SRI KRISHNA COLLEGE OF ENGINEERING AND TECHNOLOGY
An Autonomous Institution | Approved by AICTE | Affiliated to Anna University | Accredited by NAAC with A++ Grade
Kuniamuthur, Coimbatore – 641008
Phone : (0422)-2678001 (7 Lines) | Email : info@skcet.ac.in | Website : www.skcet.ac.in

Curriculum & Syllabi

Regulation 2025

2026-2028 Batch

M.E. STRUCTURAL ENGINEERING

DEPARTMENT OF CIVIL ENGINEERING

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DEPARTMENT OF CIVIL ENGINEERING

(Batch 2026-2028)

VISION OF THE INSTITUTION

- To Produce Globally Competitive Engineers with High Ethical Values and Social Responsibilities.

MISSION OF THE INSTITUTION

- To impart the highest quality state-of-the-art technical education by providing impetus to innovation, research, and development and empowering students with entrepreneurship skills.
- To instill ethical values, imbibe a sense of social responsibility, and strive for societal well-being.
- To identify the needs of society and offer sustainable solutions through outreach programs.

DEPARTMENT OF CIVIL ENGINEERING

VISION OF THE DEPARTMENT

- To be a center of excellence in Civil Engineering Education through full-fledged learning experience along with research.

MISSION OF THE DEPARTMENT

To accomplish our vision, we are committed to

- Faculty experts from all specialization of Civil Engineering to facilitate teaching learning process
- Excellent infrastructure facilities to apply Civil Engineering knowledge and perform societal based research
- Exposure to latest technologies in Civil Engineering through industry-institute interaction and professional bodies
- Environs to develop the innovative thoughts, ethics, communication, inter - and intra – personal skills
- Enthusiasm towards self-learning, social responsibility and entrepreneurship

(Dr. N. Shanmugasundaram)

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Professor & Head,
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I. PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO 1	To produce Structural Engineers with competence in planning, analysis, design, and execution of diverse projects with due consideration to global issues concerning society and environment.
PEO 2	To produce Structural Engineers who can appreciate the interactions between engineering, technology, and business in the fast-changing environment with the drive for lifelong learning, research, and continuous self-development.
PEO 3	To produce Structural Engineers who can communicate effectively, act with integrity and professional ethics and to have interpersonal skills needed to lead and nurture diverse teams

II. PROGRAMME OUTCOMS (POs)

PO 1	An ability to independently carry out research / investigation and development work to solve practical problems.
PO 2	An ability to write and present a substantial technical report/document.
PO 3	Students should be able to demonstrate a degree of mastery over the area as per the specialization of the programme. The mastery should be at a level higher than the requirements in the appropriate bachelor program.
PO 4	An ability to use modern engineering tools, software, and equipment to analyse critically, design, conduct experiments and interpret investigations to solve structural engineering problems.
PO 5	An ability to communicate technical values of Structural Engineering research with the public, learners, practitioners, and other community members of concern.
PO 6	An ability to demonstrate the traits of learning and unlearning throughout his professional career, and be willing to learn new techniques, methods, and processes.

III. MAPPING OF PEOs WITH POs

PEO	POs					
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
1	3	3	3	3	3	3
2	3	3	3	3	3	3
3	2	2	2	2	3	3
4	3	3	3	3	3	3
5	3	3	3	3	3	3
	1- low, 2 - medium, 3 - high, '-' - no correlation					

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AUTONOMOUS CURRICULA AND SYLLABI
Regulations 2025

SEMESTER I						
S. No.	Course Code	Courses	L/T/P	Total Hours	Credit	SDG Mapping
Theory (Internal 40 Marks & External 60 Marks)						
1	26PSE101	Structural Dynamics	3/0/0	3	3	9,11
2	26PSE102	Concrete Structures	3/0/0	3	3	9,11,12
3	26PSE103	Theory of Elasticity and Plasticity	3/0/0	3	3	4,9
4	26PSE104	Foundation Structures	3/0/0	3	3	9,11
5	26PSEEXX	Elective I	3/0/0	3	3	-
6	26PSEEXX	Elective II	3/0/0	3	3	-
Practical (Internal 60 Marks & External 40 Marks)						
7	26PSE105	Structural Engineering Laboratory	0/0/3	3	1.5	4,9
Audit Course (Internal 100 Marks)						
8	26PADXXX	Audit Course-I	2/0/0	2	-	-
			TOTAL	**23**	**19.5**	

SEMESTER II						
S. No.	Course Code	Courses	L/T/P	Total Hours	Credit	SDG Mapping
Theory (Internal 40 Marks & External 60 Marks)						
1	26PSE201	Structural Steel Design	3/0/0	3	3	9,11
2	26PSE202	Prestressed Concrete	3/0/0	3	3	9,11
3	26PSE203	Finite Element Analysis of Structures	3/0/0	3	3	9
4	26PSE204	Aseismic Design of structures	3/0/0	3	3	11,13
5	26PSEEXX	Elective III	3/0/0	3	3	-
6	26PSEEXX	Elective IV	3/0/0	3	3	-
Practical (Internal 60 Marks & External 40 Marks)						
7	26PSE205	Computer Aided Structural Analysis and Design Laboratory	0/0/3	3	1.5	4,9
Audit Course (Internal 100 Marks)						
8	26PADXXX	Audit Course-II	2/0/0	2	-	-
			TOTAL	**23**	**19.5**	

SEMESTER III						
S. No.	Course Code	Courses	L/T/P	Total Hours	Credit	SDG Mapping
Theory (Internal 40 Marks & External 60 Marks)						
1	26RMC001	Research Methodology and IPR	3/0/0	3	3	4,9,16
2	26PSEEXX	Elective V	3/0/0	3	3	-
3	26PSEEXX	Elective VI	3/0/0	3	3	-

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4	26PXXOXX	Open Elective	3/0/0	3	3	-
5	26PSEP01	Industrial Training	4 Weeks	2	8,9	-
6	26PSEP02	Project Work-Phase I	0/0/10	10	5	9,11,13
Mandatory Course (Internal 100 Marks)						
7	26PMC0XX	Mandatory Course	2/0/0	2	-	-
			TOTAL	**24**	**19**	

SEMESTER IV						
S. No.	**Course Code**	**Courses**	**L/T/P**	**Total Hours**	**Credit**	**SDG Mapping**
Theory (Internal 40 Marks & External 60 Marks)						
1	26PSEP03	Project Work-Phase II	0/0/24	24	12	9,11,13
			TOTAL	**24**	**12**	

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SCHEME OF CREDIT DISTRIBUTION – SUMMARY							
Sl. No.	Stream	Credits/Semester				C	%
		I	II	III	IV		
1.	Professional Core Courses (PCC)	13.5	13.5	-	-	**27**	38.571
2.	Professional Elective Courses (PEC)	6	6	6	-	**18**	25.714
3.	Open Elective Courses (OEC)	-	-	3	-	**03**	4.285
4.	Employability Enhancement Courses (EEC)	-	-	7	12	**19**	27.142
5.	Research Methodology and IPR Courses (RMC)	-	-	3	-	**03**	4.285
6.	Audit Courses (AC) / Mandatory Courses (MC)	NC	NC	NC	-	**Non-Credit**	-
Total		**19.5**	**19.5**	**19**	**12**	**70**	100

STRUCTURE FOR POSTGRADUATE ENGINEERING PROGRAM			
S. No.	Course Work - Subject Area	AICTE Suggested Credits	SKCET Credits
1.	Professional Core Courses (PCC)	22	21
2.	Professional Elective Courses (PEC)	15	27
3.	Open Elective Courses (OEC)	3	03
4.	Employability Enhancement Courses (EEC)	26	19
5.	Research Methodology and IPR Course (RMC)	-	03
6.	Audit Courses (AC) / Mandatory Courses (MC)	2	Non-Credit
	Total	**68**	**70**
Minor Variations is allowed as per need of the respective disciplines			

PROFESSIONAL CORE COURSES (27 Credits)						
SL. No.	Course Code	Course Title	L/T/P	Contact hrs./Wk.	C	SDG Mapping
1.	26PSE101	Structural Dynamics	3/0/0	3	3	9,11
2.	26PSE102	Concrete Structures	3/0/0	3	3	9,11,12
3.	26PSE103	Theory of Elasticity and Plasticity	3/0/0	3	3	4,9
4.	26PSE104	Foundation Structures	3/0/0	3	3	9,11
5.	26PSE105	Structural Engineering Laboratory	0/0/3	3	1.5	4,9
6.	26PSE201	Structural Steel Design	3/0/0	3	3	9,11
7.	26PSE202	Prestressed Concrete	3/0/0	3	3	9,11
8.	26PSE203	Finite Element Analysis of Structures	3/0/0	3	3	9
9.	26PSE204	Aseismic Design of structures	3/0/0	3	3	11,13
10.	26PSE205	Computer Aided Structural Analysis and Design Laboratory	0/0/3	3	1.5	4,9

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PROFESSIONAL ELECTIVE COURSES (18 Credits)						
SL. No.	**Course Code**	**Course Title**	**L/T/P**	**Contact hrs./Wk.**	**C**	**SDG Mapping**
1.	26PSEE01	Advanced Concrete Technology	3/0/0	3	3	9,12,13
2.	26PSEE02	Design of Bridges	3/0/0	3	3	9,11
3.	26PSEE03	Design of Structures for Dynamic Loads	3/0/0	3	3	9,11,13
4.	26PSEE04	Design of Shell and Spatial Structures	3/0/0	3	3	9
5.	26PSEE05	Design of Steel Concrete Composite Structures	3/0/0	3	3	9,12
6.	26PSEE06	Design of Tall Buildings	3/0/0	3	3	11
7.	26PSEE07	Disaster Mitigation and Management	3/0/0	3	3	11,13
8.	26PSEE08	Industrial Structures	3/0/0	3	3	9,11
9.	26PSEE09	Maintenance and Rehabilitation of Structures	3/0/0	3	3	9,11,12
10.	26PSEE10	Stability of Structures	3/0/0	3	3	9
11.	26PSEE11	Prefabricated Structural Systems	3/0/0	3	3	9,11,12
12.	26PSEE12	Experimental Methods and Model Analysis	3/0/0	3	3	4,9
13.	26PSEE13	Theory of Plates	3/0/0	3	3	4,9
14.	26PSEE14	Advanced Construction Technology	3/0/0	3	3	9,11,12
15.	26PSEE15	Soil Structure Interaction	3/0/0	3	3	9,11
16.	26PSEE16	Wind and Cyclone Effects on Structures	3/0/0	3	3	11,13
17.	26PSEE17	Nonlinear Analysis of Structures	3/0/0	3	3	9
18.	26PSEE18	Offshore Structures	3/0/0	3	3	9,14
19.	26PSEE19	Geotechnical Earthquake Engineering	3/0/0	3	3	11,13
20.	26PSEE20	Earth Pressure and Earth Retaining Structures	3/0/0	3	3	9,11
21.	26PSEE21	Quality Control and Assurance in Construction	3/0/0	3	3	9,12
22.	26PSEE22	Optimization in Structural Design	3/0/0	3	3	9,12
23.	26PSEE23	Smart Materials and Smart Structures	3/0/0	3	3	9
24.	26PSEE24	Mechanics of Composite Materials	3/0/0	3	3	9
25.	26PSEE25	Modern Construction Materials	3/0/0	3	3	9,12,13

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OPEN ELECTIVES COURSES (3 Credits) (Offered by other branches)						
SL. No.	**Course Code**	**Course Title**	**L/T/P**	**Contact hrs./Wk.**	**C**	**SDG Mapping**
1.	26PCSO01	Business Analytics	3/0/0	3	3	8,9
2.	26PEDO01	Industrial Safety	3/0/0	3	3	3,8
3.	26PEDO02	Operations Research	3/0/0	3	3	9
4.	26PEDO03	Cost Management of Engineering Projects	3/0/0	3	3	8,9
5.	26PPSO01	Waste to Energy	3/0/0	3	3	7,11,12,13

OPEN ELECTIVES COURSES (3 Credits) (Offered to other branches)						
SL. No.	**Course Code**	**Course Title**	**L/T/P**	**Contact hrs./Wk.**	**C**	**SDG Mapping**
1.	26PSEO01	Composite Materials	3/0/0	3	3	9

EMPLOYABILITY ENHANCEMENT COURSES (EEC) (19 Credits)						
SL. No.	**Course Code**	**Course Title**	**L/T/P**	**Contact hrs./Wk.**	**C**	**SDG Mapping**
1.	26PSEP01	Industrial Training	-	-	2	8,9
2.	26PSEP02	Project Work-Phase I	0/0/10	10	5	9,11,13
3.	26PSEP03	Project Work-Phase II	0/0/24	24	12	9,11,13

RESEARCH METHODOLOGY AND IPR COURSE (RMC)						
SL. No.	**Course Code**	**Course Title**	**L/T/P**	**Contact hrs./Wk.**	**C**	**SDG Mapping**
1.	26RMC001	Research Methodology and IPR	3/0/0	3	3	4,9,16

MANDATORY COURSES (MC)						
SL. No.	**Course Code**	**Course Title**	**L/T/P**	**Contact hrs./Wk.**	**C**	**SDG Mapping**
1.	26PMC001	Artificial Intelligence for Structural Engineering	2/0/0	2	-	4,9,11,13
2.	26PMC002	Constitution of India	2/0/0	2	-	16
3.	26PMC003	Technical Seminar	2/0/0	2	-	4, 9

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AUDIT COURSES (AC)						
SL. No.	**Course Code**	**Course Title**	**L/T/P**	**Contact hrs./Wk.**	**C**	**SDG Mapping**
1.	26PAD001	English for Research Paper Writing	2/0/0	2	-	4
2.	26PAD002	Disaster Management	2/0/0	2	-	11,13
3.	26PAD003	Sanskrit for Technical Knowledge	2/0/0	2	-	4
4.	26PAD004	Value Education	2/0/0	2	-	4,16
5.	26PAD005	Pedagogy Studies	2/0/0	2	-	4
6.	26PAD006	Personality Development through Life Enlightenment Skills	2/0/0	2	-	4,8

L: Lecture **T:** Tutorial **P:** Practical **C:** Credit **O:** Outside Class hours **Cat.:** Category

OEC : Open Elective Courses
EEC : Employability Enhancement Courses
MC : Mandatory Course
PCC : Professional Core Courses
AC : Audit Courses

Definition of Credit:

L – Lecture	1 Hr. Lecture (L) per week	1 credit
T – Tutorial	1 Hr. Tutorial (T) per week	1 credit
P - Practical/Practice (Project and Industry based Courses)	1 Hr. Practical (P) per week	0.5 credit

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26PSE101 SDG NO: 9,11	STRUCTURAL DYNAMICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1 To understand vibration systems including SDOF and MDOF models.

2 To learn modal analysis for structural dynamic behavior.

3 To study structural response to dynamic loads like wind and earthquakes.

4 To analyze random vibrations and estimate key vibration parameters.

MODULE I PRINCIPLES OF DYNAMICS 9

Formulation of Equations of Motion by different methods, Problems on Formulation of Equation of motion, Single degree of freedom systems, Free and Forced response, Effect of Damping, Simple Problems on beams and frames.

MODULE II MULTI DEGREE OF FREEDOM SYSTEM 9

Formulation of Structure, property matrices, Eigen value problems, methods, Dunkerly's method, Holzer method, Stodola method, Rayleigh's method, Rayleigh-Ritz method, Mode shapes, ortho normality of modes.

MODULE III DYNAMIC RESPONSE OF MULTI DEGREE OF FREEDOM SYSTEMS 9

Mode superposition Techniques, Problems on two degrees of freedom for building frames, Numerical Integration Techniques, New marks method-Linear Acceleration method, Problems, Numerical Evaluation of Duhamel Integral.

MODULE IV CONTINUOUS SYSTEMS 9

Modelling, Free and forced vibrations of bars, Flexural vibration of simple beams, Modes and frequencies, Orthogonality properties of normal modes of continuous systems.

MODULE V DESIGN OF STRUCTURES SUBJECTED TO DYNAMIC LOADS 9

Idealization of multi-storeyed frames for dynamic analysis, Machine foundations, Earthquake response- elastic rebound theory, deterministic analysis of earthquake response, Design of earthquake response, Design of earthquake resistant structures, IS code provisions.

TOTAL PERIODS: 45

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COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Understand the principles of dynamics, including the formulation of equations of motion for structural systems.	[U]
CO2	Learn the fundamental concepts and methods used in the dynamic analysis of structures	[U]
CO3	Apply solution techniques for analyzing single and multi-degree of freedom systems under dynamic loading.	[AN]
CO4	Analyze structural systems using mode superposition and other analytical methods.	[AN]
CO5	Perform dynamic analysis of multi-storeyed building frames subjected to various dynamic loads	[AP]

REFERENCES

1. Thomson, W.T., Theory of Vibration, Prentice Hall of India, 2014.
2. Biggs, J.M., Introduction to Structural Dynamics, McGraw-Hill, Co., 2010.
3. Paz, M., Structural Dynamics - Theory and Computation, Springer, 2007.
4. Anil K. Chopra, Dynamics of Structures – Theory and Applications to Earthquake Engineering, Prentice Hall of India Pvt Ltd., New Delhi, 2007.
5. Clough, R., W., and Penzien, Dynamics of Structures, McGraw Hill Book co Ltd, 1993.

INDIAN STANDARDS (IS) CODE OF PRACTICE

1. IS 1893(Part 1):2002, Criteria for earthquake resistant design of structures: Part 1 General Provisions and buildings. (First Revision)

WEB RESOURCES

1. http://onlinelibrary.wiley.com/
2. http://nptel.ac.in/courses/105101006/
3. http://freevideolectures.com/Course/3129/Structural-Dynamics

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26PSE102 SDG NO: 9,11,12	CONCRETE STRUCTURES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1 To understand various reinforced concrete (RC) design methods used in structural engineering.
2 To study the design of special RC elements, including flat slabs, grid slabs, and their practical applications
3 To analyze the inelastic behavior of RC beams and incorporate it into structural design.
4 To learn the design and detailing principles for seismic-resistant and fire-resistant RC structures.

MODULE I DESIGN OF RC ELEMENTS AND SERVICEABILITY CRITERIA 9

Review of limit state design of slabs, beams and columns according to IS codes. Calculation of Deflection and crack width for beams and slabs as per IS codes.

MODULE II DESIGN OF SPECIAL RC ELEMENTS 9

Design of RC walls – Ordinary and shear walls – Design of corbels – Design of deep beams – Detailing.

MODULE III FLAT SLABS AND GRID FLOOR 9

Design of flat slabs – Limitations - Design of voided slabs - Analysis and design of Grid floors - Detailing.

MODULE IV INELASTIC BEHAVIOUR OF CONCRETE BEAMS 9

Moment – Curvature relation of Reinforced Concrete Sections - Moment redistribution – Baker's method of plastic design – Advantages and Disadvantages of Moment Redistribution – Application of software packages and computer programming.

MODULE V WIND EFFECTS ON STRUCTURES 9

Dead Loads – Imposed Loads (IS 875 Part 2) General Theory of Wind Effects on Structures.

TOTAL PERIODS: 45

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1 Apply the limit state method for serviceability and design of reinforced concrete elements as per IS Code provisions [AP]
CO2 Design and detail special RC elements including flat slabs and grid floors. [AN]
CO3 Understand the inelastic behaviour of concrete beams and its implications in structural design. [U]

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CO4	Understand the theory and effects of wind on structures.	[U]
CO5	Design and detail complex RCC structures considering advanced structural behaviour.	[AN]

REFERENCES

1. Gambhir, “Design of Reinforced Concrete Structures”, PHI Learning Ltd., New Delhi, 2008.
2. Unnikrishnan Pillai and Devdas Menon, “Reinforced Concrete Design”, Tata McGraw Hill Publishers Company Ltd., New Delhi, 2006.
3. Baker.A.L.L, “The Ultimate Load Theory Applied to the Design of Reinforced and Prestressed concrete Frames”, Concrete Publications, London, 1956.
4. Sinha.N.C and Roy.S.K, “Fundamentals of Reinforced Concrete”, S.Chand and Company, NewDelhi, 2003.
5. Dayaratnam.P, “Design of Reinforced Concrete Structures”, Oxford & OBH Publishing Co. Pvt. Ltd., Calcutta, 2005.

INDIAN STANDARDS (IS) CODE OF PRACTICE

1. IS 456:2000 (Reaffirmed 2005) – Plain and Reinforced Concrete – Code of Practice
2. IS 875: Part 1: Dead loads - Unit weights of building material and stored materials (Incorporating IS:1911-1967).
3. IS 875: Part 3 – Wind Loads (Reaffirmed 2003) – Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures.

WEB RESOURCES

1. http://www.springer.com/in/engineering/civil-engineering
2. http://nptel.ac.in/downloads/105105104/
3. http://www.structuralengineering.info/advanced-reinforced-concrete-structures/

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26PSE103 SDG NO: 4,9	THEORY OF ELASTICITY AND PLASTICITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1 To understand the stress, strain relationships

2 To understand the two-dimensional Cartesian coordinates.

3 To understand the concepts of polar coordinates.

4 To get knowledge on torsional characteristics of bars and plastic properties of beams

MODULE I ANALYSIS OF STRESS, STRAIN AND STRESS STRAIN RELATIONS 9

Analysis of stress (two and three dimensions) - Body force, surface forces and stresses, uniform state of stress - principal stresses - stress transformation laws - Differential equations of equilibrium. Analysis of Strain (two and three dimensions) - strain and displacement relation - compatibility equations - state of strain at a point - strain transformations - principle of superposition. - Stress strain relation - Generalized Hooke's law -Lame's constants.

