications to improve hazard resistance.

Theory:45 Periods Tutorial: 0 Practical: 0 Total:45 Periods

At the end of the course students should be able to

CO1 : Know the factors affecting design dynamic loads like earthquake, blast and impact.

CO2 : Design the structures against dynamic loads using BIS codes of practice.

CO3 : Have in-depth knowledge on the concepts of favourable materials for ductility-based designing of structure along with strengthening methods.

CO/PO MAPPING (S/M/W indicates strength of correlation)	CO/PSO

Approved by BoS Chairman

3-Strong, 2-Moderate, 1-Fair													Mapping		
CO s	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2				2		2		3	1	
CO2	1	3	3	3	2				2		2		3	1	
CO3	2	3	3	3	2				2		2		3	1	

Reference books:

R1. Raiker.R.N. Learning from failure Deficiencies in Design, Construction and Service, R & D Centre(SDCPL) Raiker Bhavan, Bombay , 1987.

R2. Bela Goschy, "Design of Buildings to withstand abnormal loading", Butterworhts, 1990.

R3. Paulay.T and Priestly. M.N.J, "A seismic Design of Reinforced Concrete and Masonry Buildings", John Wiley and Sons, 1991.

R4. Alan G. Daven Port, "Wind Effects on Buildings and Structures", Proceedings of the Jubileum Conference on Wind effects on Structures", Port Alegne, Brazil, pp 25-29, May 1998, Balkema A.A. Publishers, 1998.

R5. Concrete Structures Under Impact and Impulsive loading, Synthesis Report, CEB. Lousanne, Germany, 1988.

21PSE04 **SUBSTRUCTURE DESIGN**

L	T	P	C
3	0	0	3

Course Objectives:

This course aims to provides the students,

- To discuss and evaluate the feasibility of foundation solutions to different types of soil conditions considering the time effect on soil behaviour and to build the necessary theoretical background for design and construction of foundation systems.

Pre-Requisites:

- Nil.

UNIT I INTRODUCTION **9**

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**

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

UNIT III DESIGN OF DEEP FOUNDATION **9**

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**

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**

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

Theory: 45 Hours Tutorial: 0 Practical: 0 Project: 0 Total:45 Hours

Course Outcomes:

At the end of the course students should be able to

CO1 : Interpret subsurface information and to identify a suitable foundation system for a structure.

CO2 : To design shallow and deep foundations for various types of structures.

CO3 : To analyse and design foundations for special structures such as tall towers, bridges and machines.

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair)												CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)											PSOs		
CO s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1			2	1						3	1	
CO2	1	1	1			2	1						3	1	
CO3	1	1	1			2	1						3	1	

Reference Books:

R1 Thomlinson.M.J and Boorman.R, "Foundation design and construction" ELBS Longman VI Edition, 1995.

R2 Swamisaran , "Analysis and design of substructures", Limit state design Oxford and IBH Publishing Co. Pvt. Ld , NewDelhi, 1996.

R3 API, Recommended Practice for Planning, Designing and Constructing Fixed Offshore Plat- forms, American Petroleum Institute Publication, RP2A, Dalls, Tex.

R4 Nayak.N.V, " Foundation design manual for practicing engineers ", Dhanpat Rai & Sons, 1982.

21PSE05 INDUSTRIAL STRUCTURES

L	T	P	C
3	0	0	3

Course Objectives:

This course aims to provides the students,

- The requirements, Planning and Design of Industrial Structures.

Pre-Requisites:

- Nil.

UNIT I PLANNING AND FUNCTIONAL REQUIREMENTS 9

Classification of Industries and Industrial structures - planning for Layout Requirements regarding Lighting, Ventilation and Fire Safety - Protection against noise and vibration - Guidelines of Factories Act.

UNIT II INDUSTRIAL BUILDINGS 9

Steel and RCC - Gantry Girder, Crane Girders - Design of Corbels and Nibs – Design of Staircase.

UNIT III POWER PLANT STRUCTURES 9

Types of power plants – Containment structures - Cooling Towers - Bunkers and Silos – Pipe supporting structures

UNIT IV TRANSMISSION LINE STRUCTURES AND CHIMNEYS 9

Analysis and design of transmission line towers - Sag and Tension calculations, Testing of towers – Design of self supporting chimney, Design of Chimney bases.

UNIT V FOUNDATION 9

Design of foundation for Towers, Chimneys and Cooling Towers - Machine Foundation - Design of Turbo Generator Foundation.

Theory: 45 Hours Tutorial: 0 Practical: 0 Project: 0 Total:45 Hours

Course Outcomes:

At the end of the course students should be able to

CO1 : Plan industrial structures for functional requirements.

CO2 : Design various structures such as Bunkers, Silos, Cooling Towers, Chimneys, and Transmission Towers with required foundations.

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair)													CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs		
CO s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3											2	
CO2	3	3	3											2	

Reference Books:

R1 Jurgen Axel Adam, Katharria Hausmann, Frank Juttner, Klauss Daniel, "Industrial Buildings: A Design Manual", Birkhauser Publishers, 2004.

R2 Manohar S.N, "Tall Chimneys - Design and Construction", Tata McGraw Hill, 1985

R3 Santhakumar A.R. and Murthy S.S., "Transmission Line Structures", Tata McGraw Hill, 1992.

R4 Srinivasulu P and Vaidyanathan.C, "Handbook of Machine Foundations", Tata McGraw Hill, 1976.

PROFESSIONAL ELECTIVE - II

21PSE06 ADVACNED CONCRETE TECHNOLOGY

L	T	P	C
3	0	0	3

Course Objectives:

This course aims to provides the students,

- To impart knowledge basic constituents materials of concrete, Cement and concrete properties.
- To impart the quality assurance and maintenance of concrete.
- To understand about the Construction of concrete for special processes.

Pre-Requisites:

- Nil.

UNIT I CONSTITUENT MATERIALS OF CONCRETE 9

Constituent materials of structural concrete, including: material types and production - Physical and chemical characteristics; coverage in codes and standards - Impact on fresh and hardened concrete properties; and contributions to carbon foot print and sustainability.

UNIT II DURABILITY PROPERTIES 9

Durability concept - factors affecting, reinforcement corrosion - fire resistance - frost damage - sulphate attack - alkali silica reaction - concrete in sea water - statistical quality control - acceptance criteria as per BIS code.

UNIT III NON-DESTRUCTIVE TESTING 9

Surface Hardness – Ultrasonic - Penetration resistance - Pull-out test - chemical testing for chloride and carbonation - core cutting - measuring reinforcement cover.