MODULE II TWO DIMENSIONAL PROBLEMS IN CARTESIAN COORDINATES 9

Methods of Formulation - Equilibrium equations in terms of displacements - Compatibility equations in terms of stresses - boundary value problems - plane stress - plane strain problems. Introduction to two dimensional problems in Cartesian Co-ordinates - Boundary condition - Plane stress and strain problems - examples - Airy's stress function - polynomials - Direct method of determining Airy's stress functions - solution of Bi-harmonic equation - St.Venant`s principle - Two dimensional problems in Cartesian co- ordinates - bending of a cantilever loaded at end.

MODULE III TWO DIMENSIONAL PROBLEMS IN POLAR COORDINATES 9

General equations in polar co-ordinates - stress distribution symmetrical about an axis - pure bending of curved bars - strain components in polar co-ordinates - displacements for symmetrical stress distribution - bending of a curved bar - effect of a circular hole on stress distribution – Thick cylinder - Forces on wedges - a circular disk with diametric loading.

MODULE IV TORSION OF CYLINDRICAL BARS 9

Torsion of prismatic bars - General solution of the problem by displacement (warping function) and force (Prandtl`s stress function) approaches-Torsion of shafts of circular and non-circular (elliptic, triangular and rectangular) cross sectional shapes only-Torsion of thin rectangular section and hollow thin-walled sections.

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MODULE V INTRODUCTION TO PLASTICITY 9

Introduction to stress strain curve - ideal plastic body - criterion of yielding - Rankine`s theory - St.Venant`s theory - Tresca criterion - Beltrami`s theory - Von Mises criterion - Mohr`s theory of yielding - yield surface - Flow rule (plastic stress - strain of relation) - Prandtl Reuss equations - Plastic work - stress - strain relation based on Tresca - Plastic potential. Solution of elastic - plastic problems- Elastic plastic problems of beams in bending- thick hollow spheres and cylinders subjected to internal pressure. General relation - plastic torsion - perfect plasticity - bar of circular cross sections - Nadai`s sand heap analogy.

TOTAL PERIODS: 45

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Understand the stress-strain relationship, torsion of prismatic bars, and the concept of warping function.	[U]
CO2	Understand boundary conditions in Cartesian coordinates and the fundamentals of plasticity.	[U]
CO3	Apply the concepts of polar coordinates to analyze curved bars and torsional behaviour of rectangular and thin-walled sections.	[AP]
CO4	Analyze stress distribution around circular holes and understand the plastic characteristics of beams.	[AN]
CO5	Apply theories of plasticity in structural analysis and design problems.	[AP]

REFERENCES

1 Sadhu Singh, Theory of Elasticity, Khanna Publishers, N.Delhi, 2008.

2 Timoshenko,S. and Goodier,J.N., Theory of Elasticity, McGraw Hill Book Co., 2007.

3 Chakrabarthy, T.,Theory of Plasticity, McGraw Hill Book Co., New Delhi, 2006.

4 Chow, P.C. and Pagono, N.J., Elasticity Tensor Dynamic and Engg. Approaches, D.VanNostrand Co., Inc., 1967.

WEB RESOURCES

1 http://nptel.ac.in/courses/105103094/

2 http://nptel.ac.in/courses/105108070/

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26PSE104 SDG NO: 9,11	FOUNDATION STRUCTURES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1 To understand subsurface exploration methods for geotechnical investigations.

2 To study classification and design of shallow foundations.

3 To learn design and construction of deep foundations.

4 To understand foundation design for special structures and dynamic loads.

MODULE I SUBSURFACE INVESTIGATION AND FOUNDATION SELECTION 9

Site investigation – objectives and methods – soil exploration techniques – preparation of soil investigation reports – classification and selection of foundation types – expansive soils and their identification – criteria for foundation selection in varying soil conditions.

MODULE II BEARING CAPACITY AND SETTLEMENT OF SHALLOW FOUNDATIONS 9

Introduction to shallow foundations – bearing capacity: IS code, Terzaghi's method – factors affecting bearing capacity – settlement of foundations – spread footings and contact pressure analysis.

MODULE III STRUCTURAL DESIGN OF SHALLOW FOUNDATIONS 9

Structural design of isolated footings – combined footings (rectangular and trapezoidal) – mat foundations – load distribution – reinforcement detailing.

MODULE IV PILE FOUNDATIONS AND DESIGN 9

Types of piles and their applications – static and dynamic pile capacity formulas – pile load tests – negative skin friction – design of pile groups and pile caps – group efficiency – structural detailing.

MODULE V SHEET PILES, WELL AND TOWER FOUNDATIONS 9

Sheet pile walls – types – design in cohesive and granular soils – anchored bulkheads: free earth and fixed earth support – well foundations: components, shapes, forces acting – stability under lateral loads using Terzaghi's approach – correction methods for tilt and shift – tower foundations: general design criteria, forces – liquefaction: evaluation, susceptibility, effects.

TOTAL PERIODS: 45

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COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Apply appropriate methods to investigate subsurface soil conditions for civil engineering construction.	[AP]
CO2	Apply principles to estimate bearing capacity and select suitable foundation types for given site conditions.	[AP]
CO3	Apply relevant design procedures for shallow foundations including isolated, combined, and mat footings.	[AP]
CO4	Apply design principles for pile foundations and pile caps considering various structural and soil conditions.	[AP]
CO5	Apply suitable foundation design techniques for sheet piles, well foundations, and tower foundations under different loadings.	[AP]

REFERENCES

1. Gopal Ranjan and Rao ASR, “Basic and Applied soil Mechanics”, New Age International Publishers, 2004.
2. Gulhati & Datta, “Geotechnical Engineering” Tata McGraw Hill, New Delhi, 2005.
3. Som & Das, “Theory and Practice of Foundation Design”, Prentice Hall of India New Delhi, 2006.
4. Swamy Saran, Analysis and Design of Substructures, Oxford and IBH Publishing Co. Pvt. Ltd., 2006.
5. Varghese,P.C., Foundation Engineering, Prentice-Hall of India Private Ltd, New Delhi, 2006.

INDIAN STANDARDS (IS) CODE OF PRACTICE

1. IS 2131:1981 Method of standard penetration test for soil.
2. IS 2132:1986 Code of practice for thin-walled tube sampling of soil.
3. IS 2911(Part 2):1980 Code of practice for design and construction of pile foundations.
4. IS 2911(Part 3):1980 Code of practice for design and construction of pile foundations.
5. IS 2911(Part 4):1985 Code of practice for design and construction of pile foundations.
6. IS 2950(Part 1):1981 Code of practice for design and construction of raft foundations: Part 1 Design.
7. IS 2974 (Part 1-5) a series of Indian Standard codes of practice for the design and construction of machine foundations.
8. IS 1892:1979 Code of practice for subsurface investigation for foundation.
9. IS 1888:1982 Method of load test on soil.
10. IS 1080:1985 Code of practice for design and construction of shallow foundations in soils (other than raft, ring and shell).
11. IS 1904:1986 Code of practice for design and construction of foundations in soils: General requirements.

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WEB RESOURCES

1 http://www.aboutcivil.org/geo-technical-foundation-engineering.html

2 https://archive.nptel.ac.in/courses/105/105/105105176/

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26PSE105 SDG NO: 4,9	STRUCTURAL ENGINEERING LABORATORY	L	T	P	C
		3	0	3	1.5

COURSE OBJECTIVES

1 To learn mix design and evaluate fresh and hardened properties of conventional and high-performance concrete using IS and ACI methods.

2 To assess concrete quality using destructive and non-destructive testing methods.

3 To analyze the behavior of reinforced concrete elements under flexure, shear, and loading conditions.

4 To develop practical skills in using structural engineering laboratory instruments and vibration analysis tools.

LIST OF EXPERIMENTS

Sl. No.	
1	Concrete Mix Design by IS method and ACI method for High Performance Concrete
2	Flow Characteristics of Self Compacting Concrete
3	Properties of hardened concrete-under compression, and bending – stress vs. Strain behaviour-modulus of elasticity
4	Non-destructive tests on concrete –Rebound Hammer and Ultrasonic Pulse Velocity Concrete Test
5	Behaviour of structural elements (beams /slabs) in flexure, shear.
6	Testing of Reinforced Concrete Column under Axial Compression.
7	Durability Properties – RCPT, Sorptivity, Water absorption, and Acid Test
8	Study of load cell and its design
9	Strain gauges – Principles and applications, mechanical and electrical Strain gauges, Strain recording instruments.
10	Vibration measurement

TOTAL PERIODS: 30

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Design concrete mixes using IS and ACI methods.	[AP]
CO2	Evaluate fresh and hardened concrete properties.	[AP]
CO3	Perform non-destructive tests on concrete structures.	[AP]
CO4	Analyze RC elements under axial, flexural, shear loads.	[AN]
CO5	Apply strain, load, and vibration measurement tools.	[AP]

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REFERENCES

1 Varghese. P. C, Building Materials, PHI Learning Pvt. Ltd, New Delhi, 2012.

2 Shetty, M.S., Concrete Technology (Theory and Practice), S. Chand and Company Ltd., New Delhi, 2008.

3 Gambhir, M.L Concrete Technology, 3rd Edition, Tata McGraw Hill Publishing Company Ltd, New Delhi, 2004.

INDIAN STANDARDS (IS) CODE OF PRACTICE

1 IS: 456: 2000, Plain and Reinforced concrete – code of practice

2 IS: 10262: 2009, Recommended guidelines for Concrete Mix Design

WEB RESOURCES

1 http://nptel.ac.in/courses/105102012/

2 https://onlinecourses.nptel.ac.in/noc16_ce10

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26PSE201 SDG NO: 9,11	STRUCTURAL STEEL DESIGN	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1 To study the structural behavior of steel members and various types of connections.

2 To analyze and design industrial steel buildings considering functional and structural requirements.

3 To understand the principles and design procedures for structures using cold-formed steel sections.

4 To introduce the fundamentals of plastic analysis and its application in the design of steel structures.

MODULE I LIMIT STATE DESIGN 9

Design Philosophies – Stability Criteria –Beam- Columns and Frames (Sway and Non-Sway) – Design of members subjected to combined forces

MODULE II BEHAVIOUR AND DESIGN OF CONNECTIONS 9

Behaviour of connections – Design requirements of bolted and welded connections – unstiffened and stiffened seated connections – framed connection – moment resistant connection.

MODULE III DESIGN OF INDUSTRIAL BUILDING 9

Types on loads on structures – Analysis and design of Industrial buildings and bents – sway and non- sway frames – Analysis and design of gable frames -Design of Purlins, louver rails, gable column and wind girder.

MODULE IV DESIGN OF STEEL TOWERS 9

Transmission line towers - Micro Wave Towers - Loads on towers - Analysis of towers - Design of member in towers - Design of tower foundations. Design and Analysis of Steel Towers using Software packages.

MODULE V DESIGN OF SPECIAL STRUCTURES 9

Analysis and design of trusses – forces in members – Design of self-supporting chimney and guyed steel chimney- Stress due to wind and earthquake forces – Gust factor method - Design of foundation.

TOTAL PERIODS: 45

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COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Understand the design methodologies and behaviour of compression members in steel structures.	[U]
CO2	Analyse and design steel beams and various elements in special steel structures.	[AN]
CO3	Analyse and design industrial structures and steel towers considering relevant design standards.	[AN]
CO4	Apply appropriate types of connections in the design of steel structures.	[AP]
CO5	Demonstrate competency in analysing and designing complex steel structural systems.	[AN]

REFERENCES

1. Lynn S. Beedle, Plastic Design of Steel Frames, John Wiley and Sons, 1990.
2. Narayanan.R.et.al., Teaching Resource on Structural steel Design, INSDAG, Ministry of Steel Publishing, 2000.
3. Subramanian.N, Design of Steel Structures, Oxford University Press, 2016.

INDIAN STANDARDS (IS) CODE OF PRACTICE

1. IS800:2007 – General Construction in Steel – Code of Practice.

WEB RESOURCES

1. http://nptel.ac.in/courses/105103094/
2. https://nptelvideos.in/2012/11/design-of-steel-structures.html

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26PSE202 SDG NO: 9,11,12	PRESTRESSED CONCRETE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1 To study the design of continuous beams

2 To know the principle of pre-stressing

3 To understand the design methodologies of flexural member

4 To get exposure on tension, compression members, shear and torsion

MODULE I INTRODUCTION TO PRESTRESSED CONCRETE 9

Principles of prestressing – Methods and systems of prestressing – Electro-thermal and chemical Prestressing – Classification of prestressed concrete structures – Materials used – Stress-strain characteristics – Losses in prestress: elastic shortening, creep, shrinkage, relaxation, friction – Approximate loss percentages.

MODULE II DESIGN OF FLEXURAL MEMBERS 9

Design of prismatic prestressed members for bending at working loads – Magnel's graphical method – Ultimate load checks (Limit State Design) – Non-prismatic members (Design principles) – Cable profiles – Deflection calculations – End block design.

MODULE III DESIGN OF TENSION AND COMPRESSION MEMBERS 9

Design of prestressed tension members – Columns under axial and bending loads – Working and ultimate load design – Composite beams: propped and unpropped constructions – Stress evaluations – Shear connectors – Shrinkage stresses.

MODULE IV DESIGN FOR SHEAR AND TORSION 9

Design of prestressed beams for shear and torsion – Working and ultimate loads – Anchorage zone design using Guyon's method – Concept of Magnel's method – IS 1343 code provisions.

MODULE V CONTINUOUS BEAMS AND SPECIAL PRESTRESSING TECHNIQUES 9

Analysis of statically indeterminate prestressed structures – Concordant cables – Linear transformation – Pressure line sketching for continuous beams and frames – Principles of partial prestressing – Circular prestressing – Design of circular tanks (circular and vertical prestressing).

TOTAL PERIODS: 45

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COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Apply suitable prestressing methods and systems in the design of structural members.	AP
CO2	Apply design procedures to flexural members using working and ultimate load approaches.	AP
CO3	Apply design concepts to prestressed tension and compression members.	AP
CO4	Apply appropriate techniques for designing composite prestressed beams, including stress evaluation.	AP
CO5	Apply IS code recommendations in designing prestressed members for shear, torsion, and continuous spans.	AP

REFERENCES

1. Sadhu Singh, Experimental Stress Analysis, Khanna Publishers, New Delhi, 1996.
2. Krishna Raju N., Prestressed concrete, Tata McGraw Hill Company, fifth edition, 2012.
3. Pandit.G.S. And Gupta.S.P. Prestressed Concrete, CBS Publishers and Distributers Pvt. Ltd., Second edition, 2014.
4. Ravisankar,.K. and Chellappan, A., Advanced Course on Non-Destructive Testing and Evaluation of Concrete Structures, SERC, Chennai, 2007.
5. Ganesan,T.P, Model Analysis of Structures, University Press, India, 2000.

INDIAN STANDARDS (IS) CODE OF PRACTICE

1. IS 1343:2012 (Reaffirmed 2022) – Prestressed Concrete – Code of Practice

WEB RESOURCES

1. https://nptel.ac.in/courses/112106068/
2. https://onlinecourses.nptel.ac.in/noc16_me08/course

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26PSE203 SDG NO: 9	FINITE ELEMENT ANALYSIS OF STRUCTURES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1 To analyze statically determinate structures using classical methods of structural analysis.
2 To understand and evaluate statically indeterminate structures through various analytical techniques.
3 To gain knowledge of stiffness and flexibility characteristics in structural systems.
4 To provide fundamental exposure to Finite Element Analysis and its application in structural engineering.

MODULE I INTRODUCTION 9

Introduction - Basic concepts of finite element analysis - Introduction to elasticity- Steps in finite element analysis - Finite element formulation techniques - Virtual work and variational principle - Galerkin method - Finite element method: Displacement approach - Stiffness matrix and boundary conditions.

MODULE II ELEMENT PROPERTIES 9

Natural coordinates - Triangular elements - Rectangular elements - Lagrange and serendipity elements - Solid elements - Isoparametric formulation - Stiffness matrix of Isoparametric elements numerical Integration: one, two and three dimensional – Problems.

MODULE III ANALYSIS OF FRAMED STRUCTURES 9

Stiffness of truss members - Analysis of truss-Stiffness of beam members-Finite element analysis of continuous beam-Plane frame analysis - Analysis of grid and space frame.

MODULE IV TWO AND THREE DIMENSIONAL SOLIDS 9

Constant strain triangle - Linear strain triangle - Rectangular elements- Numerical evaluation of element stiffness - Computation of stresses, Geometric nonlinearity and static condensation - Axisymmetric element - Finite element formulation of axisymmetric element - Finite element formulation for 3 dimensional elements - problems.

MODULE V APPLICATIONS OF FEM 9

Introduction to plate bending problems - Finite element analysis of thin plate - Finite element analysis of thick plate - Finite element analysis of skew plate -Introduction to finite strip method - Finite element analysis of shell - Finite elements for elastic stability - Dynamic analysis.

TOTAL PERIODS: 45

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COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Formulate a finite element problem using basic mathematical principles.	[AP]
CO2	Apply the concept to various types of elements and select the appropriate element for modelling.	[AP]
CO3	Analyse a frame using truss element.	[AN]
CO4	Formulate and analyse the two- and three-dimensional solid finite element problems.	[AN]
CO5	Analyse shells, thick and thin plates and explain the dynamic analysis using FEM.	[AN]

REFERENCES

1. David Hutton, “Fundamentals of Finite Element Analysis”, Tata McGraw Hill Publishing Company Limited, New Delhi, 2024.
2. Moaveni, S., “Finite Element Analysis Theory and Application with ANSYS”, Prentice Hall Inc., 2024.
3. Chandrupatla, R.T. and Belegundu, A.D., “Introduction to Finite Elements in Engineering”,Fourth Edition, Prentice Hall of India, 2015.
4. Zienkiewicz, O.C. and Taylor, R.L., “The Finite Element Method”, Seventh Edition, McGraw – Hill, 2013.

WEB RESOURCES

1. https://onlinecourses.nptel.ac.in/noc22_me43/preview
2. https://onlinecourses.nptel.ac.in/noc21_me109/preview
3. https://www.udemy.com/courses/search/?src=ukw&q=Finite%20Element%20Method%20for%20Structural%20Analysis

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26PSE204 SDG NO: 11,13	ASEISMIC DESIGN OF STRUCTURES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1 To understand seismology fundamentals and seismic measurement methods.

2 To assess earthquake-induced loads and their effects on structures.

3 To study structural behavior and design for earthquake resistance.

4 To apply codal provisions and modern techniques like base isolation.

MODULE I ENGINEERING SEISMOLOGY AND GROUND MOTION 9

Elements of engineering seismology – Indian seismology – historical earthquakes and case studies – catastrophic failures – lessons learned from past earthquakes – basic concepts of structural dynamics.

MODULE II PRINCIPLES OF FORCED VIBRATION AND DYNAMIC RESPONSE 9

Time history method – response spectrum method – earthquake response of linear systems – response spectrum characteristics – ground motion parameters – lumped mass system – shear building models – symmetrical and unsymmetrical structures – modal response and participation factors – spectral analysis – response history – multiple support excitation – deterministic earthquake response for continuous systems on rigid base.

MODULE III EARTHQUAKE LOAD ANALYSIS AND IS CODE PROVISIONS 9

Approximate methods for lateral load analysis – IS 1893:2002 provisions – overview of IS 4326 – dynamic analysis as per IS codes – behavior and design principles for masonry structures – IS 13827 and IS 13828 guidelines for construction in seismic zones.

MODULE IV DESIGN OF MASONRY AND RC STRUCTURES 9

Capacity design concepts – detailing as per IS 13920 – behavior of RC structures under earthquake loads – cyclic loading – ductility requirements – beam-column junctions – shear wall-frame systems – coupled shear wall systems – Khan and Sbarounis method – Rosman's method – use of push-over analysis – IS code-based design and verification of reinforced concrete systems.

MODULE V BEHAVIOR AND DESIGN OF STEEL STRUCTURES, RETROFITTING & MODERN TRENDS 9

Behavior of steel structures under seismic loading – cyclic load behavior – various bracing systems – compact and non-compact sections – buckling and joint behavior – design of beam-column joints – base isolation techniques – soil-structure interaction – adaptive structural systems – retrofitting and rehabilitation of existing structures – case studies on

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reconstruction and repair after earthquakes.

TOTAL PERIODS: 45

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Apply the fundamental concepts of seismology and historical earthquake data to understand seismic behavior in civil structures.	[AP]
CO2	Apply the principles of structural dynamics to evaluate building responses under various load conditions.	[AP]
CO3	Apply analytical techniques to assess the behavior of structures under forced and dynamic loading.	[AP]
CO4	Apply IS code provisions to analyze structures subjected to lateral and cyclic loads	[AP]
CO5	Apply design principles and IS code guidelines to design earthquake-resistant masonry, RC, and steel structures.	[AP]

REFERENCES

1. Anil K. Chopra, Dynamics of Structures – Theory and Applications to Earthquake Engineering, Prentice Hall of India Pvt. Ltd., New Delhi, 2007.
2. Agarwal P and Shrikande M, Earthquake resistant design of Structures, Prentice Hall of India, 2006.
3. Taranath, B.S., Wind and Earthquake Resistant Buildings — Structural Analysis & Design, Marcel Decker, New York, 2005.