UNIT IV SPECIAL CONCRETE 9

Lightweight concrete - description of various types - High strength concrete - Self compacting concrete - Roller compacted concrete – Ready mixed concrete – Fibre reinforced concrete – polymer concrete.

UNIT V CONCRETE PRODUCTION, SPECIAL PROCESSES FOR PARTICULAR TYPES OF STRUCTURES 9

Sprayed concrete - underwater concrete - mass concrete - slip form construction - Prefabrication technology.

Theory: 45 Hours Tutorial: 0 Practical: 0 Project: 0 Total:45 Hours

Course Outcomes:

At the end of the course students should be able to

CO1: Understand the constituent materials of structural concrete.

CO2: Understand the quality control and testing methods of concrete.

CO3: Gain ideas on non-destructive testing of concrete.

CO4: Acquire knowledge about various types of concrete.

CO5: Acquire knowledge about production of concrete for Special purposes.

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair)													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	3						1		2		3	2	
CO2	2	3	3						1		2		3	2	
CO3	2	3	3						1		2		3	2	
CO4	2	3	3						1		2		3	2	
CO5	2	3	3						1		2		3	2	

Reference Books:

R1 Shetty M.S., “Concrete Technology (Theory and Practice)”, S. Chand & Co. Ltd, 2008.

R2 Krishnaraju, N., “Advanced Concrete Technology”, CBS Publishers, 2010.

R3 Nevile, A. M., “Concrete Technology”, Prentice Hall, 2010.

R4 Santhakumar A.R., “Concrete Technology”, Oxford University Press India, 2006.

21PSE07 ENERGY EFFICIENT BUILDINGS

L	T	P	C
3	0	0	3

Course Objectives:

This course aims to provides the students,

- This course aims to provide an understanding of the concept of reduction in energy consumption through low energy building design.
- Highlight strategies to integrate day lighting and low energy heating/cooling in buildings.

Pre-Requisites:

- Nil.

UNIT I GREEN BUILDINGS, ENERGY AND ENVIRONMENT 9

Green Buildings within the Indian Context, Types of Energy, Energy Efficiency and Rebound Effect, Pollution, Better Buildings, Reducing energy consumption, Low energy design.

UNIT II RENEWABLE ENERGY SOURCES 9

Solar energy, Passive Solar Heating, Passive Solar collection, Wind and other renewable. A passive solar strategy: Direct gain - Trombe wall, convective air loop, Photovoltaic's, Climate and Energy, Macro and Microclimate - Indian Examples.

UNIT III HEATING AND COOLING 9

Building Form Surface area and Fabric Heat Loss, utilizing natural energy, Internal Planning, Grouping of buildings – Robin's Spatial Proportion – Orientation of building –Heat transmission through buildings –Thermal properties of building materials – Thermal Comfort –Psychrometric Chart –Heat transfer – Cosine Effect - Insulation - Cooling buildings, passive cooling, and mechanical cooling – Measurement of heating and cooling loads.

UNIT IV DAY LIGHTING AND ARTIFICIAL LIGHTING 9

Illumination requirements - Concepts of daylight factors and day lighting, daylight assessment, sky dome - sun path diagram, sky exposure angle, sun protection, shading coefficient, visualising day lighting: Source-Path - Target and apparent size ,illuminance calculation, penetration and spread of sky component, artificial lighting, efficacy, Radiant barriers - new light sources – luminaries - light shelves - Supplementary artificial lighting design – light distribution – electric lighting control.

UNIT V ENERGY ASSESSMENT AND COMPLIANCES PROCEDURES 9

Energy awareness, monitoring energy consumption, Building Environmental Assessment environmental criteria – embodied energy of building materials - assessment methods - assessment tools (e.g. GRIHA, LEED) – Eco-homes - Sustainable architecture and urban design – principles of environmental architecture.

Theory: 45 Hours Tutorial: 0 Practical: 0 Project: 0 Total:45 Hours

Course Outcomes:

At the end of the course students should be able to

CO1 : Understand the concept and theoretical background of low energy building design

CO2 : Apply simulation tools to achieve energy efficiency in buildings

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair)													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1		1					1		3	1	
CO2	1	1	1	1		1					1		3	1	

Reference Books:

R1 SatyajitGhosh and Abhinav Dhaka (2015), "Green Structures: Energy Efficient Buildings", Ane Books.

R2 MoncefKrarti (2016), "Energy Audit of Building Systems: An Engineering Approach", Second Edition.

R3 LalJayamaha (2006), "Energy-Efficient Building Systems: Green Strategies for Operation and Maintenance", McGraw Hill Professional.

R4 Ian M. Shapiro (2016), "Energy Audits and Improvements for Commercial Buildings", John Wiley & Sons.

21PSE08	DESIGN OF BRIDGES	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims to provides the students,

- To study the loads, forces on bridges and design of several types of bridges.

Pre-Requisites:

- Nil.

UNIT I **GENERAL INTRODUCTION AND SHORT SPAN RC BRIDGES** **9**

Types of bridges and loading standards - Choice of type - I.R.C. specifications for road bridges – Design of RCC solid slab bridges - analysis and design of slab culverts, Tee beam and slab bridges.

UNIT II **LONG SPAN RC BRIDGES** **9**

Design principles of continuous girder bridges, box girder bridges, balanced cantilever bridges – Arch bridges – Box culverts – Segmental bridges.

UNIT III **PRESTRESSED CONCRETE BRIDGES** **9**

Flexural and torsional parameters – Courbon's theory – Distribution co-efficient by exact analysis – Design of girder section – maximum and minimum prestressing forces – Eccentricity – Live load and dead load shear forces – Cable Zone in girder – check for stresses at various sections – check for diagonal tension – Diaphragms – End block – short term and long term deflections.

UNIT IV **STEEL BRIDGES** **9**

General – Railway loadings – dynamic effect – Railway culvert with steel beams – Plate girder bridges – Box girder bridges – Truss bridges – Vertical and Horizontal stiffeners.

UNIT V **BEARINGS AND SUBSTRUCTURES** **9**

Different types of bearings – Design of bearings – Design of piers and abutments of different types – Types of bridge foundations – Design of foundations.

Theory: 45 Hours **Tutorial: 0** **Practical: 0** **Project: 0** **Total:45 Hours**

Course Outcomes:

At the end of the course students should be able to

CO1 : Gain knowledge on different types and loading pattern on bridges.