INDIAN STANDARDS (IS) CODE OF PRACTICE

1. IS 13920:1993, Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic forces- Code of practice.
2. IS 1893 – 2002, Criteria for Earthquake Resistant Design of Structures
3. IS 4326 — 1976, Code of Practice for Earthquake Resistant Design and Construction of Buildings

WEB RESOURCES

1. https://www.tk.ac.in/nicee/TK-GSDMA/EBB_001_30May2013.pdf
2. cedb.asce.org/CEDBsearch/record.jsp?dockey=0034507
3. https://www.vidyarthiplus.com/vp/thread-15324.html#.WRQS1uWGPIU

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26PSE205 SDG NO: 4,9	COMPUTER AIDED STRUCTURAL ANALYSIS AND DESIGN LABORATORY	L	T	P	C
		3	0	3	1.5

COURSE OBJECTIVES

1. To acquire fundamental knowledge in the analysis and design of civil engineering structures.
2. To develop skills in using modeling software packages relevant to civil engineering applications.
3. To gain practical experience in applying engineering tools for structural analysis and design.
4. To understand core engineering concepts through the integration of software-based solutions.

Sl. No.	LIST OF EXPERIMENTS
1	Develop a Programme for semi-automatic techniques for direct stiffness approach by using MATLAB / MS Excel
2	Develop a Design of Reinforced Concrete One way slab Programme as per IS codes by using Excel spread sheet
3	Analysis and design of an Industrial Building for Gravity Loading by using commercially available software package
4	Analysis and design of an Industrial Building for Seismic Loading by using commercially available software package
5	Analysis and design of a Multi- Bay Reinforced concrete four storied building for Gravity Loading by using commercially available software package
6	Analysis and design of a Multi- Bay Reinforced concrete four storied building for Seismic Loading by using commercially available Software package
7	Finite Element Modeling of steel beam for Single Point Loading by using Software package
8	Finite Element Modeling of Reinforced Concrete beam for Two Point Symmetric Loading by using Software package

TOTAL PERIODS: 30

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Understand the design methodologies using software packages	[U]
CO2	Design the slabs using software packages	[AN]
CO3	Analyse and design Industrial building for gravity and seismic loading	[AN]
CO4	Apply the concept and design the RC Building for gravity and seismic loading	[AP]

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CO5 Analyse and design the RC steel beam using software [AN]

REFERENCES

1 Varghese, P.C., “Limit State Design of Reinforced Concrete”, Prentice Hall of India, Pvt. Ltd., New Delhi, 2009.

2 Krishna Raju, N., “Design of Reinforced Concrete Structures”, CBS Publishers & Distributors, New Delhi, 2003.

INDIAN STANDARDS (IS) CODE OF PRACTICE

1 SP 16: 1980 Design Aids for Reinforced Concrete to IS 456: 1978.

2 SP 34: 1987 Handbook on Concrete Reinforcement and Detailing.

3 IS 456: 2000 Plain and Reinforced Concrete - Code of Practice, BIS, New Delhi.

4 IS 875: 1987 Code of practice for design loads (other than earthquake) for buildings and structures, Part 1: Dead loads - Unit weights of building material and stored materials, Part 2: Imposed loads, Part 3: Wind Loads, Part 4 Snow loads, Part 5 Special loads and load combinations.

5 National Building Code Part1, Part2, Part3, Part4, Part5, and Part6, 2005, BIS, New Delhi.

6 IS 10262 (2019) Guidelines for concrete mix design.

WEB RESOURCES

1 http://nptel.ac.in/courses/105105105/

2 https://onlinecourses.nptel.ac.in/noc16_ce10

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26PSEE01 SDG NO: 9,12,13	ADVANCED CONCRETE TECHNOLOGY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1 To understand concrete materials, mix design principles, and quality control.

2 To explore admixtures and smart materials in advanced concrete.

3 To study durability and resistance of concrete to environmental effects.

4 To learn about special concretes and concrete testing methods.

MODULE I CONCRETE MATERIALS AND MIX DESIGN 9

Past, present, and future developments in concrete – constituent materials – dimensional stability of concrete – properties of fresh and hardened concrete – principles and methods of concrete mix design – quality control measures.

MODULE II ADMIXTURES AND SMART CONCRETE MATERIALS 9

Types and functions of admixtures – mineral and chemical admixtures – fly ash – silica fume – metakaolin – ground granulated blast furnace slag (GGBS) – superplasticizers – smart materials in concrete – piezoelectric materials – optical fibers in concrete.

MODULE III DURABILITY AND ENVIRONMENTAL RESISTANCE 9

Concrete permeability – resistance to chemical and sulphate attacks – quality of water – performance in marine environments – thermal properties – fire resistance – methods to enhance durability – design and construction of mass concrete – structural concrete block masonry.

MODULE IV SPECIAL CONCRETES AND PERFORMANCE TYPES 9

Lightweight and heavyweight concrete – high strength concrete – high performance concrete – self- compacting concrete – shrinkage compensating concrete – mass concrete – roller compacted concrete – self- curing concrete – polymer concrete – steel fiber reinforced concrete – ferrocement – vacuum concrete – shotcrete – ready-mixed concrete – SIFCON – use of special concretes in underground and marine constructions – hot and cold weather concreting.

MODULE V TESTING AND EVALUATION OF CONCRETE STRUCTURES 9

Testing of concrete – evaluation of existing structures – testing hardened and fresh concrete – non-destructive testing methods – semi-destructive techniques – load testing on structural components – investigation techniques for strength and durability assessment.

TOTAL PERIODS: 45

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COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Apply the principles of concrete mix design to develop concrete suitable for various structural applications.	[AP]
CO2	Apply material science concepts to assess and enhance the properties of concrete.	[AP]
CO3	Apply the techniques for producing and using special concretes like self- compacting, high-performance and fiber-reinforced concrete.	[AP]
CO4	Apply suitable concreting practices under challenging conditions such as marine, hot weather, and underwater environments.	[AP]
CO5	Apply appropriate methods to evaluate durability and implement measures to ensure the long-term performance of concrete structures.	[AP]

REFERENCES

1 Gambir,M.L, Concrete Technology, Tata McGraw Hill, Publishing Co,Ltd, New Delhi,2004.

2 Krishnaraju.N, Design of Concrete mixes, Sehgal Educational Consultants Pvt. Ltd., Faridabad, 2012.

3 Shetty M.S., Concrete Technology, S.Chand and Company Ltd. Delhi, 2003.

4 Santhakumar; Concrete Technology, Oxford University Press, 2007.

INDIAN STANDARDS (IS) CODE OF PRACTICE

1 IS: 456-2000, Indian Standards Code of Practice for Plain and Reinforced Concrete.

2 IS: 10262-2019, Recommended Guidelines for Concrete Mix Design

WEB RESOURCES

1 http://kec.edu.np/wp-content/uploads/2017/06/Advanced-Concrete-Technology.pdf

2 http://nptel.ac.in/courses/105101004/

3 https://onlinecourses.nptel.ac.in/noc 1_ch08/course

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26PSEE02 SDG NO: 9,11	DESIGN OF BRIDGES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1 To understand bridge types, components, and IRC loading standards.

2 To design and analyze RC slab and T-beam bridges using load theories.

3 To study principles of long-span and steel bridges.

4 To learn design of bridge bearings, substructures, and foundations.

MODULE I INTRODUCTION TO BRIDGES AND IRC LOADING 9

Definition and components of bridges – preliminary drawings – major bridges in India – classification and importance of bridges – investigation for bridges – choice of type – economical span – IRC specifications for road bridges – highway and railway loading – specification of road bridges – width of carriageway – loads to be considered – dead load – IRC standard live load – other forces acting on bridges – impact effect – general design considerations – straight and curved bridge decks – decks of various types.

MODULE II DESIGN OF RC SLAB AND T-BEAM BRIDGES 9

Design of reinforced concrete slab culvert bridges – load distribution theories – Courbon's theory – Pigeaud's method – design of reinforced concrete T-beam bridges – analysis of deck slab and cross girders – reinforcement detailing – articulation.

MODULE III LONG SPAN BRIDGES AND STEEL BRIDGES 9

Design principles of balanced cantilever bridges – design principles of box girder bridges – continuous bridges – plate girder bridges – railway bridges – cable-stayed and suspension bridges – introduction to steel bridges and their typical uses.

MODULE IV BRIDGE BEARINGS 9

Design of bridge bearings – types of bearings – steel rocker and roller bearings – reinforced concrete rocker and roller bearings – elastomeric pad bearings – functions of bearings – bearing selection criteria – detailing of bearings in bridge structures.

MODULE V SUBSTRUCTURES AND FOUNDATIONS 9

Types of bridge substructures – design of piers and abutments – types of bridge foundations – design of well foundations – design of pile foundations – construction considerations – stability and settlement issues in substructures and foundations.

TOTAL PERIODS: 45

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COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Apply knowledge of bridge components and IRC loadings to analyze and plan appropriate bridge types.	[AP]
CO2	Apply design procedures to develop structural elements of reinforced concrete slab and T-beam bridges.	[AP]
CO3	Apply design principles for long-span bridges such as box girder, balanced cantilever, cable-stayed, and suspension bridges.	[AP]
CO4	Apply suitable methods to design bridge bearings including rocker, roller, and elastomeric types.	[AP]
CO5	Apply foundation design techniques to substructures including piers, abutments, well, and pile foundations.	[AP]

REFERENCES

1. Krishnaraju, N., Design of Bridges, Oxford and IBH Publishing Co., Bombay, Calcutta, New Delhi, 1988.
2. Ponnuswamy, S., Bridge Engineering, Tata McGraw Hill, 2008.
3. Johnson Victor, D. Essentials of Bridge Engineering, Oxford and IBH Publishing Co, New Delhi, 2007.

INDIAN STANDARDS (IS) CODE OF PRACTICE

1. IRC 5 - 2000, Standard Specification and code of practice for road bridges, Section I General, Features of Design, 2000.
2. IRC 6 - 2000 Standard Specification and code of practice for road bridges, Section General, Load and Stresses, 2000.
3. IRC 21- 2000 Standard Specification and code of practice for road bridges, Section I Cement Concrete (Plain and Reinforced), 2000.

WEB RESOURCES

1. https://www.accessengineeringlibrary.com/browse/handbook-of-civil-engineering-calculations-second-edition/p200128239975_59001
2. https://www.teachengineering.org/lessons/view/cub_brid_lesson02
3. http://www.aboutcivil.org/Bridge-designing.html

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26PSEE03 SDG NO: 9,11,13	DESIGN OF STRUCTURES FOR DYNAMIC LOADS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1 To understand material behavior and dynamics under impact, cyclic, and blast loads.

2 To analyze structures using vibration modes, damping, and modeling techniques.

3 To learn design methods for seismic, blast, and impact loads as per IS codes.

4 To study wind effects and apply vibration control and sustainable materials.

MODULE I INTRODUCTION TO DYNAMIC LOADS AND MATERIAL BEHAVIOR 9

Factors affecting design against dynamic loads – behaviour of concrete, steel, masonry, and soil under impact and cyclic loads – recap of structural dynamics with reference to SDOF, MDOF, and continuum systems – importance of ductility in structural design – overview of energy absorption and damping mechanisms in materials.

MODULE II DEGREES OF FREEDOM AND DYNAMIC ANALYSIS 9

Degrees of freedom in structural systems – concept and classification of SDOF and MDOF systems – free and forced vibrations – damping – natural frequency and mode shapes – dynamic equilibrium – methods of solution – introduction to dynamic analysis of structures – importance of accurate modeling for impact and blast loads.

MODULE III DESIGN AGAINST EARTHQUAKES 9

Earthquake characterization – response spectra – seismic coefficient method and response spectrum method (static and dynamic) – approximate methods of estimating seismic loads – response of framed structures, braced frames, and shear wall buildings – displacement method for three-dimensional structures – coordinate transformations – analysis of space trusses and space frames – ductility-based design as per IS 13920 – seismic design guidelines as per BIS codes.

MODULE IV DESIGN AGAINST BLAST AND IMPACT LOADS 9

Nature and characteristics of blast loads – shock waves and pressure-time relationships – structural response under blast loading – design philosophy against impact loads – analytical and empirical methods – design of critical structural elements to resist blast – material behavior under high strain rates – impact-resistant design strategies – detailing for ductility under extreme loads.

MODULE V WIND LOAD EFFECTS AND VIBRATION CONTROL 9

Characteristics of wind – basic and design wind speeds – permeability effects – pressure coefficients – aeroelastic and aerodynamic effects – design as per BIS codes including gust

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factor approach – wind load effects on tall buildings, stacks, and chimneys – energy absorption capacity – detailing for ductility – passive and active vibration control – introduction to sustainable materials for dynamic loading applications.

TOTAL PERIODS: 45

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Apply knowledge of material behavior under impact and cyclic loads to assess structural performance.	[AP]
CO2	Apply the concept of degrees of freedom to analyze structural response under dynamic loading.	[AP]
CO3	Apply BIS codes to design structures that can withstand earthquakes, ensuring ductile performance.	[AP]
CO4	Apply design principles to safeguard structures against blast and impact loads.	[AP]
CO5	Apply wind load design techniques, considering code-based procedures and ductility requirements for structural safety.	[AP]

REFERENCES

1. Paulay.T and Priestly. M.J.N, seismic Design of Reinforced Concrete and Masonry Buildings, John Wiley and Sons, 1991.
2. Concrete Structures under Impact and Impulsive loading, Synthesis Report, CEB.Lousanne, Germany, 1988.
3. Alan G. Daven Port, Wind Effects on Buildings and Structures, Proceedings of the Jubileum Conference on Wind effects on Structures, Port Alegne, Brazil, pp 26-29, May1998, Balkema A.A. Publishers, 1998.

INDIAN STANDARDS (IS) CODE OF PRACTICE

1. IS 1893(Part 1):2002, Criteria for earthquake resistant design of structures: Part 1, General Provisions and buildings
2. IS 1893(Part 4):2005, Criteria for Earthquake Resistant Design of Structures: Part 4, Industrial structures including stack-like structure.
3. IS 1893:1984, Criteria for Earthquake Resistant Design of Structures
4. IS 4991:1968, Criteria for Blast Resistant Design of Structures for Explosions above ground.
5. IS 6922:1973, Criteria for Safety and Design of Structures Subject to Underground Blasts.
6. IS 13920:1993, Code of practice for Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic forces.

WEB RESOURCES

1. https://onlinelibrary.wiley.com/doi/10.1002/eqe.4290110510/pdf

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26PSEE04 SDG NO: 9	DESIGN OF SHELL AND SPATIAL STRUCTURES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1 To understand the behavior and applications of shell structures.

2 To study analysis and design of folded plate structures.

3 To learn design and load transfer in space frame structures.

4 To apply advanced analysis and modeling tools for spatial structures.

MODULE I SHELL STRUCTURES – CONCEPTS AND CLASSIFICATIONS 9

Introduction to shell structures – classification of shells – structural behavior of shells – applications in construction – design principles for circular domes and conical roofs – cylindrical shells – significance of curvature and thickness – ASCE Manual No. 31 for design of cylindrical shells.

MODULE II FOLDED PLATE STRUCTURES 9

Concept and behavior of folded plates – classification and structural action – applications in large span roofs and industrial structures – ACI-ASCE Task Committee method for design – types of folded plates – analysis and design of pyramidal roofs and complex folded forms – detailing and joint considerations.

MODULE III SPACE FRAME STRUCTURES – INTRODUCTION AND DESIGN 9

Definition and types of space frames – three-dimensional load transfer – common configurations and node types – analysis and behavior under loads – general principles of design – structural detailing – examples from stadiums, auditoriums, and industrial sheds – load distribution and structural optimization.

MODULE IV ANALYSIS OF SPACE FRAMES AND TRUSSES 9

Coordinate transformation for 3D structures – mathematical modeling – analysis of space trusses and space frames – load path and stability – application of displacement and stiffness methods – software-based modeling – validation and interpretation of software results – CAD-based design approach.

MODULE V SPECIAL METHODS AND SOFTWARE TOOLS 9

Application of Formex Algebra in structural modeling – use of FORMIAN software for generating space frame configurations – design automation techniques – parametric modeling – optimization using algorithmic design– integration with structural analysis tools – case studies of innovative spatial structures.

TOTAL PERIODS: 45

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COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Apply the concepts of shell and folded plate structures to classify and understand their behavior in structural systems.	[AP]
CO2	Apply classical and approximate methods to analyze plates under different boundary conditions.	[AP]
CO3	Apply design principles for circular domes, conical roofs, and cylindrical shells using standard design codes.	[AP]
CO4	Apply ACI-ASCE Task Committee method for the design of folded plates and analyze space frame structures.	[AP]
CO5	Apply suitable software tools for modeling and analysis of three-dimensional space frame structures.	[AP]

REFERENCES

1. Billington.D.P, Thin Shell Concrete Structures, McGraw Hill Book Co., New York, 1982.
2. Subramanian.N, Principles of Space Structures, Wheeler Publishing Co.1999.
3. Ramasamy, G.S., Design and Construction of Concrete Shells Roofs, CBS Publishers, 1986.
4. Mehdi Farshad, Design and Analysis of shell structures, Kiliwer Academic publishers, 2002.

WEB RESOURCES

1. https://www.iass-structures.org/
2. http://www.springer.com/in/book/9783540174981
3. https://onderwijsaanbod.kuleuven.be/syllabi/e/H05L8AE.htm#activetab=doelstellingen_idp7

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26PSEE05 SDG NO: 9,12	DESIGN OF STEEL CONCRETE COMPOSITE STRUCTURES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1 To introduce the concept and importance of steel–concrete composite construction.

2 To explain composite action and its effect on structural behavior.

3 To study design and detailing of composite structural members.

4 To explore applications using case studies and design codes.

MODULE I INTRODUCTION TO COMPOSITE STRUCTURES 9

Introduction to steel–concrete composite construction – advantages and applications – basic theory and behavior of composite structures – interaction between steel and concrete – types of composite elements – overview of composite construction in high-rise and industrial buildings – construction issues such as shrinkage, creep, and differential deflections.

MODULE II DESIGN OF COMPOSITE MEMBERS 9

Design principles and code provisions for composite beams, slabs, and columns – design of composite trusses – analysis of internal forces – interaction behavior and design checks – construction stages and their effects – fire resistance and durability aspects of composite members.

MODULE III DESIGN OF CONNECTIONS IN COMPOSITE STRUCTURES 9

Types of connections used in steel–concrete composite systems – design of shear connections – rigid and semi-rigid connections – behavior under load – degree of shear connection – analysis under partial shear interaction – detailing for effective load transfer and safety.

MODULE IV COMPOSITE BOX GIRDER BRIDGES 9

Introduction to composite bridges – behavior and load distribution in box girder bridges – plate girder design principles – design and detailing using IRC and international codes – construction challenges – analysis and performance comparison with traditional bridges – durability and maintenance aspects.

MODULE V CASE STUDIES AND SEISMIC PERFORMANCE 9

Case studies of steel–concrete composite construction in residential, commercial, and industrial buildings – performance evaluation – introduction to seismic behavior of composite structures – ductility and energy dissipation – comparison with conventional systems – retrofitting of structures using composite techniques.

TOTAL PERIODS: 45

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COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Apply the fundamental concepts of steel–concrete composite construction in real- world building and infrastructure projects.	[AP]
CO2	Design steel–concrete composite members including beams, slabs, columns, and trusses.	[AP]
CO3	Design shear and moment connections in composite structures with consideration of partial interaction.	[AP]
CO4	Apply composite design principles to analyze and design composite box girder bridges.	[AP]
CO5	Apply the concepts through case studies and analyze the seismic performance of composite structures.	[AP]

REFERENCES

1. Johnson R.P., Composite Structures of Steel and Concrete, Blackwell Scientific Publications, UK, 2004.
2. Oehlers D.J. and Bradford M.A., Composite Steel and Concrete Structural Members, Fundamental behaviour, Pergamon press, Oxford, 1995.
3. Proceedings of Workshop on Steel Concrete Composite Structures, Anna University, 2007.

INDIAN STANDARDS (IS) CODE OF PRACTICE

1. IS 3935:1966, Code of practice for Composite Construction
2. IS 11384:1985, Code of Practice for Composite Construction in Structural Steel and Concrete

WEB RESOURCES

1. https://www.edx.org/course/design-of-steel-concrete-composite-structures
2. Vhttp://www.steelconstruction.info/Composite_construction
3. https://c.ymcdn.com/sites/www.nibs.org/resource/resmgr/BSSC/94NEHRP_Chapter7.pdf
4. https://www.slideshare.net/pashtoonkhan35/composite-structures-of-steel-and-concrete

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26PSEE06 SDG NO: 11	DESIGN OF TALL BUILDINGS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1 To understand design philosophy and loading effects in tall buildings.

2 To study structural systems and their behavior in high-rise structures.

3 To learn analysis techniques including 3D modeling and stability checks.

4 To explore design considerations for elements and overall structural stability.

MODULE I INTRODUCTION TO TALL BUILDING DESIGN 9

Design philosophy – loading types – sequential loading and material selection – gravity loading – wind loading – earthquake loading – equivalent lateral forces – modal analysis – load combinations – factors affecting height and growth – overview of structural forms in tall buildings.

MODULE II STRUCTURAL SYSTEMS AND BEHAVIOR 9

Behavior and classification of structural systems – rigid frames – braced frames – infilled frames – shear walls – coupled shear walls – wall-frame interaction – tubular structures – cores and mega-cores – outrigger bracing – hybrid structural systems – high-rise behavior modeling.

MODULE III ANALYSIS TECHNIQUES FOR TALL BUILDINGS 9

Space frame configurations – node types – modeling for approximate analysis – accurate analysis and reduction methods – global structural system integrity – interaction of major subsystems – member force analysis – drift and twist – computerized 3D analysis.

MODULE IV DESIGN CONSIDERATIONS FOR STRUCTURAL ELEMENTS 9

Design of members for deflection, cracking, prestressing, and shear flow – selection of sectional shapes – resisting capacity – creep and shrinkage effects – design for temperature variations – fire resistance – design for differential movement and joint behavior.

MODULE V STABILITY AND BUCKLING OF TALL STRUCTURES 9

Overall buckling analysis – wall-frames – approximate methods – second-order effects – P-Δ analysis – first- order vs second-order analysis – translational and torsional instability – out-of-plumb effects – stiffness and member interaction – impact of foundation rotation.

TOTAL PERIODS: 45

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COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Apply design principles and loading conditions specific to tall buildings in structural planning.	AP
CO2	Analyze the behavior of structural systems including braced frames, shear walls, and outriggers.	AP
CO3	Perform approximate and accurate analysis of tall buildings using manual and software tools.	AP
CO4	Apply computational tools for 3D analysis and interpret structural behavior.	AP
CO5	Evaluate structural stability considering buckling, torsional effects, and foundation rotations.	AP

REFERENCES

1 Beedle, L.S., Advances in Tall Buildings CBS publishers and Distributors, Delhi, 1996.

2 Coull, A., and Smith,S.B. Tall Buildings, Pergamon Press, London, 1997.

3 Smith, B.S., and Coull, A., Tall Building Structures Analysis and Design, John Wiley and Sons,Inc, 1991.

WEB RESOURCES

1 https://www.crcpress.com/Structural-Analysis-and-Design-of-Tall-Buildings-Steel-and-Composite- Construction/Taranath/p/book/9781439850893

2 http://www.tk.ac.in/nicee/wcee/article/10_vol7_3635.pdf

3 http://peer.berkeley.edu/publications/peer_reports/reports_2010/web_PEER2010_05_GUIDELINES.pdf

4 http://www.thorntontomasetti.c`om/wp-content/uploads/2012/02/Super_Tall_Design.pdf

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26PSEE07 SDG NO: 11,13	DISASTER MITIGATION AND MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1 To understand basic concepts in disaster management

2 To understand the applications of technology in risk reduction

3 To learn about awareness of risk reduction

4 To get exposure on development planning methods

MODULE I FUNDAMENTALS OF DISASTER MANAGEMENT 9

Definition and classification of disasters – disaster preparedness – goals and objectives of ISDR – risk identification and sharing – linkage between disaster and development – principles of risk partnership –evolution of disaster management approaches.

MODULE II DISASTER-DEVELOPMENT INTERACTIONS 9

Development planning and its implications for disaster management – role of policy and financial arrangements – improvement areas in current practices – community-based disaster management – emergency response strategies – stakeholder roles in disaster response.

MODULE III SEISMICITY AND STATISTICAL SEISMOLOGY 9

Seismic waves and their characteristics – types of faults – earthquake magnitude and intensity – ground damage and secondary hazards (tsunami, landslides) – application of statistical seismology – interpretation of seismic data – early warning systems.

MODULE IV TECHNOLOGY IN DISASTER RISK REDUCTION 9

Technological tools for disaster risk reduction – databases and RDBMS – MIS and DSS – GIS applications – intranet/extranet for communication – remote sensing insights – integration of remote sensing and GIS – case studies on tech-based disaster mitigation.

MODULE V AWARENESS, EDUCATION AND TRIGGER MECHANISM 9

Constitution and functioning of trigger mechanisms – disaster information networks – education as a tool for risk reduction – public awareness and community participation – capacity building for resilience – media and ICT tools in disaster communication.

TOTAL PERIODS: 45

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COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Apply mitigation and preparedness strategies in planning disaster management programs.	AP
CO2	Analyze the impact of different disaster types on vulnerable communities and ecosystems.	AP
CO3	Apply statistical seismology techniques in assessing earthquake risks.	AP
CO4	Utilize recent technologies like GIS, remote sensing, and MIS in disaster risk reduction.	AP
CO5	Integrate disaster management techniques and strategies with development planning and emergency response systems.	AP

REFERENCES

1. Sundar.I., Disaster Management , Sarup & Sons, 3rd edition New Delhi 2007.
2. Pardeep Sahni, Madhavimalalgoda and Ariyabandu, “Disaster risk reduction in south Asia”, PHI.
3. Amitasinvhal, “Understanding Earthquake Disasters” TMH, 2010.

WEB RESOURCES

1. http:// nptel.ac.in/courses/122102006/9
2. https://tcyonline.com/video-tutorials-disaster-management/94374/course

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26PSEE08 SDG NO: 9,11	INDUSTRIAL STRUCTURES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1 To get knowledge on basic industrial structures

2 To get exposure on plastic analysis

3 To learn about power plant structures and transmission structures

4 To learn about industrial structures

MODULE I FUNCTIONAL REQUIREMENTS AND INDUSTRIAL PLANNING 9

Classification of industries and industrial structures – layout planning – lighting, ventilation, and fire safety provisions – protection against noise and vibration – guidelines of Factories Act – roof systems (steel and RCC) – gantry girders – design of corbels and nibs – introduction to machine foundations.

MODULE II PLASTIC ANALYSIS OF STRUCTURAL ELEMENTS 9

Basic concepts of plastic analysis – plastic hinge formation – shape factors – mechanism method – moment rotation characteristics – ultimate load calculation – moment redistribution – evaluation of structural sections for plastic behavior.

MODULE III ROOF AND POWER PLANT STRUCTURES 9

Design of roof structures – types and selection of roof trusses – design of turbo-generator foundations – containment structures – vibration and stability considerations in power plant buildings – construction materials and special elements.

MODULE IV POWER TRANSMISSION STRUCTURES 9

Design of transmission line towers – substation structures – tower foundations – wind and seismic considerations – testing of towers – load combinations – design methodology based on standards and codes of practice.

MODULE V AUXILIARY INDUSTRIAL STRUCTURES 9

Design of chimneys – reinforced concrete and steel chimneys – design of cooling towers – classification and behavior of bunkers and silos – design principles of pipe supporting structures – maintenance and durability considerations.

TOTAL PERIODS: 45

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COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Apply functional requirements in planning and designing industrial structures.	AP
CO2	Apply plastic design concepts for analyzing structural elements.	AP
CO3	Design roof structures and power plant components based on structural analysis.	AP
CO4	Apply suitable design methodologies for transmission and auxiliary structures.	AP
CO5	Evaluate the behavior of R.C. sections under ultimate loading using moment-rotation and mechanism methods.	AP

REFERENCES

1. Santhakumar, A.R.and Murthy S.S., Transmission Line Structures, Tata McGraw Hill, 1992.
2. Manohar, S.N, Tall Chimneys - Design and Construction, Tata McGraw Hill, 1985.
3. Srinivasulu P. and Vaidyanathan.C, Handbook of Machine Foundations, Tata McGraw Hill, 1976.
4. Jurgen Axel Adam, Katharria Haussmann, Frank Juttner, Klauss Daniel, Industrial Buildings: A Design Manual, Birkhauser Publishers, 2004.

INDIAN STANDARDS (IS) CODE OF PRACTICE

1. IS 14689:1999, Code of practice for fire safety in industrial buildings (Printing and Publishing Industry).

WEB RESOURCES

1. http://nptel.ac.in/courses/105106113/3/
2. https://onlinecourses.nptel.ac.in/noc16_ee02/course

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26PSEE09 SDG NO: 9,11,12	MAINTENANCE AND REHABILITATION OF STRUCTURES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1 To understand causes of deterioration and durability issues in concrete structures.

2 To study serviceability requirements and mechanisms of concrete degradation.

3 To explore materials and techniques for structural repair and protection.

4 To learn methods for retrofitting, rehabilitation, and demolition of structures.

MODULE I CONCEPTS OF MAINTENANCE AND DURABILITY 9

Definition and importance of maintenance – repair and rehabilitation – facets of maintenance – inspection techniques – assessment procedures – types of surface defects – causes of deterioration – durability issues: permeability, surface wear, crystallization, frost action – chemical attacks: sulphates, alkali-aggregate reaction, marine exposure effects – efflorescence and salt weathering.

MODULE II SERVICEABILITY AND CONCRETE DEGRADATION 9

Serviceability requirements – fire effects – frost damage – carbonation – corrosion of reinforcement – surface blemishes and color variation – cracks and their classification – exposure conditions – impact of environment on service life – deterioration due to physical and chemical mechanisms.

MODULE III MATERIALS FOR REPAIR AND PROTECTION 9

Special concretes and mortars – polymer-modified concrete – expansive cements – sulphur infiltrated concrete – ferrocement – epoxy-based materials – protective coatings – corrosion inhibitors – cathodic protection – gunite and shotcrete – dry pack and vacuum concrete – underwater repair materials.

MODULE IV STRUCTURAL REPAIR TECHNIQUES 9

Epoxy injection for crack sealing – bonding steel plates – FRP wrapping and jacketing – strengthening of beams, columns, and slabs – shoring and underpinning – retrofitting of seismic-distressed structures – techniques for concrete floor repair – leak sealing and surface treatments.

MODULE V REHABILITATION, RETROFITTING, AND DEMOLITION 9

Testing and evaluation methods – classification of structures by safety – retrofitting for seismic and flood- prone areas – rehabilitation strategies for heritage and special structures – engineered demolition techniques – risk assessment and safe demolition planning – documentation and case studies.

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TOTAL PERIODS: 45

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Apply fundamental concepts of maintenance and serviceability to assess structures.	AP
CO2	Apply building repair methodologies considering serviceability and durability characteristics.	AP
CO3	Use modern materials and techniques to repair and restore structural elements.	AP
CO4	Apply assessment and engineered demolition techniques for damaged or failed structures.	AP
CO5	Select appropriate materials and post-repair techniques for strengthening special structures.	AP

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2. B.Vidivelli, Rehabilitation of Concrete Structures Standard Publishes Distribution.1st edition 2009.
3. P.C.Varghese, Maintenance Repair and Rehabilitation & Minor works of building, Prentice Hall India Pvt Ltd 2014.
4. Handbook on repair and rehabilitation of RCC buildings", CPWD, Government of India, New Delhi, 2002.

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2. https://www.constrofacilitator.com/various-retrofitting-methods-for-repair-and-rehabilitation- for-concrete-failure/
3. https://nptel.ac.in/courses/105/106/105106202/

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26PSEE10 SDG NO: 9	STABILITY OF STRUCTURES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1 To study the inelastic buckling concept

2 To understand the concept of bucking of column

3 To Study the types of bucking of frames

4 To study the torsional buckling concepts and plate buckling concepts

MODULE I INTRODUCTION TO BUCKLING AND ANALYTICAL APPROACHES 9

States of equilibrium – classification of buckling problems – concept of equilibrium, energy, imperfection and vibration methods – Eigenvalue problems – governing equation for columns – effect of shear on buckling – methods of solution: Equilibrium method, Energy method, Rayleigh-Ritz method, Galerkin's method – numerical approaches: finite difference method

MODULE II BUCKLING OF BEAM-COLUMNS AND FRAME STRUCTURES 9

Theory of beam-columns – stability analysis of beam-columns under point loads, distributed loads, and end moments – effect of slenderness ratio – rigid jointed frames with and without sway – methods for stability evaluation – estimation of critical load using approximate and numerical techniques.

MODULE III TORSIONAL AND FLEXURAL-TORSIONAL BUCKLING 9

Concepts of torsional buckling – torsional-flexural interaction – local buckling of thin-walled open sections – analysis of open and closed cross-sections – application of numerical solutions – buckling of angles and channels – instability of thin webs and flanges.

MODULE IV LATERAL BUCKLING OF BEAMS 9

Lateral-torsional buckling of beams – beams in pure bending – influence of boundary conditions – lateral buckling in cantilevers and simply supported beams – influence of lateral restraints – critical moment derivation and practical applications.

MODULE V BUCKLING OF PLATES AND INELASTIC STABILITY 9

Governing differential equations – buckling of thin rectangular plates – edge support conditions – equilibrium and energy methods for plates – approximate and numerical approaches – inelastic buckling: double modulus theory, tangent modulus theory – Shanley's model – post-buckling behavior – eccentrically loaded columns.

TOTAL PERIODS: 45

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COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Apply fundamental approaches to calculate buckling loads of columns.	AP
CO2	Estimate the buckling loads of beam-columns and rigid frames using various methods.	AP
CO3	Analyze lateral-torsional buckling in thin-walled beams under flexural loading	AN
CO4	Apply principles to determine the buckling behavior of plates under various edge conditions.	AP
CO5	Analyze inelastic buckling behavior of columns and plates using appropriate models.	AN

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1. S.R.Damodaraswamy & S.Kavitha, Basics of Dynamics and Aseismic Design, PHI Learning, 2009.
2. Pankaj Agarwal & Shrikhande, Earth quake resistant Design of Structures, PHI Learning, 2009.
3. Chopra A.K., “Dynamics of Structures - Theory and Applications to Earthquake Engineering”, Second Edition, Pearson Education, 2007.
4. Ashwini Kumar, Stability Theory of Structures, Tata McGraw Hill Publishing Company Ltd., New Delhi, 1995.
5. Gambhir, Stability Analysis and Design of Structures, Springer, New York, 2004.

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26PSEE11 SDG NO: 9,11,12	PREFABRICATED STRUCTURAL SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1 To know the IS Codal specifications

2 To understand the design principles of prefabricated structures

3 To study about prefabricated walls

4 To learn about industrial buildings, prefabricated floors, stairs, roof

MODULE I FUNDAMENTALS AND PLANNING FOR PREFABRICATION 9

Civil engineering requirements for prefabricated construction – planning and layout of prefabrication plant – IS code specifications – modular coordination – standardization – disuniting of prefabricated elements – stages of loading – production, transportation and erection – material properties – safety factors – deflection control – lateral load resistance – overview of shear wall types and placement.

MODULE II DESIGN OF PREFABRICATED WALLS AND SHEAR WALLS 9

Types of wall panels: load-bearing and partition walls – long wall and cross wall systems – framed buildings with curtain walls – load transfer mechanism – vertical loads and eccentricity – stability of wall panels – joint types and their design – sandwich wall panels – joint sealants and leak prevention – approximate design of shear walls – design curves and reinforcement strategies.

MODULE III DESIGN OF FLOORS, STAIRS AND ROOF SLABS 9

Types of prefabricated floor slabs – cored slabs, panel slabs, and two-way systems – insulation needs – analysis and design of stairs and roof slabs – joint descriptions and reinforcement – short-term and long-term deflection control – ultimate strength calculations in flexure and shear – load transfer through floor to wall interfaces.

MODULE IV FORCES IN MANUFACTURE AND HANDLING 9

Stripping forces during lifting and handling – codal considerations for manufacturing stresses – design for lifting, transportation and erection stresses – stress development during demolding – safety in prefabrication processes – stability and cracking due to handling – performance of prefabricated units under temporary construction loads.

MODULE V DESIGN OF INDUSTRIAL BUILDINGS WITH PREFABRICATION 9

Structural elements of single-storey industrial sheds – design of R.C. roof trusses – analysis of roof panels – design of R.C. gantry girders, corbels and columns – wind bracing and load paths – design of shell roofs – Integration of prefabricated components in large-span buildings.

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TOTAL PERIODS: 45

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Apply IS codes and modular coordination principles in the planning of prefabricated structures.	AP
CO2	Apply design principles to prefabricated wall panels and shear walls.	AP
CO3	Apply suitable methods to design prefabricated floors, stairs, and roof slabs.	AP
CO4	Apply design procedures to calculate stripping forces during production and erection of units.	AP
CO5	Apply appropriate analysis and design techniques for roof trusses and industrial prefabricated sheds.	AP

REFERENCES

1 Hubert Bachmann and Alfred Steinle, Precast Concrete Structures, 2012.

2 Lewicki.B, Building with Large Prefabricates, Elsevier Publishing Company, 1988.

INDIAN STANDARDS (IS) CODE OF PRACTICE

1 IS 15916:2010 Building Design and Erection using Prefabricated Concrete — Code of Practice

WEB RESOURCES

1 https://www.engineeringcivil.com/different-types-of-slabs-used-in-construction-and-their-uses- advantages-disadvantages.html

2 https://uta.pressbooks.pub/buildinginformationmodeling/chapter/floors-roofs-and-ceilings

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26PSEE12 SDG NO: 4,9	EXPERIMENTAL METHODS AND MODEL ANALYSIS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1. To provide fundamental knowledge of strain, vibration, wind, and acoustic measurements in structural systems.
2. To introduce techniques for identifying structural distress using non-destructive testing methods.
3. To develop understanding of instrumentation and experimental tools for structural health monitoring.
4. To apply real-time monitoring techniques for assessing the condition and performance of infrastructure.

MODULE I FUNDAMENTALS OF EXPERIMENTAL STRESS ANALYSIS AND STRAIN MEASUREMENT 9

Basics of experimental methods, types and sources of errors in measurements, principles of strain measurement, photoelasticity and its applications, hydraulic jacks, pressure gauges, electronic load cells, proving rings, and fiber optic sensors. Introduction to strain gauges and calibration of testing machines.

MODULE II VIBRATION MEASUREMENT TECHNIQUES AND INSTRUMENTATION 9

Overview of structural vibrations, vibration sensors, long-term monitoring, transducers for velocity and acceleration (LVDT), vibration meters, seismographs, vibration analyzers, signal display and recording systems (CRO, XY plotter, chart plotters), and digital data acquisition systems.

MODULE III WIND FLOW MEASUREMENT AND ACOUSTIC TECHNIQUES 9

Principles of pressure and flow measurements, wind tunnel testing, sound level meters, pitot-static tubes, venturimeter, anemometers, and their use in structural and fluid flow modeling. Introduction to acoustic emission techniques for monitoring structural behavior.

MODULE IV DISTRESS DETECTION AND STRUCTURAL HEALTH MONITORING 9

Diagnosis of distress in structures, crack identification and monitoring, corrosion assessment in concrete, use of half-cell potential, rebound hammer, load testing on structural elements, damage assessment, and controlled demolition techniques.

MODULE V NON-DESTRUCTIVE TESTING (NDT) METHODS IN CIVIL STRUCTURES 9

Advanced NDT methods: Ultrasonic testing (pulse echo, impact echo), laser-based techniques, holography, infrared thermography, GECOR, ground-penetrating radar (GPR), and other recent tools for material evaluation and structural safety assessment.

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TOTAL PERIODS: 45

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Understand various measurement techniques for strain, vibration, and acoustic behavior	U
CO2	Apply experimental techniques for wind flow and acoustic analysis in structural systems	AP
CO3	Analyze the condition of structural components using distress and damage indicators	AN
CO4	Evaluate appropriate non-destructive testing methods for structural diagnostics	AP
CO5	Classify and interpret testing equipment and sensors used in experimental stress analysis	AN

REFERENCES

1. Ravisankar,.K. and Chellappan, A., Advanced Course on Non-Destructive Testing and Evaluation of Concrete Structures, SERC, Chennai, 2007.
2. Ganesan,T.P, Model Analysis of Structures, University Press, India, 2000.
3. Sadhu Singh, Experimental Stress Analysis, Khanna Publishers, New Delhi, 1996.
4. Dalley., J.W and Riley.,W.F, Experimental Stress Analysis, McGraw Hill Book Company, N.Y.1991.

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26PSEE13 SDG NO:4,9	THEORY OF PLATES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1. To understand the fundamentals of thin and thick plate behavior, including material classification (isotropic/orthotropic), and governing differential equations under various boundary conditions.
2. To apply analytical methods such as Navier's and Levy's solutions to solve classical plate theory problems in rectangular and circular plates.
3. To analyze plate structures using approximate energy methods and numerical approaches, including finite difference and finite element methods, for complex geometries and support conditions.
4. To integrate advanced theories like shear deformation and large deflection theory into structural design applications, and evaluate slab and shell systems in accordance with design codes and detailing requirements.

MODULE I FUNDAMENTALS OF PLATE BEHAVIOR 9

Introduction to thin and thick plates – Classification – Material behavior: isotropic and orthotropic plates – Classical plate theory – Small deflection theory – Governing differential equation of plates in Cartesian coordinates – Boundary conditions and exact solutions – Navier's and Levy's solutions for simply supported rectangular plates.