CO2 : Design different types of bridges.

CO3 : Design bearings and sub structure for the bridges.

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair)													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2									1		3	1	
CO2	2	2									1		3	1	

Approved by BoS Chairman

CO3	2	2									1		3	1	

Reference Books:

R1 Jagadeesh.T.R. and Jayaram.M.A., "Design of Bridge Structures", Prentice Hall of India Pvt. Ltd. 2004

R2 Johnson Victor, D. "Essentials of Bridge Engineering", Oxford and IBH Publishing Co. New Delhi, 2001.

R3 Ponnuswamy, S., "Bridge Engineering", Tata McGraw Hill, 2008

R4 Raina V.K." Concrete Bridge Practice" Tata McGraw Hill Publishing Company, New Delhi, 1991.

		L	T	P	C
21PSE09	**DESIGN OF STEEL CONCRETE COMPOSITE STRUCTURES**	**3**	**0**	**0**	**3**

Course Objectives:

This course aims to provides the students,

- To impart Knowledge on design of composite beams, columns, trusses and box girder bridges including the related connections.

Pre-Requisites:

- Nil.

UNIT I FUNDAMENTALS 9

Constituent materials of structural concrete, including: material types and production - Physical and chemical characteristics; coverage in codes and standards - Impact on fresh and hardened concrete properties; and contributions to carbon foot print and sustainability.

UNIT II COMPOSITE SLABS AND BEAMS 9

Introduction to steel-concrete composite construction – Design Philosophy - Advantages – Types of composite construction – Basic concepts of composite structures - Material properties under static loads and dynamic loads.

Shear connection - Methods – Properties - Partial interaction - Effect of slip on stresses and deflection – Longitudinal shear in compression slabs.

UNIT III COMPOSITE SLABS AND BEAMS 9

Composite floor slabs - conventional composite beams - resistance to sagging bending, longitudinal shear and vertical shear – stresses in service – design examples. Continuous.

UNIT IV COMPOSITE TRUSSES 9

Composite Trusses – Behaviour and Design - Design of connections - case studies on steel concrete composite construction in buildings – seismic Behaviour.

UNIT V SPECIAL STRUCTURES 9

Steel sandwich construction- Box Girder Bridge - Case studies – seismic Behaviour - Different codal provisions - Fabrication and erection of structures including heavy structures, Prefab construction, and Industrialized construction.

Theory: 45 Hours Tutorial: 0 Practical: 0 Project: 0 Total:45 Hours

Course Outcomes:

At the end of the course students should be able to

CO1 : Acquire sufficient knowledge on behaviour of composite structures under various loads.

CO2 : Select appropriate design methods for composite structures such as slabs, beams, columns, frames and trusses including connecting elements.

CO3 : Gain thorough knowledge about construction sequence of special composite structures.

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair)													CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs		
CO s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	2	2	2	3							3	1	
CO2	2	3	2	2	2	3							3	1	
CO3	2	3	2	2	2	3							3	1	

Reference Books:

R1 Johnson R.P., "Composite Structures of Steel and Concrete", Blackwell Scientific Publications, UK, 1994.

R2 Owens G.W. and Knowles P., "Steel Designers Manual", Fifth Edition, Steel Concrete Institute, UK, Oxford Blackwell Scientific Publications, 1992.

R3 Workshop on Steel – concrete Composite Structures, conducted at Anna University, chennai, 2000.

R4 IS: 11384 -1985 Code of Practice for Steel concrete Composite structures.

21PSE10 SOIL STRUCTURE INTERACTION

L	T	P	C
3	0	0	3

Course Objectives

This course aims to provides the students,

- To get an idea on soil structure interaction, soil foundation models, finite difference and finite element analysis and elastic analysis of piles and piled raft.

UNIT I SOIL - FOUNDATION INTERACTION 9

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, Time dependent behaviour.

UNIT II BEAMS ON ELASTIC FOUNDATION - SOIL MODELS 9

Infinite beam, Two parameters, Isotropic elastic half space, Analysis of beams of finite length, Classification of finite beams in relation to their stiffness – Analysis through application packages.

UNIT III PLATE ON ELASTIC MEDIUM 9

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, Analysis of braced cuts – Application packages.

UNIT IV ELASTIC ANALYSIS OF PILE 9

Elastic analysis of single pile, Theoretical solutions for settlement and load distribution, Analysis of pile group, Interaction analysis, Load distribution in groups with rigid cap – Pile raft – Application packages.

UNIT V LATERALLY LOADED PILE 9

Load deflection prediction for laterally loaded piles, subgrade reaction and elastic analysis, Interaction analysis, pile raft system, solutions through influence charts - Application packages.

Theory: 45 Hours Tutorial: 0 Practical: 0 Project: 0 Total:45 Hours

Course Outcomes

At the end of the course students should be able to

CO1 : Understand various soil response models applicable to soil-foundation interaction analysis.

CO2 : Come up with elastic solutions for problems of pile, pile-raft system.

CO3 : Use software packages to analyse soil-foundation system including laterally loaded piles.

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair)													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	2	2	2	1					2		3	1	
CO2	1	1	2	2	2	1					2		3	1	
CO3	1	1	2	2		1					2		3	1	

Reference Books

R1 Saran, S., Analysis and design of substructures, Taylor & Francis Publishers, 2006.

R2 Murthy, V.N.S., Advanced Foundation Engineering, CBS Publishers, New Delhi, 2007.

R3 McCarthy, R.N., Essentials of Soil Mechanics and Foundations: Basic Geotechnics, Sixth Edition, Prentice Hall, 2002.

R4 Scott, R.F., Foundation Analysis, Prentice Hall, 1981.

R5 Structure Soil Interaction – State of Art Report, Institution of structural Engineers, 1978.

PROFESSIONAL ELECTIVE - III

21PSE11 DESIGN OF PLATES AND SHELLS

L	T	P	C
3	0	0	3

Course Objectives:

This course aims to provides the students,

- To impart knowledge on structural behaviour and analysis of different types of plates and shells under different boundary conditions.

Pre-Requisites:

- Nil.

UNIT I LATERALLY LOADED PLATES 9

Thin Plates with Small Defection. Laterally Loaded Thin Plates, Governing Differential Equation, Boundary Conditions. Rectangular Plates Simply Supported Rectangular Plates, Navier Solution and Levy's Methods, Plates with Various Edge Conditions - Symmetrical Bending of Circular Plates, Plates on Elastic Foundation.

UNIT II NUMERICAL METHODS 9

Finite Difference Method – Isotropic Rectangular plates – Boundary Conditions – All-round simply supported square plate, clamped square plate and fixed square plate subjected to uniformly distributed load.

UNIT III ANISOTROPIC PLATES AND THICK PLATES 9

Orthotropic Plates and Grids, Moderately Thick Plates.

UNIT IV MEMBRANE THEORY OF SHELLS 9

Classification of Shells - Types of Shells - Structural Action - Membrane Theory - Shells of Revolution and Shells of Translation - Examples - Limitations of Membrane Theory.

UNIT V FOLDED PLATES 9

Folded Plate structures - structural behaviour and analysis - Types - Design by ACI - ASCE Task Committee method.

Theory: 45 Hours Tutorial: 0 Practical: 0 Project: 0 Total:45 Hours

Course Outcomes:

At the end of the course students should be able to

CO1 : Analyse the laterally loaded plates, anisotropic plates and thick plates

CO2 : Apply various numerical methods for analysis of plates.

CO3 : Analyse and design of shells and folded plates.

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair)													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2		3	2	2								3	1	
CO2	2		3	2	2								3	1	
CO3	2		3	2	2								3	1	

Reference Books:

R1 Szilard, R., "Theory of Analysis of Plates", Prentice Hall Inc. 2004.

R2 Timoshenko, S. and Krieger S.W. "Theory of Plates and Shells", McGraw Hill Book Company,1990.

R3 Wilhelm Flügge, "Stresses in shells", Springer – Verlag, 1988.

R4 Ramasamy, G.S., "Design and Construction of Concrete Shells Roofs", CBS Publishers,1986.

21PSE12 WIND AND CYCLONE EFFECTS ON STRUCTURES

L	T	P	C
3	0	0	3

Course Objectives:

This course aims to provides the students,

- A better understanding about concept of wind and cyclone effects for the analysis and design of structures.

Pre-Requisites:

- Nil.

UNIT I INTRODUCTION 9

Introduction, Types of wind – Characteristics of wind – Wind velocity, Method of measurement, variation of speed with height, shape factor, aspect ratio, drag effects - Dynamic nature of wind – Pressure and suctions - Spectral studies, Gust factor

UNIT II WIND TUNNEL STUDIES 9

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

UNIT III EFFECT OF WIND ON STRUCTURES 9

Classification of structures – Rigid and Flexible – Effect of wind on structures - Static and dynamic effects on Tall buildings – Chimneys.

UNIT IV DESIGN OF SPECIAL STRUCTURES 9

Design of Structures for wind loading – as per IS, ASCE and NBC code provisions – design of Tall Buildings – Chimneys – Transmission towers – Industrial sheds

UNIT V CYCLONE EFFECTS 9

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

Theory: 45 Hours Tutorial: 0 Practical: 0 Project: 0 Total:45 Hours

Course Outcomes:

At the end of the course students should be able to

CO1 : Design high rise structures subjected wind load, even structures exposed to cyclone.

CO2 : Conversant with various code provisions for the design of structures for wind load.

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair)													CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs		
CO s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3											2	
CO2	3	3	3											2	

Reference Books:

R1 Cook.N.J., "The Designer's Guide to Wind Loading of Building Structures", Butterworths,1989.

R2 Kolousek.V, Pirner.M, Fischer.O and Naprstek.J,"Wind Effects on Civil Engineering Structures", Elsevier Publications, 1984.

R3 Lawson T.V., "Wind Effects on Building Vol. I and II", Applied Science Publishers, London, 1980.

R4 Peter Sachs, "Wind Forces in Engineering", Pergamon Press, New York, 1972

21PSE13	DESIGN OF PRE STRESSED CONCRETE ELEMENTS	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims to provides the students,

- To impart knowledge on the basic principles of Prestressed concrete members and design.

Pre-Requisites:

- Nil.

UNIT I ANALYSIS OF BEAMS AND LOSSES IN PRESTRESS 9

Principles of prestressing – Different systems of prestressing – Materials and Allowable stresses – Elastic Design of prismatic beams – Simple cable profile Design of beams for shear. Losses And Deflection In Beams - Losses in prestress - Deflections –Short Term and Long Term deflection.

UNIT II DESIGN OF TENSION AND COMPRESSION MEMBERS 9

Design of compression and tension members – Design of Compression members with bending End Block - Introduction- Stress Distribution in End Block – Anchorage Zone Stresses - Design of end block – Guyon's method, Magnel's method – IS 1343 recommendations.

UNIT III CONTINOUS BEAMS AND COMPOSITE CONSTRUCTION 9

Concept of concordance and Linear Transformation – Elastic analysis of continuous beams– Sketching of pressure lines for continuous beams and single span single storey rigid frames – Load balancing method - Design of continuous beams. Composite construction – Types and behaviour – Analysis and design for flexure and shear – Differential shrinkage.

UNIT IV SPECIAL TOPICS 9

One way slabs – Two way slabs – Circular prestressing – Prestressed concrete pipes – Analysis and design of liquid retaining tanks – Design of prestressed concrete sleepers and poles.

UNIT V LIMIT STATE DESIGN 9

Safety and Serviceability requirements – Partial safety factors – Limit state Design of beams in flexure and shear – Limit state Design of Compression members. Non prestressed reinforcements – partial prestressing.

Theory: 45 Periods Tutorial: 0 Practical: 0 Total: 45 Periods

Course Outcomes:

At the end of the course students should be able to

CO1 : Learn the principles of prestressing and to analyse and design the PSC beam sections.

CO2 : Analyse and design pre-stressed concrete tension members, compression members, statically indeterminate structures, composite beams, pipes, sleepers, tanks and end blocks.

CO3 : To learn LSD of PSC beams and compression members.

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair												CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3

CO1	2	2		2	2	1					1		2	1	
CO2	2	2		2	2	1					1		2	1	
CO3	2	2		2	2	1					1		2	1	

Reference Books

R1. Lin.T.Y. and Ned.H.Burns, Design of Prestressed concrete structures (S.I Version), John wiley & Sons Inc., New York, 1982.

R2. Sinha.N.C. and Roy.S.K. Fundamentals of prestressed Concrete, S.Chand and Co., 1985.

R3. Krishnaraju N., Prestressed Concrete, Tata McGraw Hill publishing Co.Ltd. New Delhi, 1986.

R4. Leonhardt.F. Prestressed Concrete Design and Construction, Wiley Ernst and Sons, 1964.