MODULE II SYMMETRICAL BENDING OF CIRCULAR PLATES 9

Differential equation for circular plates under symmetrical loading – Boundary conditions: simply supported, clamped – Plates with central holes – Concentric loading – Application to circular slabs – Analysis of thin circular plates using classical theory.

MODULE III APPROXIMATE AND ENERGY METHODS 9

Energy-based approaches: Rayleigh-Ritz, Galerkin's method – Simultaneous bending and stretching – Application to rectangular and circular plates – Introduction to numerical methods – Finite difference method basics for rectangular plates.

MODULE IV PLATES OF COMPLEX GEOMETRY AND SUPPORTS 9

Finite Element Method: introduction and basic concepts – Triangular, elliptic, and skew plates – Sector plates – Plates on elastic foundations – Behavior of continuous plates – Applications in engineering structures.

MODULE V ADVANCED THEORIES AND DESIGN APPLICATIONS 9

Large deflection theory – Shear deformation theories (Mindlin's theory) – Flat plate behavior – Engineering design of rectangular floor slabs – Structural detailing considerations – Introduction to design codes and applications in shell and slab systems.

TOTAL PERIODS: 45

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COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Understand the mechanical behavior and governing equations of thin and thick plates	U
CO2	Apply analytical and numerical methods to evaluate plate deflection and stress	AP
CO3	Analyze isotropic and orthotropic plates subjected to various loading and support conditions	AP
CO4	Solve complex plate problems using energy methods and finite difference techniques	AN
CO5	Interpret and apply advanced plate theories for practical structural systems	AN

REFERENCES

1. Rudolph Szilard., “Theory and Analysis of Plates”, Prentice Hall, 1995.
2. Timoshenko and Krieger, “Theory of Plates and Shells”, Mc-Graw Hill Inc, New York, 1959.
3. Donnel, L.H., “Beams, Plates and Shells”, McGraw Hill Inc, 1976.
4. Bairagi. N.K., “A Text Book of Plate Analysis”, Khanna Publishers”, New Delhi, 1996.

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26PSEE14 SDG NO: 9,11,12	ADVANCED CONSTRUCTION TECHNOLOGY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1 To understand the methods, equipment, and technologies used in advanced sub-structure and superstructure construction, including jacking techniques, tunneling, and high-rise erection.
2 To apply techniques for repair, retrofitting, and safe demolition of civil engineering structures, with emphasis on modern materials and safety standards.
3 To develop skills in construction project management, personnel leadership, and stakeholder coordination through real-world project-based learning.
4 To evaluate construction resources, equipment productivity, and cost management using estimation techniques and computer-based tools for effective project delivery.

MODULE I SUB-STRUCTURE CONSTRUCTION TECHNIQUES 9

Box jacking and pipe jacking - Diaphragm walls and basement construction - Tunneling, well and caisson sinking - Sheet piling, cofferdam construction, and grouting - Dewatering systems and vacuum dewatering of concrete.

MODULE II SUPERSTRUCTURE AND HIGH-RISE CONSTRUCTION 9

Concrete paving and continuous concreting for tall buildings - Suspended formwork and aerial erection methods - Erection of cooling towers, chimneys, silos, and transmission towers - Launching of decks and in-situ prestressing - Construction of large span structures, cable-stayed and bowstring bridges

MODULE III REPAIR AND DEMOLITION TECHNOLOGIES 9

Mud jacking and micro piling - Underpinning and advanced waterproofing - Pipeline laying and sheet pile protection - Sequence of demolition and safety in dismantling operations

MODULE IV PROJECT AND PERSONNEL MANAGEMENT 9

Project management principles and modern trends - Stakeholder roles and project organization types - Innovation in construction and feasibility studies - Leadership, motivation, and interpersonal behaviour in teams.

MODULE V RESOURCES AND COST MANAGEMENT 9

Labour productivity and material management - Equipment selection and production rates - Construction cost estimation: unit cost method, cost indices - Operating costs and computer-aided cost estimation tools.

TOTAL PERIODS: 45

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COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Understand construction methods used in sub-structure and superstructure for heavy structures	[U]
CO2	Apply advanced techniques in construction, repair, demolition, and dismantling.	[AP]
CO3	Analyze project management processes including stakeholder roles and planning tools	[AN]
CO4	Evaluate labour, material, and equipment management techniques and their effect on productivity	[AN]
CO5	Apply cost estimation principles and modern software tools in construction project planning	[AP]

REFERENCES

1. Seetharaman S, Construction Engineering and Management, Umesh Publications, Nai Sarak, Delhi, 2008.
2. National Building Code, Bureau of Indian Standards, New Delhi, 2017.
3. Peurifoy, R.L. Construction Planning, Methods and Equipment, McGraw Hill, 2011.
4. Nunnally, S.W. Construction Methods and Management, Prentice Hall, 2006
5. Jerry Irvine Advanced Construction Techniques, CA Rocker, 2001.

WEB RESOURCES

1. https://www.youtube.com/watch?v=pIdaC_I6H_M
2. https://www.youtube.com/watch?v=3Do2cZMUG

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26PSEE15 SDG NO:9,11	SOIL STRUCTURE INTERACTION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1 To understand the interaction mechanisms between soil and foundation systems under various loading and support conditions.
2 To analyze soil response models and apply them to beams and plates on elastic foundations using theoretical and numerical approaches.
3 To evaluate the behavior of axially and laterally loaded piles and pile groups, including settlement, load distribution, and pile-raft interaction.
4 To assess ground-foundation-structure interaction effects under static and dynamic loading conditions, considering contact pressure and soil-structure feedback mechanisms.

MODULE 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– Elastic continuum- Two parameter elastic models- Elastic-plastic behaviour- Time dependent behaviour.

MODULE II BEAM ON ELASTIC FOUNDATION- SOIL MODELS 9

Infinite beam – Two-parameters models – Isotropic elastic half space model – Analysis of beams of finite length – combined footings.

MODULE III PLATES ON ELASTIC CONTINUUM 9

Thin and thick rafts – Analysis of finite plates - Numerical analysis of finite plates.

MODULE IV ANALYSIS OF AXIALLY AND LATERALLY LOADED PILES AND PILE GROUPS 9

Elastic analysis of single pile – Theoretical solutions for settlement and load distributions – Analysis of pile group – Interaction analysis – Load distribution in groups with rigid cap – Load deflection prediction for laterally loaded piles – Subgrade reaction and elastic analysis – Interaction analysis – Pile-raft system.

MODULE V GROUND-FOUNDATION-STRUCTURE INTERACTION 9

Effect of structure on ground-foundation interaction – Static and dynamic loads- Contact pressure and its estimation – Estimation of the settlement from the constitutive laws – Free-field response – Kinetic interaction – Inertial interaction.

TOTAL PERIODS: 45

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COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Explain the concept of soil structure interaction	[U]
CO2	Do a static analysis of infinite and finite beams resting on elastic foundation	[U]
CO3	Analyse finite thin and thick plates	[U]
CO4	Do a static and dynamic analysis of soil structure interaction problems	[AP]
CO5	Analyze ground foundation and structure interaction problems	[AP]

REFERENCES

1. Selvadurai, A.P.S., Elastic Analysis of Soil Foundation Interaction, Elsevier.1979.
2. Poulos, H.G., and Davis, E.H., Pile Foundation Analysis and Design, John Wiley, 1980.
3. Scott, R.F., Foundation Analysis, Prentice Hall, 1981.

WEB RESOURCES

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26PSEE16 SDG NO: 11,3	WIND AND CYCLONE EFFECTS ON STRUCTURES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1 To understand the characteristics of wind, its measurement, and its dynamic effects on various types of structures.
2 To apply wind tunnel study methods for evaluating aerodynamic and aero-elastic behavior of structural models, including damping and load combinations.
3 To analyze the static and dynamic response of structures such as tall buildings, chimneys, and transmission towers under wind and cyclone loading.
4 To interpret and implement national and international code provisions in the wind-resistant design of special structures and cladding systems.

MODULE 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.

MODULE 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 - Modeling Requirements, Aero dynamic and Aero-elastic models-Recent advancements.

MODULE 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- Wind effect - case studies.

MODULE 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 and steel monopoles– Industrial sheds.

MODULE 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- Cyclone case studies.

TOTAL PERIODS: 45

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1 Design high rise structures subjected wind load, even structures exposed to cyclone [AP]

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CO2	Illustrate various code provisions for the design of structures for wind load.	[AP]
CO3	Explain the concepts on the wind effects on structures	[AP]
CO4	Examine the behavior of various special structures due to wind loading	[AP]
CO5	Perform the design of structures against cyclone.	[AN]

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1. Cook, N.J., the Designers Guide to Wind Loading of Building Structures, Butterworths, 1989.
2. Kolousek,.V, Pirner.M, Fischer.O and Naprstek.J, Wind Effects on Civil Engineering Structures, Elsevier Publications, 1984.
3. Lawson, T.V., Wind Effects on Building Vol. I and , Applied Science Publishers, London, 1980.

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26PSEE17 SDG NO: 9	NONLINEAR ANALYSIS OF STRUCTURES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1. To understand the fundamental concepts of material and geometric nonlinearity in statically determinate and indeterminate systems.
2. To apply inelastic analysis methods to flexural members and bars with varying stiffness and axial restraints under small deformations.
3. To analyze the vibration response of flexural members, including hysteretic behavior under cyclic loading.
4. To evaluate the elastic and inelastic behavior of plates and investigate nonlinear vibration and stability issues in elastically supported structures.

MODULE I INTRODUCTION TO NONLINEAR ANALYSIS 9

Material nonlinearity, geometric nonlinearity; statically determinate and statically indeterminate bar systems of uniform and variable thickness.

MODULE II INELASTIC ANALYSIS OF FLEXURAL MEMBERS 9

Inelastic analysis of uniform and variable thickness members subjected to small deformations; inelastic analysis of bars of uniform and variable stiffness members with and without axial Restraints.

MODULE III VIBRATION THEORY AND ANALYSIS OF FLEXURAL MEMBERS 9

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

MODULE IV ELASTIC AND INELASTIC ANALYSIS OF PLATES 9

Elastic and inelastic analysis of uniform and variable thickness plates.

MODULE V NONLINEAR VIBRATION AND INSTABILITY 9

Nonlinear vibration and Instabilities of elastically supported beams.

TOTAL PERIODS: 45

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Analyze the bar system considering the material and geometric nonlinearity	[AN]
CO2	Perform inelastic analysis of flexural members	[AN]
CO3	Perform vibration analysis of flexural members	[AN]
CO4	Perform elastic and inelastic analysis of Plates	[AN]
CO5	Perform nonlinear and instability analysis of elastically supported beams	[AN]

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1 Sathyamoorthy, M., Nonlinear Analysis of Structures, CRC Press, Boca Raton, Florida, 1997.

2 Fertis, D. G., Nonlinear Mechanics, CRC Press, Boca Raton, Florida, 1998.

3 Reddy.J.N, Non linear Finite Element Analysis, Oxford University Press, 2008.

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26PSEE18 SDG NO: 9,14	OFFSHORE STRUCTURES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1 To understand wave generation mechanisms and apply wave theories to analyze ocean wave behavior and its interaction with structures.
2 To evaluate wind and current forces acting on offshore structures using appropriate theoretical models including Morrison's equation.
3 To analyze offshore structural systems and their foundations through static and dynamic analysis techniques.
4 To design offshore components such as platforms, mooring systems, and pipelines, considering factors like corrosion and fatigue failure.

MODULE I WAVE THEORIES 9

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

MODULE II FORCES OF OFFSHORE STRUCTURES 9

Wind forces, wind forces on vertical, inclined cylinders, structures - current forces and use of Morrison equation.

MODULE III OFFSHORE SOIL AND STRUCTURE MODELLING 9

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

MODULE IV ANALYSIS OF OFFSHORE STRUCTURES 9

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

MODULE V DESIGN OF OFFSHORE STRUCTURES 9

Design of platforms, helipads, Jacket tower, analysis and design of mooring cables and pipelines. Corrosion and Fatigue Failure

TOTAL PERIODS: 45

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Develop the concept of wave theories	[AP]
CO2	Apply the knowledge of wave forces and offshore structures	[AP]
CO3	Explain the modeling for offshore structure and its foundation	[AP]
CO4	Analyse offshore structures by means of static and dynamic methods	[AN]
CO5	Design of jacket towers, mooring cables and pipelines	[AN]

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REFERENCES

1 Chakrabarti, S.K. Hydrodynamics of Offshore Structures, Computational Mechanics Publications, 1987.

2 Dawson.T.H. Offshore Structural Engineering, Prentice Hall Inc Englewood Cliffs, N.J. 1983.

3 Brebia, C.A and Walker, S., Dynamic Analysis of Offshore Structures, NewButterworths, U.K. 1979.

WEB RESOURCES

1 https://www.youtube.com/watch?v=f26ycZ1fXB0

2 https://www.youtube.com/watch?v=SP7TdqXwZ_w

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26PSEE19 SDG NO: 11,13	GEOTECHNICAL EARTHQUAKE ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1 To understand the fundamentals of earthquake mechanisms and vibration theory, and their application to geotechnical engineering problems.
2 To analyze ground motion characteristics and wave propagation effects using seismological principles and spectral parameters.
3 To evaluate dynamic soil behavior, liquefaction potential, and associated hazards through laboratory, in-situ testing, and hazard mapping techniques.
4 To apply seismic hazard analysis and design principles to geotechnical structures in compliance with codal provisions.

MODULE I FUNDAMENTALS OF EARTHQUAKE AND VIBRATION THEORY 9

Scope of geotechnical earthquake engineering, types of earthquake loading, and the fundamentals of vibration theory including free and forced vibration, damping, response spectra, and single and multi- degree-of-freedom systems. Basics of seismology, causes of earthquakes, fault mechanisms, plate tectonics, and earthquake data interpretation.

MODULE II GROUND MOTION AND WAVE PROPAGATION 9

Strong ground motion parameters such as magnitude, intensity, frequency content, and attenuation. Analysis of spectral parameters, arias intensity, and spatial variability. Introduction to wave propagation in unbound and layered media, seismic travel time curves, Methods to locate earthquake epicentres.

MODULE III DYNAMIC SOIL BEHAVIOUR AND LIQUEFACTION 9

Introduction to stiffness, damping, and plasticity parameters of soil under dynamic loading. Laboratory and in-situ testing methods for parameter evaluation. Liquefaction phenomenon, evaluation, effects such as lateral spreading, and hazard mapping

MODULE IV SEISMIC HAZARD AND SITE RESPONSE ANALYSIS 9

Deterministic and probabilistic seismic hazard analysis (DSHA and PSHA), including source characterization, magnitude indicators, recurrence laws, and logic tree methods. Ground response analysis, transfer functions, and site classification using linear and non-linear approaches

MODULE V SEISMIC DESIGN OF GEOTECHNICAL STRUCTURES 9

Pseudo-static and pseudo-dynamic methods for the seismic design of various geotechnical systems such as retaining walls, slopes, shallow and deep foundations, MSW landfills, and ground anchors. Behaviour of reinforced soils and tailing dams under seismic conditions using relevant IS code provisions

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TOTAL PERIODS: 45

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Understand the basics of earthquakes, ground motion, and seismic wave propagation relevant to geotechnical applications.	[U]
CO2	Evaluate dynamic soil properties and their influence on soil behaviour during seismic events, including liquefaction.	[AP]
CO3	Apply seismic hazard and site response analysis techniques for geotechnical engineering problems	[AP]
CO4	Design geotechnical structures such as foundations, retaining walls, and slopes under seismic loading using appropriate analysis methods	[AN]
CO5	Interpret codal guidelines and apply practical solutions for geotechnical earthquake risk mitigation	[AN]

REFERENCES

1. KameswaraRao, N.S.V., Dynamics soil tests and applications, Wheeler Publishing – New Delhi, 2000.
2. Krammer S.L., Geotechnical Earthquake Engineering, Prentice Hall, International Series, Pearson Education (Singapore) Pvt. Ltd., 2004.
3. KameswaraRao, Vibration Analysis and Foundation Dynamics, Wheeler Publishing, New Delhi, 1998.

WEB RESOURCES

1. http://nptel.ac.in/courses/105104136/
2. https://www.youtube.com/watch?v=HpNOskWd9oc

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26PSEE20 SDG NO: 9,11	EARTH PRESSURE AND EARTH RETAINING STRUCTURES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1. To understand the fundamental theories of earth pressure and their application under various soil and loading conditions, including seismic influences.
2. To apply classical and graphical methods to determine active and passive earth pressures for different backfill and wall conditions.
3. To analyze and design rigid and flexible retaining structures with emphasis on stability, safety, and geotechnical considerations.
4. To evaluate the behavior and design of underground soil-structure systems such as braced excavations and buried conduits under different field conditions.

MODULE I FUNDAMENTALS OF EARTH PRESSURE THEORIES 9

Basic concepts of earth pressure, including types of pressures (active, passive, at-rest), assumptions, and derivations based on Rankine's and Coulomb's theories. Influence of backfill parameters like soil type, surface inclination, surcharge loading, layered backfills, and groundwater conditions. Wall friction and inclination effects.

MODULE II EARTHQUAKE AND GRAPHICAL APPROACHES TO EARTH PRESSURE 9

Introduction to seismic earth pressure concepts and graphical techniques for analysis. Modifications to classical theories under seismic conditions. Graphical tools like Rebhann's and Culmann's methods for both active and passive pressure estimation.

MODULE III RIGID EARTH RETAINING STRUCTURES 9

Types and configurations of rigid retaining structures including gravity, semi-gravity, cantilever, and counterfort retaining walls. Empirical design techniques and comprehensive stability analysis considering sliding, overturning, and bearing capacity failures.

MODULE IV FLEXIBLE RETAINING STRUCTURES AND BRACED EXCAVATIONS 9

Types and behaviour of flexible retaining systems such as cantilever sheet piles and anchored bulkheads. Free earth and fixed earth methods, moment reduction factors, types of anchors, and anchorage systems. Braced excavation methods in sands and clays, including construction practices and pressure distributions.

MODULE V UNDERGROUND STRUCTURES IN SOIL 9

Analysis and geotechnical design considerations of underground soil-structure systems such as buried pipes, conduits, and trenches. Load transfer mechanisms, trench stability, and interaction between soil and buried structures.

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TOTAL PERIODS: 45

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Understand different types of earth pressures and their governing theories.	[U]
CO2	Apply Rankine's and Coulomb's theories for the design of retaining walls under varied backfill and loading conditions.	[AP]
CO3	Analyze and design rigid retaining structures based on empirical and stability methods.	[AN]
CO4	Evaluate flexible retaining systems such as sheet piles, bulkheads, and braced excavations using classical and modern approaches.	[AN]
CO5	Understand the behaviour and analysis of underground structures including conduits and trenches within soil media.	[AN]

REFERENCES

1. Clayton, C.R.I., Militisky, J. and Woods, R.I., Earth pressure and Earth-Retaining structures, Second Edition, Survey University Press, 1993.
2. Das, B.M., Principles of Geotechnical Engineering, Fourth Edition, the PWSseries in Civil Engineering, 1998.
3. Militisky, J. and Woods, R., Earth and Earth retaining structures, Routledge, 1992.
4. Winterkorn, H.F. and Fang, H.Y., Foundation Engineering Handbook, Galgotia Book-source, 2000.

WEB RESOURCES

1. https://www.youtube.com/watch?v=aKseZc-d-zQ
2. https://www.youtube.com/watch?v=ucbinKVZvF8

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26PSEE21 SDG NO:9,12	QUALITY CONTROL AND ASSURANCE IN CONSTRUCTION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1 To understand the principles, definitions, and frameworks of quality management and their application to construction projects.
2 To apply quality system standards such as ISO 9000 for planning, documenting, training, and certifying construction quality practices.
3 To evaluate methods of quality planning, assurance, and control using modern tools, standards, and statistical techniques in the construction process.
4 To implement quality improvement techniques considering materials, design, specification, value engineering, and life cycle cost analysis for sustainable construction.

MODULE I QUALITY MANAGEMENT 9

Introduction – Definitions and objectives – Factors influencing construction quality – Responsibilities and authority – Quality plan – Quality Management Guidelines – Quality circles.

MODULE II QUALITY SYSTEMS 9

Introduction - Quality system standard – ISO 9000 family of standards – Requirements – Preparing Quality System Documents – Quality related training – Implementing a Quality system – Third party Certification.

MODULE III QUALITY PLANNING 9

Quality Policy, Objectives and methods in Construction industry - Consumers satisfaction, Ergonomics - Time of Completion - Statistical tolerance – Taguchi's concept of quality – Codes and Standards – Documents – Contract and construction programming – Inspection procedures - Processes and products – Total QA / QC programme and cost implication.