R5. Mallick S.K and Gupta A.P., Prestressed Concrete, Oxford and IBH Publishing Company Pvt.Ltd. New Delhi, 1986.

		L	T	P	C
21PSE14	**COMPUTER METHODS OF STRUCTURAL ANALYSIS**	**3**	**0**	**0**	**3**

Course Objectives:

This course aims to provides the students,

- To analyse the structures by matrix methods and energy concepts.

Pre-Requisites:

- Nil.

UNIT I FUNDAMENTAL CONCEPTS 9

Force and displacement measurement – Generalized or Independent measurement – Constrained or Dependent measurements – Principle of superposition – Stiffness and flexibility matrices in

UNIT II ENERGY CONCEPTS AND TRANSFORMATION OF INFORMATION 9

Strain energy in terms of stiffness & flexibility matrices – Betti's law – Application of Betti's law - Computing displacements and forces from virtual work – other energy theorems - Transformation of forces and displacements in general – Stiffness and flexibility in general - Normal coordinates and orthogonal transformation – Principle of contra gradience.

UNIT III FLEXIBILITY METHOD 9

Statically determinate structures – Indeterminate structures – Choice of redundants leading to ill and well-conditioned matrices Transformation to one set of redundants 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 IV STIFFNESS METHOD 9

Introduction – Development of the stiffness method – Analogy between flexibility and stiffness – lack of fit – Application of stiffness approach to pin jointed plane truss – Continuous beams – Frames – Grids – Space frames introduction only – Static condensation technique - Direct stiffness approach.

UNIT V ANALYSIS BY SUBSTRUCTURING AND ITERATION 9

Analysis by sub-structuring technique using the stiffness and the flexibility method with tridiagonalization. Iteration method for frames with non-prismatic members – Computer program

for the analysis of rigidly connected beams.

Theory: 45 Hours Tutorial: 0 Practical: 0 Project: 0 Total:45 Hours

Course Outcomes:

At the end of the course students should be able to

CO1 : Fundamental principles to evaluate the characteristics of structures and Use energy concepts to analyse the structures

CO2 : Apply the flexibility matrix method and stiffness matrix for the solution of beams, trusses and frames.

CO3 : Perform complex analysis procedures such as sub structuring and iteration techniques.

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair)													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	1									3	1	
CO2	2	2	1	1									3	1	
CO3	2	2	1	1									3	1	

Reference Books:

R1 William McGuire, Richard H. Gallagher, Ronald D. Ziemian, "Matrix structural Analysis", Wiley, 2015.

R2 Pandit G.S, Gupta S.P, "Structural Analysis - A matrix Approch", Tata McGraw Hill Publishing Company Ltd, 2008.

R3 Manicka Selvam V.K, "Elements of Matrix Stability Analysis of structures", Khanna Publishers, 2006.

R4 Rajasekaran S. and, Sankarasubramanian G., "Computational Structural Mechanics", PHI Learning Pvt. Ltd, 2001.

21PSE15 BRIDGE MAINTENANCE AND MANAGEMENT **L T P C**
3 0 0 3

Course Objectives:

This course aims to provides the students,

- To introduce the concepts of monitoring, testing and maintaining bridge structures in their life span.

Pre-Requisites:

- Nil.

UNIT I INTRODUCTION **9**

Bridge maintenance management - The system - Inspection - Inspection equipment - planning - condition rating.

UNIT II ASSESSMENT AND EVALUATION **9**

Basic consideration - structural safety - analysis method - Reliability concepts.

UNIT III NON-DESTRUCTIVE TESTING **9**

Concrete Elements - Corrosion analysis equipment's - Resistivity measurements - Rebar locators - Ultrasonic testing - Rebound hammer - carbonation test – permeability testing - internal fracture tester - impulse radar - infrared thermography - Endoscopy - Impact echo - Radiography - coring -

steel elements - masonry elements.

UNIT IV BRIDGE DETERIORATION 9

Basic Theory - Discount rate - Traffic disruption - Future development - maintenance strategy - performance profiles - whole life assessment.

UNIT V STRESSS MEASUREMENTS AND BRIDGE MONITORING 9

In - situ residual stresses - stress relief principle - Indirect stress management - Live load stresses - Monitoring - scour sensing - load cells - displacement transducers - Traffic monitoring.

Theory: 45 Hours Tutorial: 0 Practical: 0 Project: 0 Total:45 Hours

Course Outcomes:

At the end of the course students should be able to

CO1 : Understand the Philosophy under the bridge maintenance and management.

CO2 : Understand the testing assessment and monitoring of bridge structures.

CO3 : Analyse the stress monitoring in bridge structures.

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair)													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2									1		3	1	
CO2	2	2									1		3	1	
CO3	2	2									1		3	1	

Reference Books:

R1 Ryall .M J, "Bridge Management", Butterworth Heinemann, Oxford, 2009.

R2 Proc. First “International Conference on Bridge Management” (1990). Elsevier, London.

R3 Proc. Second “International Conference on Bridge Management” (1993). Thomas Telford, London.

R4 Proc. Third “International Conference on Bridge Management” (1996). F & N Spon, London.

R5 Proc. Fourth “International Conference on Bridge Management” (2000). Thomas Telford, London.

PROFESSIONAL ELECTIVE - IV

21PSE16 OFFSHORE STRUCTURES

L	T	P	C
3	0	0	3

Course Objectives:

This course aims to provides the students,

- The concept of wave theories, forces and design of jacket towers, pipes and cables.

Pre-Requisites:

- Nil.

UNIT I WAVE THEORIES 9

Wave generation process, small, finite amplitude and nonlinear wave theories.

UNIT II FORCES OF OFFSHORE STRUCTURES 9

Wind forces, wave forces on small bodies and large bodies - current forces and use of Morison equation.

UNIT III OFFSHORE SOIL AND STRUCTURE MODELLING 9

Different types of offshore structures, foundation modelling, fixed jacket platform structural modelling.

UNIT IV ANALYSIS OF OFFSHORE STRUCTURES 9

Static method of analysis, foundation analysis and dynamics of offshore structures.

UNIT V DESIGN OF OFFSHORE STRUCTURES 9

Design of platforms, helipads, Jacket tower, analysis and design of mooring cables and pipe lines.

Theory: 45 Hours Tutorial: 0 Practical: 0 Project: 0 Total:45 Hours

Course Outcomes:

At the end of the course students should be able to

CO1 : Determine the forces due to oceanwaves

CO2 : Analyse and design offshore structures like platform, helipads, jackets, towers etc.

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair)													CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs		
CO s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3											2	
CO2	3	3	3											2	

Reference Books:

R1 Dalley .J. W and Riley. W. F, "Experimental Stress Analysis", McGraw Hill Book Company, N.Y. 1991.

R2 Ganesan.T.P, "Model Analysis of Structures", University Press, India, 2000.

R3 Ravisankar.K. and Chellappan.A., "Advanced course on Non-Destructive Testing and Evaluation of Concrete Structures", SERC, Chennai, 2007.

R4 Sadhu Singh, "Experimental Stress Analysis", Khanna Publishers, New Delhi, 2006.

R5 Sirohi.R.S., Radhakrishna.H.C, "Mechanical Measurements", New Age International (P) Ltd. 1997.

21PSE17 PREFABRICATED STRUCTURES

L	T	P	C
3	0	0	3

Course Objectives:

This course aims to provides the students,

- To impart Knowledge on pre-fabricated elements and the technologies used in fabrication and erection.

Pre-Requisites:

- Nil.

UNIT I INTRODUCTION AND DESIGN PRINCIPLES 9

General Civil Engineering requirements, specific requirements for planning and I layout of prefabricates plant. IS Code specifications. Modular co-ordination, standardization, Disuniting of

Prefabricates, production, transportation, erection, stages of loading and codal provisions, safety factors, material properties, Deflection control, Lateral load resistance, Location and types of shear walls.

UNIT II REINFORCED CONCRETE 9

Prefabricated structures - long wall and cross-wall large panel buildings, one way and two way prefabricated slabs, Framed buildings with partial and curtain walls, single storey industrial buildings with trusses and shells, Crane - gantry systems.

UNIT III FLOORS, STAIRS, ROOFS AND WALLS 9

Types of floor slabs, analysis and design example of cored and panel types and two -way systems, staircase slab design, types of roof slabs and insulation requirements, Description of joints, their behaviour and reinforcement requirements, Deflection control for short term and long term loads, Ultimate strength calculations in shear and flexure. Types of wall panels, Blocks and large panels, Curtain, Partition and load bearing walls.

UNIT IV DESIGN OF INDUSTRIAL BUILDINGS 9

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

Cylindrical, Folded plate and hyper -prefabricated shells, Erection and jointing, joint design, hand book-based design.

Theory: 45 Hours Tutorial: 0 Practical: 0 Project: 0 Total:45 Hours

Course Outcomes:

At the end of the course students should be able to

CO1 : Gain knowledge on the establishment of prefabricates plant and IS code specifications.

CO2 : Analyze the behaviour of various prefabricated structural members, floors, stairs, roofs and walls.

CO3 : Design prefabricated industrial buildings and shell roofs.

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair)													CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs		
CO s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2			3	3	1				1		3	1	
CO2	2	2			3	3	1				1		3	1	
CO3	2	2		2	3	3	1				1		3	1	

Reference Books:

R1 Structural Design Manual, “Precast Concrete Connection Details”, Society for the Studies in the use of Precast Concrete, Netherland Betor Verlag, 1978.

R2 Lasslo Mokk, “Prefabricated Concrete for Industrial and Public Sectors”, Akademiai Kiado, Budapest, 1964.

R3 CBRI, Building Materials and Components, 1990, India.

R4 Gerostiza. C.Z., Hendrikson, C., Rehat D.R., “Knowledge Based Process Planning for Construction and Manufacturing”, Academic Press, Inc., 1989.

21PSE18	DESIGN OF TALL BUILDINGS	L	T	P	C
		3	0	0	3

Course objectives:

This course aims to provides the students,

- To impart knowledge on behaviour, analyse and design of tall structural systems.

Pre-Requisites:

- Nil.

UNIT I DESIGN CRITERIA 9

Design philosophy, Loading, Sequential loading, materials - high performance Concrete - Fiber reinforced Concrete - Lightweight Concrete - Design mixes.

UNIT II LOADING AND MOVEMENT 9

Gravity Loading: Dead and live load, methods of live load reduction, Impact, gravity loading, construction loads. Wind loading: Static and dynamic approach, Analytical and wind tunnel experimental method. Earthquake loading: Equivalent lateral force, modal analysis, combinations of loading working stress design, Limit state design, plastic design.

UNIT III BEHAVIOUR OF VARIOUS STRUCTURAL SYSTEMS 9

Factors affecting growth, Height and Structural form. High rise behaviour, Rigid frames, braced frames, In filled frames, shear walls, coupled shear walls, wall-frames, tubulars, cores, outrigger - braced and hybrid mega system.

UNIT IV ANALYSIS AND DESIGN 9

Modelling for approximate analysis, Accurate analysis and reduction techniques, Analysis of building as total structural system considering overall integrity and major subsystem interaction, Analysis for member forces, drift and twist, computerized general three-dimensional analysis. Structural elements: Sectional shapes, properties and resisting capacity, design, deflection, cracking, prestressing, shear flow. Design for differential movement, creep and shrinkage effects, temperature effects and fire resistance.

UNIT V STABILITY OF TALL BUILDINGS 9

Overall buckling analysis of frames, wall -frames, Approximate methods, second order effects of gravity of loading, P-Delta analysis, simultaneous first-order and P -Delta analysis, Translational, Torsional instability, out of plum effects, stiffness of member in stability, effect of foundation rotation.

Theory: 45 Hours Tutorial: 0 Practical: 0 Project: 0 Total:45 Hours

Course outcomes:

At the end of the course students should be able to

CO1 : Familiarize with the problems associated with the large heights of structures with respect to different loads and materials.

CO2 : Analyse and design various structural systems for high rise buildings.

CO3 : Carryout stability analysis, overall buckling analysis of frames and analysis of various secondary effects on tall building.

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair)												CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	1	3	1						2		3	1	

Approved by BoS Chairman

CO2	1	2	1	3	1						2		3	1	
CO3	1	2	1	3	1						2		3	1	

Reference Books

R1 Taranath B.S., "Structural Analysis and Design of Tall Building", McGraw Hill, 1988.

R2 Bryan stafford Smith, Alexcoull, "Tall Building Structures, Analysis and Design", John Wiley and Sons, Inc., 1991

R3 Lynn S.Beedle, "Advances in Tall Buildings", CBS Publishers and Distributors, Delhi, 1986.

R4 Wilf gang Schuller, "High Rise Building Structures", John Wiley and Sons, 1977.