MODULE IV QUALITY ASSURANCE AND CONTROL 9

Objectives – Regularity agent, owner, design, contract and construction-oriented objectives, methods – Techniques and needs of QA/QC – Different aspects of quality – Appraisals, Factors influencing construction quality – Critical, major failure aspects and failure mode analysis, – Stability methods and tools, optimum design – Reliability testing, reliability coefficient and reliability prediction

MODULE V QUALITY IMPROVEMENT TECHNIQUES 9

Selection of new materials – Influence of drawings, detailing, specification, standardization – Bid preparation – Construction activity, environmental safety, social and environmental factors – Natural causes and speed of construction – Life cycle costing – Value engineering and value analysis

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TOTAL PERIODS: 45

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Understand the basic concepts of quality planning, assurance and control techniques in construction industry	[U]
CO2	Understand the existing quality policy, guidelines and different aspects of quality planning	[U]
CO3	Apply the tools and methods of stability and reliability in QA/QC methods	[AP]
CO4	Apply various quality improvement techniques in construction industry	[AP]
CO5	Evaluate the social and environmental factors in construction projects	[AP]

REFERENCES

1. James, J.O' Brian, Construction Inspection Handbook – Quality Assurance and Quality Control, Van Nostrand, New York, 2012.
2. Kwaku, A., Tena, Jose, M. Guevara, Fundamentals of Construction Management and Organization, Reston Publishing Co., Inc., Virginia, 1985.
3. John L. Ashford, The Management of Quality in Construction, E &F.N.Spon, NewYork, 1989.

WEB RESOURCES

1. https://www.youtube.com/watch?v=U9GBYUFubNg
2. https://www.youtube.com/watch?v=nly3cxgsXOA

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26PSEE22 SDG NO: 9,12	OPTIMIZATION IN STRUCTURAL DESIGN	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1 To understand the basic principles of optimization, including objective functions, constraints, and optimality criteria in engineering design.
2 To apply linear, nonlinear, and geometric programming techniques to solve constrained and unconstrained optimization problems.
3 To analyze and solve multistage decision problems using dynamic programming and classical optimization methods.
4 To implement optimization techniques in structural engineering applications such as design of beams, frames, trusses, and reinforced concrete structures.

MODULE I BASIC PRINCIPLES AND CLASSICAL OPTIMIZATION TECHNIQUES 9

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

MODULE II LINEAR AND NON-LINEAR PROGRAMMING 9

LINEAR PROGRAMMING: Formulation of problems -Graphical solution – Analytical methods- Standard form - Slack, surplus and artificial variables – Canonical form – Basic feasible solution - simplex method – Two phase method – Penalty method- Duality theory – Primal – Dual algorithm, Dual Simplex method. Non- linear programming: One Dimensional minimization methods: Unidimensional - Unimodal function – Exhaustive and unrestricted search – Dichotomous search - Fibonacci Method – Golden section method - Interpolation methods. Unconstrained optimization Techniques.

MODULE III GEOMETRIC PROGRAMMING 9

Polynomial – degree of difficulty – reducing G.P.P to a set of simultaneous equations – Unconstrained and constrained problems with zero difficulty – Concept of solving problems with one degree of difficulty.

MODULE IV DYNAMIC PROGRAMMING 9

Bellman's principle of optimality – Representation of a multistage decision problem- concept of sub- optimization problems using classical and tabular methods.

MODULE V STRUCTURAL APPLICATIONS 9

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

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– Optimization principles to design of R.C. structures such as multistory buildings, water tanks and bridges.

TOTAL PERIODS: 45

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Apply the knowledge of engineering fundamentals to formulate and solve engineering problems by classical optimization techniques	[AP]
CO2	Identify, formulate and solve engineering problems by linear and non-linear programming	[AP]
CO3	Analyse the problem and reduce G.P.P to a set of simultaneous equations	[AN]
CO4	Apply the Engineering knowledge to understand the concept of dynamic programming	[AP]
CO5	Design various structural elements with minimum weight	[AN]

REFERENCES

1. Ravindran, Ragsdell and Reklatis, “Engineering Optimization”, Wily India Edition, New Delhi, 2006.
2. Kalyanmoy Deb, ““Optimization for Engineering Deisgn”, Prentice Hall of India, New Delhi, 2002.
3. Rao.S.S, “Optimization theory and applications”, Wiley eastern (P) Ltd., 2005.

WEB RESOURCES

1. https://www.youtube.com/watch?v=SHbb9dV-we8
2. https://www.youtube.com/watch?v=0g8_u0RnwrQ

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26PSEE23 SDG NO:9	SMART MATERIALS AND SMART STRUCTURES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1 To understand the evolution, interdisciplinary nature, and biomimetic foundations of smart materials used in adaptive systems.
2 To study the behavior and applications of smart polymers, piezoelectric materials, and shape memory alloys in sensing, actuation, and control.
3 To analyze the principles and functions of Magnetostrictive, electrostrictive, and rheological smart materials for use in intelligent damping and adaptive structures.
4 To explore emerging applications and integration strategies of smart materials in biomedical, aerospace, and civil engineering systems.

MODULE I INTRODUCTION AND BIOMIMETIC BASIS OF SMART MATERIALS **9**

Evolution, definitions, and interdisciplinary nature of smart materials and structures. Biomimetic design principles, bioinspired materials, and the role of nanoscale biomimicry in the development of responsive systems.

MODULE II SMART POLYMERS AND PIEZOELECTRIC SYSTEMS **9**

Types and behavior of smart polymers such as shape memory, stimuli-responsive, and self-healing polymers. Piezoelectricity, electromechanical coupling, piezoelectric actuators and sensors, active vibration control, and energy harvesting.

MODULE III SHAPE MEMORY MATERIALS AND ELECTROACTIVE POLYMERS **9**

Properties, behavior, and modeling of shape memory alloys and polymers, including constitutive laws and applications. Dielectric elastomers, conducting polymers, and ionic polymer-metal composites as soft actuators.

MODULE IV MAGNETOSTRICTIVE ELECTROSTRICTIVE AND RHEOLOGICAL SMART MATERIALS **9**

Principles and applications of magnetostrictives, magnetic shape memory alloys, and electrostrictive materials. Electrorheological (ER) and magnetorheological (MR) fluids, modeling of smart fluid behavior, and their use in vibration damping systems.

MODULE V EMERGING APPLICATIONS AND INTEGRATED SMART STRUCTURES **9**

Recent advances in nanostructured smart materials, polymeric sensors and actuators, nanofibers, and multifunctional composites. System-level integration of smart materials in biomedical, aerospace, and civil engineering applications.

TOTAL PERIODS: 45

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COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Understand the characteristics, classifications, and significance of smart materials and structures.	[U]
CO2	Analyze the electromechanical and magneto mechanical responses of piezo electrics, shape memory materials, and polymeric actuators.	[AN]
CO3	Apply the principles of smart polymers, including shape memory and self-healing types, in sensor and actuator design.	[AP]
CO4	Evaluate the performance of ER/MR fluids and other multifunctional materials in control and damping systems.	[AP]
CO5	Design and integrate smart material systems for energy harvesting, biomedical, aerospace, and structural health monitoring applications.	[AN]

REFERENCES

1. Srinivasan, A.V., and Michael McFarland. D., “Smart Structures – Analysis and Design”, Cambridge University Press, 2001.
2. BrianCulshaw, “Smart Structures and Materials”, Artech House, Boston, 1996.
3. Gandhi, M.V and Thompson, B.S., “Smart Materials and Structures”, Chapman and Hall, 1992.

WEB RESOURCES

1. https://www.youtube.com/watch?v=SHbb9dV-we8
2. https://www.youtube.com/watch?v=0g8_u0RnwrQ

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26PSEE24 SDG NO:9	MECHANICS OF COMPOSITE MATERIALS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1. To understand the fundamental differences between homogeneous and composite structural materials, and analyze stress-strain behavior in isotropic and orthotropic laminates.
2. To evaluate the stiffness and strength characteristics of laminated composites under various loading conditions, including axial and transverse forces.
3. To analyze the structural performance of laminated composite members such as beams and plates, considering interlaminar stresses, delamination, and fiber orientation.
4. To study the behavior of GRP structural members, particularly box beams, under short-term and long-term loading, considering material properties, environmental effects, and jointing methods.

MODULE I FUNDAMENTALS OF COMPOSITE MATERIALS AND LAMINATE MECHANICS 9

Essential requirements of structural materials and the influence of material nature on structural forms. Introduction to the types of structural materials – homogeneous vs. composite materials - Assumptions and idealizations in structural modeling - Basic stress-strain relationships for isotropic and orthotropic laminates - Macro-mechanical analysis, including stiffness characteristics - Limitations in modeling glass-reinforced laminates

MODULE II STRESS-STRAIN BEHAVIOUR AND STRENGTH CHARACTERISTICS OF LAMINATES 9

Stress-strain behaviour in both continuous and discontinuous fibre laminates - Strength characteristics. Stiffness characteristics in various laminated composites - Analytical assumptions - Mechanical response under axial and transverse loads - Case examples of glass fibre-reinforced laminates.

MODULE III STRUCTURAL PERFORMANCE OF LAMINATED COMPOSITE MEMBERS 9

Behaviour of laminated beams and plates under load - Strength analysis and failure criteria - Effects of interlaminar stresses and delamination in laminated composites - Difference between uni-directionally and multi-directionally continuously reinforced laminates - Fibre orientation in stiffness and strength.

.

MODULE IV GRP STRUCTURAL PROPERTIES AND ENVIRONMENTAL EFFECTS 9

Analyzing GRP (Glass Reinforced Plastic) - Short-term and long-term mechanical performance - Tensile, compressive, flexural, and shear behaviour - Environmental influences such as temperature and fire exposure - Structural jointing techniques including adhesive, mechanical, and combinational types - Review of transformed section analysis in structural design.

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MODULE V GRP BOX BEAM DESIGN AND BEHAVIOUR UNDER LONG-TERM LOADING **9**

Structural behaviour of GRP box beams, including material selection, manufacturing methods, and cross- section - Beam stresses, stiffness (I value), modulus of elasticity, and compressive strength - Parameters for preventing compression buckling - Experimental observations on GRP beam behaviour under long-term
loading conditions

TOTAL PERIODS: 45

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Understand the fundamental differences between homogeneous and composite materials and evaluate stress-strain behavior in isotropic and orthotropic laminates.	U
CO2	Analyze the mechanical response and stiffness characteristics of composite laminates under various loading conditions.	AN
CO3	Evaluate the strength and failure behaviour of laminated composite beams and plates considering fibre orientation and interlaminar effects.	AP
CO4	Assess the short-term and long-term performance of GRP materials and joints under environmental influences like temperature and fire.	AP
CO5	Design and analyse GRP box beams for structural applications, including prevention of buckling failure and performance under sustained loading.	AN

REFERENCES

1. Holmes. M. and Just. D.J., GRP in Structural Engineering, Narosa Publications, New Delhi, 2008.
2. Madhujith Mukhopadhyay Mechanics of composite materials and Structures Universities Press 2001.
3. RobartM.Jones, Mechanical of Composite Materials McGraw Hill Publishing Co. 2002.
4. Bhagwan D Agarvalm, and Lawrence J Brutman, Analysis and Performance of Fiber Composites John Wiley and Sons, 2004.

WEB RESOURCES

1. https://www.youtube.com/watch?v=b5IPJeCDEPw
2. https://www.youtube.com/watch?v=ync30eHVD8s

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26PSEE25 SDG NO: 9,12,13	MODERN CONSTRUCTION MATERIALS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1. To understand the properties, behavior, and applications of special concretes such as high-strength, high-performance, fiber-reinforced, and self-compacting concrete.
2. To study the types, manufacturing processes, and advantages of modern metals and metal products including new alloy steels, aluminium, and various coatings.
3. To explore the characteristics, types, and structural applications of polymer-based composites such as FRP in civil engineering.
4. To examine the roles of waterproofing agents, non-weathering materials, construction chemicals, and smart/intelligent materials in enhancing building performance and durability.

MODULE I SPECIAL CONCRETES 9

Concretes, Behaviour of concretes – Properties and Advantages of High Strength and High-Performance Concrete – Properties and Applications of Fibre Reinforced Concrete, Self-compacting concrete, Alternate Materials to concrete on high performance & high Strength concrete.

MODULE II METALS 9

Types of Steels – Manufacturing process of steel – Advantages of new alloy steels –Properties and advantages of aluminium and its products – Types of Coatings & Coatings to reinforcement – Applications of Coatings.

MODULE III COMPOSITES 9

Types of Plastics – Properties & Manufacturing process – Advantages of Reinforced polymers – Types of FRP – FRP on different structural elements – Applications of FRP.

MODULE IV OTHER MATERIALS 9

Types and properties of Water Proofing Compounds – Types of Non-weathering Materials and its uses – Types of Flooring and Facade Materials and its application, concrete admixtures and construction chemicals.

MODULE V SMART AND INTELLIGENT MATERIALS 9

Types & Differences between Smart and Intelligent Materials – Special features – Case studies showing the applications of smart & Intelligent Materials.

TOTAL PERIODS: 45

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COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Evaluate the behaviour, properties, and applications of various special concretes including high-strength, high-performance, fibre-reinforced, and self-compacting concretes.	AP
CO2	Understand the types, manufacturing processes, and advantages of structural metals including new alloy steels and coated reinforcements.	U
CO3	Analyse the characteristics and applications of fibre-reinforced polymers (FRP) and other composite materials in structural engineering.	AN
CO4	Identify and apply appropriate other construction materials such as waterproofing compounds, non-weathering materials, flooring, facade systems, admixtures, and construction chemicals.	AP
CO5	Distinguish between smart and intelligent materials and evaluate their special features and potential through case studies in structural applications.	U

REFERENCES

1. Aitkens , High Performance Concrete, McGraw Hill, 1999.
2. Ashby, M.F. and Jones.D.R.H.H. “Engineering Materials 1: An introduction to Properties, applications and designs”, Elsevier Publications, 2005.
3. Deucher, K.N, Korfiatis, G.P and Ezeldin, A.S, Materials for civil and Highway Engineers, Prentice Hall Inc., 1998.
4. Ganapathy, C., Modern Construction Materials, Eswar Press, 2015.

WEB RESOURCES

1. https://www.goconstruct.org/educational-resources/learn-about-construction/modern-methods-of-construction.

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26RMC001 SDG NO: 4,916	RESEARCH METHODOLOGY AND IPR	L	T	P	C
		2	0	0	0

COURSE OBJECTIVES

1. To understand the fundamentals of identifying and formulating a research problem, and to develop skills for data collection, analysis, and ethical literature review.
2. To gain proficiency in technical writing and proposal preparation, and to understand the structure and evaluation of research documentation.
3. To acquire knowledge of intellectual property rights, including patents, copyrights, and trademarks, and their role in protecting innovations.
4. To explore the procedures, legal aspects, and global perspectives of IPR, with insights into recent developments in technology transfer, patenting, and traditional knowledge protection.

MODULE I FUNDAMENTALS OF RESEARCH METHODOLOGY 9

Introduction to research and the concept of a research problem. Identification and sources of research problems. Criteria and characteristics of a good research problem. Common errors in selecting research problems. Defining the scope and setting objectives for a research study. Approaches to solving research problems, including hypothesis formulation and theoretical analysis.

MODULE II RESEARCH DESIGN, DATA COLLECTION AND ETHICS 9

Investigation techniques for research problem-solving. Methods of data collection, classification, analysis, and interpretation. Understanding the importance of instrumentation in research. Approaches for effective literature review and referencing. Ethical issues in research, plagiarism, and the significance of research integrity and ethics in academic writing.

MODULE III TECHNICAL WRITING AND RESEARCH PROPOSAL 9

Essentials of technical and scientific writing. Structure and style of research reports, theses, and journal papers. Guidelines for writing research proposals. Components and format of a research proposal. Preparing presentations for research review and conducting assessments. Best practices in academic communication and presentation before a review committee.

MODULE IV INTRODUCTION TO INTELLECTUAL PROPERTY RIGHTS (IPR) 9

Overview and significance of Intellectual Property Rights. Types of IPR: patents, designs, trademarks, and copyrights. Process of patenting and innovation: from idea to patent. Understanding technological research and its transformation into intellectual property. International cooperation in IPR and the procedure for patent grants under national and international systems including the Patent Cooperation Treaty (PCT).

MODULE V IPR IN PRACTICE AND EMERGING TRENDS 9

Scope and limitations of patent rights. Licensing, commercialization, and transfer of technology. Accessing and using patent databases and information systems. Introduction to

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Geographical Indications. Recent developments in IPR, including administration, IPR in biological systems, computer software, and traditional knowledge. Case studies illustrating real-life applications of IPR and its role in protecting innovations.

TOTAL PERIODS: 45

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Understand the fundamentals of research methodology, including identification and formulation of research problems, and various approaches to research	[U]
CO2	Apply appropriate methods for data collection, analysis, and interpretation, while adhering to research ethics and avoiding plagiarism.	[AP]
CO3	Demonstrate effective technical writing and proposal preparation skills, including the development of research reports and presentations.	[AP]
CO4	Gain knowledge about various forms of Intellectual Property Rights (IPR), patent filing procedures, and international IPR systems like PCT.	[AP]
CO5	Analyze recent developments in IPR, including case studies on patent rights, licensing, geographical indications, and traditional knowledge systems.	[AP]

REFERENCES

1. Ranjit Kumar, 2nd Edition, “Research Methodology: A Step-by-Step Guide for beginners”.
2. Wayne Goddard and Stuart Melville, “Research Methodology: An Introduction.
3. Halbert, “Resisting Intellectual Property”, Taylor & Francis Ltd, 2007.

WEB RESOURCES

1. https://www.euacademic.org/BookUpload/9.pdf
2. https://www.researchgate.net/publication/319207471_HANDBOOK_OF_RESEARCH_METHODOLOGY

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26PCSO01 SDG NO: 8,9	BUSINESS ANALYTICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1 To understand the scope, process, and strategic importance of business analytics in supporting data-driven decision-making across various business functions.
2 To apply descriptive statistical methods and data visualization techniques for summarizing, exploring, and interpreting business data.
3 To analyze business trends using regression and forecasting techniques, including time series analysis and predictive modeling.
4 To implement predictive and prescriptive models for optimization, simulation, and decision-making under uncertainty, and apply them to real-life business scenarios.

MODULE I INTRODUCTION TO BUSINESS ANALYTICS 6

Overview, scope, and importance of business analytics - Business Analytics Process and its relationship with Business Processes - Competitive advantages and applications in various domains - Types of analytics: Descriptive, Predictive, and Prescriptive.

MODULE II DESCRIPTIVE STATISTICAL TOOLS & DATA ANALYSIS 9

Statistical Notation, Descriptive methods, probability distribution, and data modeling - Sampling and estimation, data visualization, summarizing and exploring data - Review of tools and techniques for business data interpretation.

MODULE III REGRESSION AND FORECASTING TECHNIQUES 10

Trend analysis and regression models, Simple and Multiple Linear Regression - Forecasting Models: Qualitative, Judgmental, and Statistical - Time Series Analysis: Trend, Seasonality, Smoothing, and Causal Models.

MODULE IV PREDICTIVE & PRESCRIPTIVE MODELING 10

Predictive analytics and data mining techniques - Predictive modeling using tools (e.g., regression, classification) - Prescriptive analytics: Optimization models, Simulation, Decision-making under uncertainty.

MODULE V BUSINESS ANALYTICS IN PRACTICE 10

Organization structures supporting business analytics - Managing data quality, change, and business processes - Real-life analytics applications in marketing, HR, finance, and operations - Case studies on tools such as Solver, Overbooking Model, Cash Budget Model.

TOTAL PERIODS: 45

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COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Understand the scope, process, and impact of business analytics within an organization.	U
CO2	Apply data analysis techniques using statistical and data mining tools to analyze business data.	AN
CO3	Develop skills to visualize, interpret, and report data insights for business decision-making.	U
CO4	Use forecasting and predictive modeling techniques to support business operations and strategy.	AP
CO5	Demonstrate the ability to translate business problems into analytical tasks and derive actionable insights.	U

REFERENCES

1 Business analytics Principles, Concepts, and Applications by Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson FT Press 2014.

2 Business Analytics by James Evans, persons Education (2nd Edition) ©2016 Pearson.

WEB RESOURCES

1 www.tutorialspoint.com/business_analysis

2 www.guru99.com/business-analyst-tutorial-course.html

3 https://www.coursera.org/specializations/business-analytics

4 https://www.edx.org/learn/business-intelligence

5 https://www.simplilearn.com/resources/data-science-business-analytics

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26PEDO01 SDG NO:3,8	INDUSTRIAL SAFETY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1. To understand the causes, effects, and control measures of industrial accidents, along with legal provisions and safety practices related to occupational health and fire prevention.
2. To study the functions and types of maintenance, tools used, and the economic aspects related to equipment service life and replacement strategies.
3. To analyze wear mechanisms, lubrication methods, and fault diagnosis techniques applicable to various mechanical and electrical systems.
4. To implement periodic and preventive maintenance procedures for industrial equipment to enhance reliability, reduce downtime, and improve operational efficiency.

MODULE I INTRODUCTION TO INDUSTRIAL SAFETY 9

Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

MODULE II FUNDAMENTALS OF MAINTENANCE ENGINEERING 9

Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost and its relation with replacement economy, Service life of equipment.

MODULE III WEAR AND LUBRICATION SYSTEMS 9

Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, Pressure grease gun, i. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, v. Ring lubrication

MODULE IV CORROSION AND FAULT DIAGNOSIS 9

Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods. Fault tracing: Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault-finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, I. Any one machine tool, . Pump i. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

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MODULE V PERIODIC AND PREVENTIVE MAINTENANCE 9

Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: i. Machine tools, Pumps, i. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance.