		L	T	P	C
21PSE19	**GEOTECHNICAL EARTHQUAKE ENGINEERING**	**3**	**0**	**0**	**3**

Course Objectives

This course aims to provides the students,

- To understand the mechanism of earthquake, wave propagation analysis, ground motion, earthquake hazards, their mitigation and design of earthquake resistant foundations.

UNIT I EARTHQUAKE SEISMOLOGY 9

Causes of earthquake – Plate tectonics –Earthquake Fault sources – Elastic Rebound theory – Seismic waves– Elastic Rebound theory – Locating an earthquake – Quantification of earthquakes – Intensity and magnitudes – Locating an earthquake –Case studies.

UNIT II GROUND MOTION AND GROUND RESPONSE ANALYSIS 9

Characteristics of ground motion – Factors influencing ground motion – Evaluation of shear wave velocity – Lab tests – Need for Ground Response Analysis – Methods of Ground Response analysis.

UNIT III LIQUEFACTION AND LATERAL SPREADING 9

Liquefaction related phenomena – Liquefaction susceptibility – Evaluation of liquefaction by Cyclic Stress and Cyclic Strain approaches – Lateral deformation and spreading – Criteria for mapping liquefaction hazard zones – Liquefaction computation from Lab and Field tests.

UNIT IV SEISMIC DESIGN OF FOUNDATIONS, RETAINING WALLS AND SLOPES 9

Seismic design requirements of foundation – Seismic design of pile foundations – Seismic design of retaining walls – Behaviour of reinforced slope under seismic condition – Recommendations of seismic codes related to geotechnical engineering.

UNIT V SEISMIC HAZARD ANALYSIS 9

Seismic hazard analysis – DSHA – PSHA – Seismic micro zonation – Soil Improvement for remediation of seismic hazards.

Theory: 45 Hours Tutorial: 0 Practical: 0 Project: 0 Total:45 Hours

Course Outcomes

At the end of the course students should be able to

CO1 : Acquire knowledge about the earthquake ground motion, making familiar with code and software packages to study the ground motion.

CO2 : Analyse the liquefaction susceptibility of the site using laboratory and field tests.

CO3 : Design earthquake resistant geotechnical structures and the methods to improve the ground for hazard resistance.

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair)													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	2	2	3	1					1		3	1	
CO2	1	2	2	2	3	1					1		3	1	
CO3	1	2	2	2	2	1					1		3	1	

Reference Books

R1 KameswaraRao, N.S.V., "Dynamics soil tests and applications", Wheller Publishing – New Delhi, 2000.

R2 Krammer S.L., "Geotecnical Earthquake Engineering", Prentice hall, International series Pearson Education (Singapore) Pvt. Ltd., 2004.

R3 Bharat Bhushan Prasad, "Fundamentals of Soil Dynamics and Earthquake Engineering", PHI Learning Pvt.Ltd.,NewDelhi, 2009.

R4 Bharat Bhushan Prasad, "Advanced Soil Dynamics and Earthquake Engineering", PHI Learning Pvt.Ltd.,NewDelhi, 2011.

R5 McGuire, R.K., "Seismic Hazard and Risk Analysis", Earthquake Engineering Research Institute. MNo – 10, ISBN 0-943198-01-1, 2004.

21PSE20 STABILITY OF STRUCTURES

L	T	P	C
3	0	0	3

Course Objectives:

This course aims to provides the students,

- Concept of buckling and analysis of structural elements.

Pre-Requisites:

- Nil.

UNIT I BUCKLING OF COLUMNS 9

States of equilibrium - Classification of buckling problems - concept of equilibrium, energy, imperfection and vibration approaches to stability analysis - Eigen value problem. Governing equation for columns - Analysis for various boundary conditions - using Equilibrium, Energy methods. Approximate methods - Rayleigh Ritz, Galerkins approach - Numerical Techniques - Finite difference method - Effect of shear on buckling.

UNIT II BUCKLING OF BEAM-COLUMNS AND FRAMES 9

Theory of beam column - Stability analysis of beam column with single and several concentrated loads, distributed load and end couples Analysis of rigid jointed frames with and without sway – Use of stability function to determine the critical load.

UNIT III TORSIONAL AND LATERAL BUCKLING 9

Torsional buckling – Combined Torsional and flexural buckling - Local buckling. Buckling of Open Sections. Numerical solutions. Lateral buckling of beams, pure bending of simply supported and cantilever beams.

UNIT IV BUCKLING OF PLATES 9

Governing differential equation - Buckling of thin plates, various edge conditions -Analysis by equilibrium and energy approach – Finite difference method.

UNIT V INELASTIC BUCKLING 9

Double modulus theory - Tangent modulus theory - Shanley's model - Eccentrically loaded inelastic column. Inelastic buckling of plates - Post buckling behaviour of plates.

Theory: 45 Hours Tutorial: 0 Practical: 0 Project: 0 Total:45 Hours

Course Outcomes:

At the end of the course students should be able to

CO1 : Know the phenomenon of buckling.

CO2 : Calculate the buckling load on column, beam – column, frames and plates using classical and approximate methods.

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair)													CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs		
CO s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3								1		2	
CO2	3	3	3	3								1		2	

Reference Books:

R1 Ashwini Kumar, "Stability Theory of Structures", Allied publishers Ltd., New Delhi, 2003.

R2 Chajes, A. "Principles of Structures Stability Theory", Prentice Hall, 1974

R3 Gambhir, "Stability Analysis and Design of Structures", springer, New York, 2004.

R4 Simitser.G.J and Hodges D.H, "Fundamentals of Structural Stability", Elsevier Ltd., 2006.

R5 Timoshenko.S.P, and Gere.J.M, "Theory of Elastic Stability", McGraw Hill Book Company,1963.

AUDIT COURSES

21AC101 ENGLISH FOR RESEARCH WRITING

L	T	P	C
2	0	0	0

Course Objectives:

This course aims to provide the students,

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

Pre-Requisites:

- Nil.

UNIT I 5

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

UNIT II 6

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

UNIT III **4**

Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

UNIT IV **6**

Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature,

UNIT V **5**

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

UNIT VI **4**

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

Theory: 30 Hours Tutorial: 0 Practical: 0 Project: 0 Total:30 Hours

Course Outcomes:

At the end of the course students should be able to

CO1 :	Know about different types of disasters, causes and their impact on environment and society.
CO2 :	Assess the vulnerability and mitigation measures of disasters.
CO3 :	Gain knowledge on relationship between disaster and development.
CO4 :	Study the hazard and vulnerability profile of India, Scenarios in the Indian context.