TOTAL PERIODS: 45

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Understand the fundamental safety principles and preventive steps to avoid industrial accidents	U
CO2	Interpret maintenance practices, costs, and the roles and responsibilities of the maintenance department	U
CO3	Explain wear and corrosion mechanisms and methods for their reduction in mechanical systems	AN
CO4	Demonstrate the ability to identify faults in mechanical and electrical equipment using decision trees	AP
CO5	Develop a systematic periodic and preventive maintenance plan for various industrial systems and equipment	AP

REFERENCES

1 Mark A. Friend, James P. Kohn “Fundamentals of Occupational Safety and Health”,2014.

2 R. C. Mishra, K. Pathak “Maintenance Engineering and Management”, PHI Learning Private Limited, 2012.

3 Ben-Daya, M., Duffuaa, S.O., Raouf, A., Knezevic, J., Ait-Kadi, D. “Handbook of Maintenance Management and Engineering”, Springer Publication, 2009.

4 Charles D. Reese “Occupational Health and Safety Management: A PracticalApproach”,2015.

WEB RESOURCES

1 http://dce.mst.edu/credit/certificates/safetyengineering/

2 https://www.breeam.nl/sites/breeam.nl/files/hulp/CIBSE%20Guide%20M.pdf

3 https://link.springer.com/chapter/10.1007/978-1-84800-131-2_46

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26PEDO02 SDG NO:9	OPERATIONS RESEARCH	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1 To understand mathematical modeling and linear programming techniques for solving optimization problems, including simplex methods and sensitivity analysis.
2 To apply linear, nonlinear, and geometric programming algorithms to practical problems in inventory control, project management, and resource allocation.
3 To develop solutions for scheduling, sequencing, and multi-stage decision-making using dynamic programming and simulation methods.
4 To explore the applications of game theory and graph theory in optimization and strategic decision-making for engineering and management problems.

MODULE I INTRODUCTION TO OPTIMIZATION TECHNIQUES 9

Model Formulation, models, General L.R Formulation, Simple Techniques, Sensitivity Analysis, Inventory Control Models. Formulation of an LPP: Graphic solution revised simplex method - duality theory - dual simplex method - parametric programming Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT.

MODULE II LINEAR AND NON-LINEAR PROGRAMMING 9

Linear and non-linear programming techniques - dual simplex methods, geometric programming, and applications of these models in practical optimization problems - appropriate optimization algorithms to reach solutions – case study.

MODULE III SCHEDULING AND SEQUENCING MODELS 9

Single server and multiple server models - deterministic inventory models Probabilistic inventory control models - Geometric Programming.

MODULE IV SIMULATION AND DYNAMIC PROGRAMMING 9

Introduction to dynamic programming concepts and simulation techniques for solving complex decision- making problems - Real-world applications through simulation of multi-stage decision processes - modeling systems involving discrete and continuous variables, and developing algorithmic solutions for system optimization.

MODULE V GAME THEORY AND GRAPH THEORY APPLICATIONS 9

Application of game theory and graph theory to strategic decision-making and network-based problems - flow in networks, elementary graph theory concepts, and the use of game theory for competitive modeling and conflict resolution.

TOTAL PERIODS: 45

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COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Apply optimization techniques to solve linear and non-linear programming problems	AP
CO2	Demonstrate the ability to analyze and interpret sensitivity and decision-making scenarios	U
CO3	Construct mathematical models for sequencing, scheduling, and inventory problems	AP
CO4	Apply simulation techniques to real-world dynamic and competitive systems	AP
CO5	Utilize concepts from graph theory and game theory for modeling and solving business problems	AN

REFERENCES

1. H.A. Taha, Operations research, An Introduction, PHI, 2008.
2. J.C. Pant, Introduction to Optimisation: Operations Research, Jain Brothers, Delhi, 2008.
3. Hitler Libermann, Operations Research: McGraw Hill Pub., 2009.
4. Pannerselvam, Operations Research: Prentice Hall of India, 2010.

WEB RESOURCES

1. https://www.coursera.org/courses?query=optimization
2. https://nptel.ac.in/courses/110106045/26
3. https://www.coursera.org/courses?query=operations%20research
4. https://onlinecourses.nptel.ac.in/noc17_mg10/course

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26PEDO03 SDG NO: 8,9	COST MANAGEMENT OF ENGINEERING PROJECTS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1. To understand cost concepts and the strategic role of cost management in decision-making, inventory valuation, and operational control.
2. To study the phases of project management, from conception to commissioning, with a focus on cost control, documentation, and execution strategies.
3. To analyze cost behavior through techniques like marginal costing, standard costing, break-even analysis, life cycle costing, and modern costing strategies including ABC and target costing.
4. To apply budgeting systems and quantitative tools such as linear programming, PERT/CPM, and simulation to support cost optimization and strategic planning.

MODULE I INTRODUCTION AND OVERVIEW OF THE STRATEGIC COST MANAGEMENT PROCESS 6

Cost concepts in decision-making; relevant cost, Differential cost, Incremental cost, Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.

MODULE II PROJECT 10

Meaning, Different types, why to manage, cost overruns centers, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and non- technical activities. Detailed Engineering activities. Pre project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance. Project contracts. Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process

MODULE III COST BEHAVIOUR AND PROFIT PLANNING MARGINAL COSTING 10

Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis.

MODULE IV BUDGETARY CONTROL 10

Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.

MODULE V QUANTITATIVE TECHNIQUES FOR COST MANAGEMENT 9

Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

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TOTAL PERIODS: 45

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Discuss various construction costs to manage a construction project	U
CO2	Summarize different construction activities and its application related to cost based on the field requirements	AP
CO3	Identify Cost Behaviour of various types of cost and Quality Management	AN
CO4	Identifying various construction Budgets involved Cost Management process	AN
CO5	Discussing various types of Techniques and Problem-solving techniques involved in Construction	AN

REFERENCES

1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi, 2012.
2. Charles T. Horngren and George Foster, Advanced Management Accounting, Pearson, 2002.
3. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting, Pearson, 1994.

WEB RESOURCES

1. http://nptel.ac.in/courses/105101084/

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26PPSO01 SDG NO: 7,11,12,13	WASTE TO ENERGY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1. To understand the principles and hierarchy of waste management, and the role of waste as a resource for energy production and sustainability.
2. To identify and classify various sources of waste across sectors, and evaluate their potential for energy recovery based on composition and characteristics.
3. To analyze biochemical and thermo-chemical technologies for converting waste into energy, including emerging methods like gasification and plasma arc.
4. To explore energy recovery strategies from municipal, industrial, plastic, and e-waste, along with relevant legislative frameworks and environmental concerns.

MODULE I INTRODUCTION 6

The Principles of Waste Management and Waste Utilization. Waste Management Hierarchy and 3R Principle of Reduce, Reuse and Recycle. Waste as a Resource and Alternate Energy source.

MODULE II WASTE SOURCES 10

Waste production in different sectors such as domestic, industrial, agriculture, postconsumer, waste etc. Classification of waste – agro based, forest residues, domestic waste, industrial waste (hazardous and non- hazardous). Characterization of waste for energy utilization.

MODULE III TECHNOLOGIES FOR WASTE TO ENERGY 12

Biochemical Conversion: Energy production from organic waste through anaerobic digestion and fermentation. Thermo-chemical Conversion: Combustion, Incineration and heat recovery, Pyrolysis, Gasification; Plasma Arc Technology and other newer technologies.

MODULE IV WASTE TO ENERGY OPTIONS 10

Landfill gas, collection and recovery. Refuse Derived Fuel (RDF) – fluff, briquettes, pellets. Alternate Fuel Resource (AFR) – production and use in Cement plants, Thermal power plants and Industrial boilers. Conversion of wastes to fuel resources for other useful energy applications. Energy from Plastic Wastes – Non-recyclable plastic wastes for energy recovery. Energy Recovery from wastes and optimization of its use, benchmarking and standardization.

MODULE V E-WASTE 7

E-waste in the global context, Growth of Electrical and Electronics Industry in India, Environmental concerns and health hazards, Recycling e-waste: a thriving economy of the unorganized sector, Global trade in hazardous waste, impact of hazardous e-waste in India. Management of e-waste: e-waste legislation, Government regulations on e-waste management, international experience, need for stringent health safeguards and environmental protection laws of India.

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TOTAL PERIODS: 45

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Understand the principles and hierarchy of waste management including the 3R concept and the role of waste as a resource and alternate energy source.	[U]
CO2	Identify and classify various sources and types of waste from domestic, industrial, and agricultural sectors, and describe their characteristics for effective utilization	[U]
CO3	Explain various waste-to-energy technologies such as biochemical and thermo- chemical conversions, including modern methods like plasma arc technology	[AP]
CO4	Evaluate different waste-to-energy recovery options including landfill gas collection, RDF, AFR, and plastic waste energy conversion, with focus on efficiency and standardization.	[AN]
CO5	Analyze the impact of e-waste at national and global levels, and discuss its management through legislative measures, health safeguards, and recycling strategies	[AN]

REFERENCES

1. Efstratios N. Kalogirou, Waste-to-Energy Technologies and Global Applications, CRC Press, 1st Edition, 2017.
2. Paul Breeze, Energy from Waste, Academic Press, 1st Edition, 2017.
3. E-waste in India: Research unit, Rajya Sabha Secretariat, New Delhi, June 2011.
4. Biogas Production: From Anaerobic Digestion to Sustainable Nagamani Balagurusamy, Anuj Kumar Chandel, 2021.

WEB RESOURCES

1. https://nptel.ac.in/courses/103107126/8
2. https://www.studentenergy.org/topics/waste-to-energy
3. https://www.eia.gov/energyexplained/?page=biomass_waste_to_energy
4. http://www.wrfound.org.uk/articles/waste-to-energy.html

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26PSEO01 SDG NO: 9	COMPOSITE MATERIALS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1 To understand the fundamental concepts of composite materials, including types of reinforcements, matrices, and their applications compared to conventional materials.
2 To study various manufacturing methods for composite structures and evaluate fiber/matrix interface properties and system characterization.
3 To analyze the strength and mechanical behavior of unidirectional and discontinuous fiber systems through geometrical and mechanical testing criteria.
4 To explore laminate theory, joining methods, and failure mechanisms in composite structures under different loading and environmental conditions.

MODULE I REINFORCEMENT IN COMPOSITES 9

Definitions, Composites, Reinforcements and matrices, Types of reinforcements, Types of matrices, Types of composites, Carbon Fibre composites, Properties of composites in comparison with standard materials, Applications of metal, ceramic and polymer matrix composites.

MODULE II MANUFACTURING METHODS 9

Hand and spray lay - up, injection molding, resin injection, filament winding, pultrusion, centrifugal casting and prepregs. Fibre/Matrix Interface, mechanical. Measurement of interface strength. Characterization of systems; carbon fibre/epoxy, glass fibre/polyester, etc.

MODULE III STRENGTH CRITERION 9

Geometrical aspects – volume and weight fraction. Unidirectional continuous fibre, discontinuous fibers, Short fiber systems, woven reinforcements –Mechanical Testing: Determination of stiffness and strengths of unidirectional composites; tension, compression, flexure and shear.

MODULE IV LAMINATES 9

Plate Stiffness and Compliance, Assumptions, Strains, Stress Resultants, Plate Stiffness and Compliance, Computation of Stresses, Types of Laminates -, Symmetric Laminates, Antisymmetric Laminate, Balanced Laminate, Quasi-isotropic Laminates, Cross-ply Laminate, Angle ply Laminate. Orthotropic Laminate, Laminate Moduli, Hygrothermal Stresses.

MODULE V JOINING METHODS AND FAILURE THEORIES 9

Joining –Advantages and disadvantages of adhesive and mechanically fastened joints. Typical bond strengths and test procedures.

TOTAL PERIODS: 45

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COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Identify types and properties of reinforcements, matrices, and composite materials	[U]
CO2	Explain composite manufacturing methods and evaluate fiber/matrix interface strength	[U]
CO3	Determine strength and stiffness of composites using mechanical testing methods	[U]
CO4	Analyze stresses and strains in various laminate configurations	[AN]
CO5	Evaluate joining methods and failure modes in composite structures	[AN]

REFERENCES

1. Krishan K. Chawla, Composite Materials, Springer New York, 2013.
2. Robert M. Jones, Mechanics Of Composite Materials, CRC Press, 2018.
3. Kamal K. Kar, Composite Materials Processing, Applications, Characterizations, Springer Berlin Heidelberg, 2016.

WEB RESOURCES

1. http://www.eng.usf.edu/~kaw/class/composites/resources.html
2. https://soaneemrana.org/onewebmedia/Mechanics of composite material
3. https://nptel.ac.in/courses/112104168
4. https://www.asminternational.org/learning/courses/online/journal_content/56/10192/39909181/CLASS

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26PSEP03 SDG NO:8,9	INDUSTRIAL TRAINING	L	T	P	C
		0	0	0	2

COURSE OBJECTIVES

1 To expose students to real-time structural engineering practices through hands-on experience in reputed industries or construction firms.
2 To develop the ability to relate academic knowledge to field applications, enhancing problem-solving and decision-making skills.
3 To improve communication, technical documentation, and professional presentation skills through training reports and oral evaluations.
4 To instill professional responsibility, teamwork, and workplace ethics aligned with industry standards.

COURSE CONTENTS (4 WEEKS)

The students individually undertake training in reputed structural engineering companies for the specified duration. At the end of the training, a report on the work done will be prepared and presented. The students will be evaluated jointly by external examiners constituted by the COE based on oral presentation and the training report.

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Identify critical activities in the Construction Industry	[AN]
CO2	Develop the methodology to solve the identified problem	[AN]
CO3	Develop skills in facing the problems experienced in the field	[AP]
CO4	Develop skills in solving the problems experienced in the field	[AP]
CO5	Acquire the skills to communicate effectively	[AP]

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26PSEP01 SDG NO: 9,11,13	PROJECT WORK- PHASE I	L	T	P	C
		0	0	10	5

COURSE OBJECTIVES

1 To provide students an opportunity to exercise their creative and innovative qualities in a group project environment.
2 To develop the ability to addressing a specific problem right from its identification.
3 To estimate the ability of the student in transforming the theoretical knowledge studied so far into an application.
4 To train the students to analyze the problems and its solutions, report preparation and to present and defend the report.

COURSE CONTENTS

1. Each student is expected to do an individual project.
2. Every student shall have a guide who is the member of the faculty of the institution. Identification of faculty guide has to be completed within a week from the day of beginning of third semester.
3. The student has to identify and select the problem to be addressed as his/her project work by conducting a complete literature survey and finalize a comprehensive aim and scope of his/her work to be done.
4. 25% of the total project work has to be completed by the end of third semester.
5. A project report (of the phase I) to this effect has to be submitted by each student. Also, the project report has to be submitted by each student.
6. Two mid semester reviews and one end semester review of the progress of the project work will be conducted by a team of faculty (minimum 3 and a maximum of 5) along with their faculty guide as a member of the faculty team.
7. During the end semester exam, one internal examiner and one external examiner, appointed by the COE will examine the project phase I done by the students.

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1 Make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to the project task [AN]
CO2 Acquire collaborative skills through working in a team to achieve common goals [AP]
CO3 Formulate proper methodology for solving problems concerned with Civil Engineering [E]
CO4 Acquire the skills to communicate effectively and to present ideas clearly and coherently to specific audience in both the written and oral forms [E]

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26PSEP02 SDG NO: 9,11,13	PROJECT WORK- PHASE II	L	T	P	C
		0	0	24	12

COURSE OBJECTIVES

1 To provide students an opportunity to exercise their creative and innovative qualities in a group project environment.
2 To develop the ability to addressing a specific problem right from its identification.
3 To estimate the ability of the student in transforming the theoretical knowledge studied so far into an application.
4 To train the students to analyze the problems and its solutions, report preparation and to present and defend the report.

COURSE CONTENTS

1. The entire semester shall be utilized by the students to do their project work by receiving the directions from the guide. The time may be used for library reading, laboratory work, computer analysis or field work as assigned by the guide and also to present periodical seminars about the progress made in the project.
2. The progress of the project is to be evaluated on a continuous basis by conducting a minimum of three reviews. The review committee may be constituted by the Head of the Department.
3. Each student shall finally produce a comprehensive report covering background information, literature survey, problem statement, project work details and conclusion. This final report shall be in typewritten form as specified in the guidelines issued by the COE.
4. The project work is evaluated jointly by external and internal examiners constituted by the COE based on
5. oral presentation and the project report. The candidate is expected to publish the project work in peer reviewed journal. Presenting a portion of the project in International Conference/Journal is mandatory.

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to the project task	[AN]
CO2	Acquire collaborative skills through working in a team to achieve common goals	[AP]
CO3	Formulate proper methodology for solving problems concerned with Civil Engineering	[E]
CO4	Acquire the skills to communicate effectively and to present ideas clearly and coherently to specific audience in both the written and oral forms	[E]

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26PMC001 SDG NO: 4, 9, 11, 13	ARTIFICIAL INTELLIGENCE FOR STRUCTURAL ENGINEERING	L	T	P	C
		2	0	0	0

COURSE OBJECTIVES

1 To introduce the fundamentals of Artificial Intelligence and its relevance to Structural Engineering applications.
2 To familiarize students with AI tools, machine learning concepts, and data-driven approaches used in civil engineering.
3 To explore the applications of AI in structural analysis, design, construction, and structural health monitoring.
4 To develop awareness of emerging AI technologies, ethical practices, and research trends in structural engineering.

MODULE I INTRODUCTION TO ARTIFICIAL INTELLIGENCE AND STRUCTURAL ENGINEERING 9

Introduction to Artificial Intelligence – history and evolution of AI – importance of AI in Civil and Structural Engineering – types of AI: Machine Learning, Deep Learning, Expert Systems – overview of data-driven engineering – applications of AI in structural design, construction, maintenance, and infrastructure management – AI tools and software used in structural engineering – introduction to Python, MATLAB, BIM-integrated AI tools, and cloud-based engineering platforms..

MODULE II DATA HANDLING AND MACHINE LEARNING FUNDAMENTALS 9

Engineering data and its importance – data collection from structures – sensors and IoT in civil engineering – basics of data preprocessing and visualization – introduction to Machine Learning concepts – supervised and unsupervised learning – regression and classification techniques – introduction to neural networks – simple applications using spreadsheets, Python libraries, and MATLAB tools for structural engineering problems.

MODULE III AI APPLICATIONS IN STRUCTURAL ANALYSIS AND DESIGN 9

AI in structural analysis and optimization – prediction of structural behavior using machine learning – AI-assisted design of beams, columns, slabs, and foundations – optimization of material usage and cost estimation – applications in seismic analysis and wind load prediction – use of AI in finite element analysis and automated structural modelling – introduction to generative design concepts and smart structural systems.

MODULE IV AI IN CONSTRUCTION AND STRUCTURAL HEALTH MONITORING 9

Artificial Intelligence in construction management – AI-based scheduling and project monitoring – safety management using AI and computer vision – drone applications in structural inspection – Structural Health Monitoring (SHM) using AI – crack detection and damage prediction using image processing and machine learning – predictive maintenance of bridges and buildings – smart sensors and digital twins for infrastructure systems.

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MODULE V EMERGING TRENDS, ETHICS, AND RESEARCH APPLICATIONS 9

Emerging trends in AI for structural engineering – Building Information Modelling (BIM) integrated with AI – robotics and automation in construction – AI for sustainable and resilient infrastructure – ethical issues and limitations of AI in engineering – reliability and safety considerations – research opportunities in AI and Structural Engineering – future scope of AI-enabled smart cities and intelligent infrastructure systems.

TOTAL PERIODS: 45

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Understand the basic concepts of Artificial Intelligence and its applications in Structural Engineering.	[U]
CO2	Explain the fundamentals of machine learning, data handling, and AI tools used in civil engineering applications.	[U]
CO3	Apply AI techniques for structural analysis, design optimization, and engineering problem-solving.	[AP]
CO4	Analyze the role of AI in construction management and structural health monitoring systems.	[AN]
CO5	Interpret emerging AI technologies, ethical practices, and research opportunities in Structural Engineering.	[AN]

REFERENCES

1. S. Rajasekaran and G. A. Vijayalakshmi Pai, “Neural Networks, Fuzzy Logic and Genetic Algorithms”, PHI Learning Pvt. Ltd., New Delhi, 2017.
2. Pedro Domingos, “The Master Algorithm: How the Quest for the Ultimate Learning Machine Will Remake Our World”, Basic Books, 2015.
3. Ian Goodfellow, Yoshua Bengio and Aaron Courville, “Deep Learning”, MIT Press, 2016.
4. Siddique, N. and Adeli, H., “Computational Intelligence: Synergies of Fuzzy Logic, Neural Networks and Evolutionary Computing”, Wiley Publications, 2013.

WEB RESOURCES

1. https://nptel.ac.in/courses/106105215
2. https://onlinecourses.nptel.ac.in/noc22_cs97
3. https://www.coursera.org/learn/machine-learning
4. https://www.autodesk.com/solutions/bim

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26PMC002 SDG NO: 16	CONSTITUTION OF INDIA	L	T	P	C
		2	0	0	0

COURSE OBJECTIVES

1 To introduce the historical evolution and the drafting process of the Indian Constitution, including the role and working of the Drafting Committee.
2 To develop an understanding of the core values and philosophical foundation of the Constitution through the study of the Preamble, Fundamental Rights, Duties, and Directive Principles of State Policy.
3 To familiarize students with the structure, functions, and powers of the key organs of governance—Legislature, Executive, and Judiciary—along with their interrelationship.
4 To explore the roles and responsibilities of local self-government institutions, Panchayat Raj, and the Election Commission in promoting democratic governance and social welfare.