Text Books:

T1	Adrian Wallwork, "English for Writing Research Papers", Springer New York Dordrecht Heidelberg London, 2011.

Reference Books:

R1	Goldbort R (2006), "Writing for Science", Yale University Press (available on Google Books).
R2	Day R (2006), "How to Write and Publish a Scientific Paper", Cambridge University Press
R3	Highman N (1998), "Handbook of Writing for the Mathematical Sciences", SIAM. Highman's

		L	T	P	C
21AC102	**DISASTER MANAGEMENT**	**2**	**0**	**0**	**0**

Course Objectives:

This course aims to provide the students,

- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction.
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR).

- To enhance awareness of institutional processes in the country and
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity.

Pre-Requisites:

- Nil.

UNIT I INTRODUCTION TO DISASTERS 5

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc – Classification, Causes, Impacts including social, economic, political, environmental and health - Global trends in disasters: urban disasters, complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.

UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR) 6

Disaster cycle – Phases, prevention, mitigation and preparedness community based DRR, Structural- non-structural measures, Roles and responsibilities of- Government & NGO's- Institutional Processes and Framework at State and Central Level- State Disaster Management Authority (SDMA) – Early Warning System – Advisories from Appropriate Agencies.

UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT 6

Factors affecting Vulnerabilities, impact of Development projects such as dams, embankments, changes in Land-use etc. - Climate Change Adaptation- IPCC and Scenarios in the context of India – Relevance of indigenous knowledge, appropriate technology and local resources.

UNIT IV DISASTER RISK MANAGEMENT IN INDIA 7

Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Disaster Management Act and Policy – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

UNIT V DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS 6

Natural disasters- Case Studies, Earthquake, Landslide, Drought, Floods: Fluvial and Pluvial Flooding - Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works for disaster management.

Theory: 30 Hours Tutorial: 0 Practical: 0 Project: 0 Total:30 Hours

Reference Books:

R1 Singhal J.P. "Disaster Management", Laxmi Publications, 2010.

R2 Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., 2012.

R3 Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011.

R4 Kapur Anu Vulnerable India: A Geographical Study of Disasters, IIAS and Sage Publishers, New Delhi, 2010.

21AC103	STRESS MANAGEMENT BY YOGA	L	T	P	C
		0	0	2	0

Course Objectives:

This course aims to provide the students,

- To enable the student to have good health.
- To practice mental hygiene.
- To possess emotional stability.
- To Integrate moral values.
- To attain higher level of consciousness.

Pre-Requisites:

- Nil.

UNIT I **6**

Shatha karma - Kapalbhati (11-30 strokes)

Asanas - Trikonasana, Ardha-Kati Chakrasana, Tadasana, Vrikshasana, Padmasana Simhasana, Paschimottanasana, Uttanpadasana, Salabhasana, Shavasana

Pranayama – Bhastrika

Concentration – On own breath (2 min) ohm chanting and shanti path

Shatha karma – Introduction of trataka and practice of concentric on nose – tip.

UNIT II **6**

Asanas – Garudasana, EK – Pad Pranamasana kati chakrasana, Urdhava Hastottanasana, Natrajasana , Parvatasana, Kukkutasana, Pawanmuktasana, Bhujangasana, Shavasana

Pranayama – Bhramari

Concentration – On own breath (3 min) ohm chanting and shanti path

UNIT III **6**

Shatha karma – Introduction of Nauli

Asanas – Pada Hastasana, Urdhv Pranamasana, Konasana, Vajrasana, Supta Vajrasana, Shashankasana, Gomukhasana, Janusirasana, Naukasana, Halasana, Chakrasana, Shavasana, Surya Namaskar

Pranayama – Anuloma-Viloma(Nadishodhan)

Concentration – On own breath (So-ham) Ohm Chanting and shanti path

UNIT IV **6**

Shatha karma – Jala Neti (if facility Available)

Asanas – Trikonasana, Tadasana, Natrajasana, Kato Chakarasana, Baddhapadmasana, Ushtrasana, Paschimottanasana, Bakasana, Kurmasana, Ardha Marsyendrasana, Makrasana, Dhanurasana, Shavasana, Surya Namaskar

Pranayama – Ujjayi and Suryabhedan

Concentration – In between eyebrows, Ohm Chanting and shanti path

UNIT V **6**

Shatha karma – Trataka

Asanas – Trikonasana, Vrikshasana, Parivrat Trikonasana, Padmasana, Yogmudra, Matsyasana, Mandukasana, Vristitapada Bhoonamanasana, Pawanmuktasana, Vipritkarni, Shavasana, Yoganidra

Pranayama – Bhramari, Sheetkari

Concentration – on ‘Dot’ or ‘Ohm’, Ohm Chanting and shanti path

Theory: 30 Hours Tutorial: 0 Practical: 0 Project: 0 Total:30 Hours

Text Books:

T1 Yogic Asanas for Group Tarining-Part-I": Janardan Swami Yogabhyasi Mandal, Nagpur.

Reference Books:

R1 Rajayoga or conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata.

21AC104	VALUE EDUCATION	L	T	P	C
		2	0	2	0

Course Objectives:

This course aims to provide the students,

- Understand value of education and self- development.
- Imbibe good values in students.
- Let the student know about the importance of character.

Pre-Requisites:

- Nil.

UNIT I **7**

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 **7**

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 **9**

Personality and Behaviour Development, Soul and Scientific, attitude, positive thinking, integrity and discipline, Punctuality, Love and Kindness, avoid fault Thinking, Free from anger, Dignity of labour, 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 **7**

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

Theory: 30 Hours Tutorial: 0 Practical: 0 Project: 0 Total:30 Hours

Text Books:

T1 Chakroborty, S.K. "Values and Ethics for organizations Theory and practice", Oxford University Press, New Delhi.

Reference Books:

R1 John Haggai “Lead On” & “How to win over worry” – World Book Publisher – 1986.

R2 Prasantham J.P. “Therapeutic Counselling” – Asian Trading Corporation – 1994.

R3 Fr. Joe Curie S.J. “Barefoot Counsellor” – aTc Publication – 1998.

R4 Atkinson D.J. & Field D.H. “New Dictionary of Christian Ethics and Pastoral Theology” – Intervarsity Press, USA – 1995.

R5 David Clyde Jones “Biblical Christian Ethics” – Baker Books – 1994.