MODULE I HISTORICAL BACKGROUND AND CONSTITUTION-MAKING 9

History of the Indian Constitution – freedom movement, constitutional development during British rule. Formation of the Constituent Assembly. Composition and working of the Drafting Committee. Adoption and enforcement of the Constitution.

MODULE II PHILOSOPHY AND FEATURES OF THE INDIAN CONSTITUTION 9

Philosophy of the Constitution: Ideals and objectives enshrined in the Preamble. Salient features of the Constitution – federal structure, parliamentary democracy, secularism, fundamental rights, and duties. Importance of the Constitution as a living document.

MODULE III FUNDAMENTAL RIGHTS, DUTIES, AND DIRECTIVE PRINCIPLES 9

Detailed study of Fundamental Rights: Right to Equality, Freedom, against Exploitation, to Freedom of Religion, Cultural and Educational Rights, and Constitutional Remedies. Directive Principles of State Policy and their significance. Fundamental Duties and their role in nation-building.

MODULE IV STRUCTURE OF GOVERNMENT AND LOCAL ADMINISTRATION 9

Three organs of governance: Legislature (Parliament – composition, powers, and disqualifications), Executive (President, Governor, Council of Ministers), and Judiciary (structure, powers, appointments, and transfer of judges). Local Administration: Role of District Collector, Municipalities – Mayor, elected representatives, and CEOs.

MODULE V PANCHAYATI RAJ, ELECTIONS, AND SOCIAL WELFARE 9

Structure and functioning of Panchayati Raj Institutions – Zila Panchayat, Block-level and Village-level administration. Role of elected and appointed officials. Election Commission: structure, powers, and functions at central and state levels. Overview of constitutional bodies and institutions for the welfare of SC/ST/OBC and women.

TOTAL PERIODS: 45

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COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Understand the historical evolution and philosophical foundations of the Indian Constitution.	[U]
CO2	Explain the salient features of the Constitution, including fundamental rights, duties, and directive principles.	[U]
CO3	Analyze the roles and powers of the Legislature, Executive, and Judiciary in the Indian democratic framework.	[AP]
CO4	Evaluate the structure and importance of local governance, including municipalities and district administration.	[AN]
CO5	Interpret the roles of Panchayati Raj Institutions, the Election Commission, and welfare bodies in strengthening democracy and social justice.	[AN]

REFERENCES

1 The Constitution of India, 1950 (Bare Act), Government Publication.

2 Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.

3 M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.

WEB RESOURCES

1 https://archive.nptel.ac.in/courses/129/106/129106003/

2 https://legislative.gov.in/sites/default/files/COI...pdf

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26PMC003 SDG NO: 4,9	TECHNICAL SEMINAR	L	T	P	C
		2	0	0	0

COURSE OBJECTIVES

1 To encourage students to study recent developments and emerging technologies in Civil and Structural Engineering.
2 To develop technical presentation, communication, and report writing skills.
3 To improve the ability of students to analyze and present engineering concepts using modern presentation tools.
4 To motivate students toward self-learning, research orientation, and professional interaction in structural engineering domains.

COURSE CONTENTS

Students shall identify recent and emerging topics related to Civil and Structural Engineering and present seminars individually under the guidance of faculty members. Each student shall prepare seminar material and deliver presentations using modern teaching aids such as PowerPoint presentations, models, videos, simulation software, charts, and demonstrations. Students are expected to critically review research articles, technical papers, case studies, IS codes, and industrial practices related to their seminar topics.

The seminar presentation shall include literature review, methodology, engineering applications, advantages, limitations, recent advancements, and future scope of the selected topic. Students shall also prepare and submit a technical report at the end of the semester.

A faculty guide shall be allotted to monitor the progress of the student, evaluate the seminar performance, and maintain attendance records. Evaluation shall be based on technical content, presentation skills, communication ability, report preparation, interaction during discussion, and overall understanding of the topic.

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1 Understand recent developments and emerging technologies in Civil and Structural Engineering. [U]
CO2 Demonstrate effective technical presentation and communication skills. [AP]
CO3 Analyze and interpret technical information from journals, research papers, and engineering reports. [AN]
CO4 Prepare and present technical reports using appropriate engineering tools and presentation techniques. [AP]
CO5 Develop confidence in professional discussions, technical interaction, and lifelong self-learning. [AN]

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26PAD001 SDG NO: 4	ENGLISH FOR RESEARCH PAPER WRITING	L	T	P	C
		2	0	0	0

COURSE OBJECTIVES

1 To develop clarity and precision in scientific writing by understanding sentence structure, paragraph organization, and techniques for conciseness and clarity.
2 To cultivate essential writing skills for each section of a technical paper, including the abstract, introduction, literature review, and methodology.
3 To enhance students' ability to interpret and present research results effectively and construct critical discussions and conclusions.
4 To prepare students for successful manuscript submission by teaching best practices, useful phrases, plagiarism avoidance, and final quality checks.

MODULE I FOUNDATIONS OF ACADEMIC WRITING 9

Planning and preparation for research writing. Principles of word order and clarity. Techniques for breaking up long sentences and improving readability. Structuring coherent paragraphs and logical sentence flow. Strategies for conciseness and removing redundancy. Avoiding ambiguity and vagueness in academic writing.

MODULE II CLARITY, STYLE, AND ETHICAL WRITING 9

Clarifying authorship and responsibility (who did what). Highlighting research findings with appropriate emphasis. Using hedging and criticism constructively. Techniques for effective paraphrasing and avoiding plagiarism. Understanding and structuring various sections of a research paper. Elements and purpose of an abstract.

MODULE III WRITING THE CORE SECTIONS OF A PAPER 9

Key skills for writing the Introduction and Review of Literature. Structure and content of the Methods section. Presenting and formatting Results effectively. Crafting a compelling Discussion section. Drawing strong Conclusions. Conducting the final check before submission. .

MODULE IV ENHANCING IMPACT AND READABILITY 9

Developing effective titles and abstracts that attract attention. Using academic and subject-specific phrases appropriately. Maintaining tone, objectivity, and formal language throughout the paper. Creating cohesion and coherence across sections. Strategies to ensure the first submission is of high quality.

MODULE V TOOLS, TECHNIQUES, AND BEST PRACTICES 9

Common writing errors and how to avoid them. Using language tools and reference managers. Peer review and responding to reviewer comments. Journal selection and submission protocols. Ethical considerations in publishing and authorship. Case examples and analysis of well-written papers.

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TOTAL PERIODS: 45

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Understand the principles of effective academic writing, including sentence structure, clarity, conciseness, and coherence in research papers.	[U]
CO2	Apply ethical writing practices such as proper paraphrasing and avoiding plagiarism while structuring the different sections of a research paper.	[AP]
CO3	Demonstrate the ability to write clear and well-organized core sections of a research paper, including Introduction, Methods, Results, and Discussion	[AP]
CO4	Develop skills in crafting impactful titles, abstracts, and conclusions using appropriate academic vocabulary and style.	[AP]
CO5	Utilize writing tools, referencing techniques, and peer feedback effectively to prepare and submit high-quality research papers for publication.	[AP]

REFERENCES

1. Adrian Wall work, English for Writing Research Papers, Springer New York Dordrecht Heidelberg, London, 2016.
2. Philip M. McCarthy, Khawlah Ahmed, Writing the Research Paper, Bloomsbury Publishing, 2021.
3. James D. Lester (Jr.), Writing Research Papers, Pearson Publishing, 2015.
4. Gábor L. Lövei, Writing and Publishing Scientific Papers, open book publishers, 2021.

WEB RESOURCES

1. https://www.ejournals.eu/pliki/art/5722/
2. https://www.ref-n-write.com/blog/how-to-write-a-research-paper-academic-phrasebank-vocabulary/
3. https://writing.wisc.edu/handbook/assignments/planresearchpaper/
4. https://www.grammarly.com/blog/how-to-write-a-research-paper/

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26PAD002 SDG NO: 11,13	DISASTER MANAGEMENT	L	T	P	C
		2	0	0	0

COURSE OBJECTIVES

1. To understand the concepts, types, and impacts of natural and man-made disasters on human life, property, and ecosystems.
2. To identify disaster-prone zones in India and evaluate preparedness measures using tools such as remote sensing, meteorological data, and risk evaluation.
3. To develop knowledge of risk assessment techniques and disaster risk reduction strategies at local, national, and global levels.
4. To explore disaster mitigation methods, including structural and non-structural approaches, and review key mitigation programs implemented in India.

MODULE I INTRODUCTION TO DISASTERS AND HAZARDS 9

Definition and significance of disasters. Key differences between hazards and disasters. Classification of disasters: natural and man-made. Understanding the nature, types, and magnitude of disasters. Overview of factors influencing disasters and their repercussions on society, environment, and infrastructure.

MODULE II IMPACT OF DISASTERS 9

Economic damages caused by disasters. Loss of human and animal life. Destruction of ecosystems and long-term environmental consequences. Case studies of major disaster events illustrating the scale of damage and disruption. Social and psychological repercussions on affected populations.

MODULE III CLASSIFICATION AND EXAMPLES OF DISASTERS 9

Detailed study of natural disasters: earthquakes, volcanic eruptions, cyclones, tsunamis, floods, droughts and famines, landslides, and avalanches. Overview of man-made disasters: nuclear reactor failures, industrial accidents, oil spills, epidemics, and conflict-induced disasters. Analysis of recent disaster events and lessons learned. .

MODULE IV DISASTER PRONE REGIONS AND PREPAREDNESS IN INDIA 9

Disaster-prone zones in India: seismic zones, flood- and drought-prone areas, landslide and avalanche zones, coastal areas vulnerable to cyclones and tsunamis. post-disaster health risks and epidemics. Monitoring of disaster-prone phenomena, data interpretation from remote sensing, meteorological sources, and media reports. Roles of governmental and community preparedness.

MODULE V RISK ASSESSMENT AND MITIGATION STRATEGIES 9

Concept and elements of disaster risk. Risk reduction strategies at national and global levels. Techniques for disaster risk assessment and early warning systems. Community participation in risk evaluation. Mitigation strategies – structural and non-structural. Emerging trends in mitigation planning. Overview of national disaster mitigation programs and international

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cooperation.

TOTAL PERIODS: 45

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Understand the fundamental concepts, types, and causes of natural and man-made disasters and differentiate between hazards and disasters.	[U]
CO2	Analyze the socio-economic and environmental impacts of disasters, including damage assessment and long-term repercussions.	[AN]
CO3	Classify various disasters and evaluate specific examples to understand their characteristics, magnitude, and consequences.	[AP]
CO4	Identify disaster-prone regions in India and explain preparedness strategies using data from remote sensing, meteorological, and governmental sources.	[AP]
CO5	Apply disaster risk assessment techniques and formulate appropriate structural and non-structural mitigation strategies for effective disaster risk reduction.	[AP]

REFERENCES

1 Palanivel K., —Disaster Managementǁ, Allied Publishers, 2015.

2 Sulphey M.M., —Disaster Managementǁ PHI Learning Publications, 2017.

3 Singh A., Punia M, Haran N P and Singh T B., —Development and Disaster Management, Springer, 2018.

4 Rajendra Kumar Pandey., —Disaster Management in India, SAGE Publications Pvt. Ltd.,2020.

WEB RESOURCES

1 https://ndma.gov.in/

2 https://nidm.gov.in/

3 https://tnsdma.tn.gov.in/

4 https://nptel.ac.in/courses/124/107/124107010/

5 https://www.coursera.org/learn/disaster-preparedness

6 https://www.edx.org/course/natural-disasters

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26PAD003 SDG NO: 4	SANSKRIT FOR TECHNICAL KNOWLEDGE	L	T	P	C
		2	0	0	0

COURSE OBJECTIVES

1 To introduce the basic structure of the Sanskrit language, including alphabets, tenses, and simple sentence formation.
2 To build vocabulary and comprehension through study of roots and structured sentence construction relevant to technical communication.
3 To explore technical information and classical knowledge found in ancient Sanskrit literature.
4 To connect Sanskrit terminology with modern engineering concepts in fields such as Electrical, Mechanical, Architecture, and Mathematics.

MODULE I FUNDAMENTALS OF SANSKRIT LANGUAGE 9

Introduction to Sanskrit alphabets – vowels, consonants, and pronunciation. Basic grammatical structure. Usage of tenses – past, present, and future. Construction of simple sentences for everyday communication.

MODULE II GRAMMAR AND LINGUISTIC STRUCTURE 9

Understanding sentence order and syntax in Sanskrit. Introduction to roots (धातु) and their conjugation. Word formation and basic vocabulary. Introduction to declensions and basic sentence patterns.

MODULE III SANSKRIT AND CLASSICAL LITERATURE 9

Overview of Sanskrit literature with technical relevance. Texts related to science, mathematics, and technology in ancient India. Introduction to treatises like *Vaimanika Shastra*, *Sushruta Samhita*, *Aryabhatiya*, and *Charaka Samhita*. Discussion on the structure and preservation of technical knowledge in ancient texts.

MODULE IV TECHNICAL SANSKRIT TERMINOLOGY 9

Understanding Sanskrit terminology in technical contexts. Terminologies in engineering disciplines such as mechanical, civil, and architecture. Use of Sanskrit terms in modern scientific expressions and translation of technical terms.

MODULE V APPLICATION OF SANSKRIT IN MODERN TECHNICAL FIELDS 9

Study of Sanskrit-origin terms used in modern Indian languages in technical domains. Sanskrit references in electrical engineering, mechanics, mathematics, and architecture. Relevance of Sanskrit in computational linguistics, AI, and programming languages. Promoting the use of Sanskrit for documentation and technical communication.

TOTAL PERIODS: 45

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COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Gain foundational knowledge of Sanskrit alphabets, grammar, and sentence structure to construct simple sentences.	[U]
CO2	Understand and apply basic grammatical concepts, roots, and linguistic constructs relevant to technical communication.	[U]
CO3	Explore Sanskrit literature to identify and interpret classical texts containing scientific and technical knowledge	[U]
CO4	Develop the ability to recognize and use Sanskrit terminology relevant to various engineering and technical disciplines	[U]
CO5	Appreciate the application of Sanskrit in modern science and technology, and explore its relevance in computational fields and AI	[U]

REFERENCES

1. Nirmala Trikha, Scientific Knowledge in Sanskrit Literature, Eastern Book Linkers, 2009.
2. R. Raman Nair, L. Sulochana Devi, Sanskrit Informatics, Centre for Informatics Research and Development publisher, 2011.
3. Rajiv Malhotra, Satyanarayana Dasa Babaji, Sanskrit Non-translatables, Amaryllis publisher, 2020.

WEB RESOURCES

1. https://little-guru.com/blog-detail/sanskrit-in-the-technology-world-736529
2. https://bhagavanbhakthi.com/2021/02/beautiful-sanskrit-words-with-meaning/
3. https://onlinecourses.nptel.ac.in/noc20_hs12/preview
4. https://www.unive.it/data/course/333400/programma

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26PAD004 SDG NO: 4,16	VALUE EDUCATION	L	T	P	C
		2	0	0	0

COURSE OBJECTIVES

1 To develop awareness of social and personal values, attitudes, and work ethics essential for individual growth and societal harmony.
2 To foster personality and behavior development through cultivation of positive traits such as discipline, tolerance, cooperation, and compassion.
3 To encourage understanding of self-management, mental well-being, and ethical behavior through reflections on spiritual teachings and scientific insights.
4 To promote critical thinking about values in the context of faith, equality, and competence for responsible and meaningful living.

MODULE I ETHICS 9

Understanding values and self-development. Social values and individual attitudes. Moral and non-moral valuation, standards, and principles. Value judgments and the importance of cultivating core human values. Introduction to work ethics and the Indian vision of humanism. Concepts of truthfulness, cleanliness, honesty, and devotion.

MODULE II NATIONAL, SOCIAL, AND ENVIRONMENTAL VALUES 9

Values promoting national unity and social harmony: patriotism, humanity, love for nature, and universal brotherhood. Importance of discipline, power of faith, self-reliance, and a sense of duty. Awareness and respect for cultural and religious diversity. Environmental awareness and love for nature as a value-driven responsibility.

MODULE III PERSONALITY AND BEHAVIOURAL DEVELOPMENT 9

Personality development through values: integrity, punctuality, kindness, tolerance, and dignity of labour. Cultivating a scientific attitude and positive thinking. Avoiding fault-finding, managing anger, and eliminating self-destructive habits. Developing cooperation, empathy, and emotional intelligence for meaningful relationships.

MODULE IV CHARACTER BUILDING AND INNER STRENGTH 9

Understanding character and competence. Insights from holy books versus blind faith. Concepts of self-management, humility, honesty, and nonviolence. Role of women in value development. Development of self-control, equality, and effective study habits. Pursuing happiness through self-awareness and self-improvement.

MODULE V SPIRITUAL AND PHILOSOPHICAL DIMENSIONS OF VALUES 9

Exploration of the science of reincarnation and spiritual growth. Relationship between soul and scientific outlook. Common value messages across all religions. The principle of “Mind your Mind.” Holistic well-being through good health, self-discipline, and spiritual practices. Integrating values into daily life for long-term personal and societal well-being

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TOTAL PERIODS: 45

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Understand the significance of human values and ethical principles in shaping individual personality and societal harmony.	[U]
CO2	Apply value-based thinking to foster national unity, environmental responsibility, and social inclusiveness.	[AP]
CO3	Develop interpersonal and behavioral skills such as empathy, integrity, tolerance, and emotional balance.	[U]
CO4	Cultivate strong character traits including honesty, humility, self-control, and discipline for personal and academic excellence.	[U]
CO5	Reflect on the spiritual and philosophical foundations of values to build a meaningful, ethical, and purpose-driven life.	[U]

REFERENCES

1. Chakroborty, S.K. “Values and Ethics for organizations Theory and practice”, Oxford University Press, New Delhi, 1998.
2. Dr Kiruba Charles and V Arul Selvi “Value Education”, Neelkamal Publications Pvt Ltd, Hyderabad, 2012.

WEB RESOURCES

1. https://nptel.ac.in/courses/109104068
2. https://www.youtube.com/watch?v=8dLqGLKr3t8
3. https://www.youtube.com/watch?v=gw07USDCtBo

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26PAD005 SDG NO: 4	PEDAGOGY STUDIES	L	T	P	C
		2	0	0	0

COURSE OBJECTIVES

1 To understand the aims, rationale, and policy context for effective pedagogical practices with a focus on developing countries.
2 To explore the conceptual framework, theories of learning, curriculum development, and teacher education as they relate to pedagogy.
3 To examine evidence on the effectiveness of pedagogical practices through quality assessment of studies and identify key strategies and teacher beliefs that impact learning.
4 To analyze the role of professional development, peer and community support, and the influence of school curriculum and assessments on teaching practices.

MODULE I INTRODUCTION TO PEDAGOGY AND LEARNING THEORIES 9

Definition and significance of pedagogy in educational systems. Aims and rationale behind pedagogy studies. Policy background related to education in developing contexts. Overview of key learning theories (constructivism, behaviorism, cognitive theories). Understanding curriculum and teacher education in relation to pedagogy.

MODULE II RESEARCH FRAMEWORK AND METHODOLOGY IN PEDAGOGICAL STUDIES 9

Conceptual framework and terminology in pedagogy research. Framing research questions and selecting suitable methodologies. Thematic overview of pedagogical practices in formal and informal settings. Methodology for conducting systematic reviews and evidence gathering. Searching, reviewing, and mapping existing pedagogical practices.

MODULE III EFFECTIVENESS OF PEDAGOGICAL PRACTICES 9

Review and quality assessment of studies on pedagogy. Pedagogical approaches: learner-centered, teacher-directed, inquiry-based, etc. Role of teacher beliefs, values, and attitudes in influencing classroom practices. Effectiveness of teacher education programs and school curricula in enhancing pedagogy. The "theory of change" in educational settings.

MODULE IV PROFESSIONAL DEVELOPMENT AND TEACHER SUPPORT 9

Professional development aligned with effective pedagogy. In-service teacher support systems: peer learning, mentorship, and leadership roles of head teachers. Integration of curriculum and assessment with pedagogical strategies. Role of community in supporting teachers. Barriers to learning such as limited resources and large class sizes.

MODULE V RESEARCH GAPS AND FUTURE DIRECTIONS IN PEDAGOGY 9

Identifying gaps in pedagogy research: curriculum, teacher education, pedagogy in context. Enhancing research design to suit varied educational environments. Strategies for improving dissemination and research impact. Innovations in pedagogy for diverse and disadvantaged learners. Future pathways in pedagogy, teacher training, and classroom transformation.

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TOTAL PERIODS: 45

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	What pedagogical practices are being used by teachers in formal classrooms in developing countries?	[U]
CO2	What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?	[U]
CO3	How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy	[U]
CO4	Pedagogy strategies to be followed in all aspects	[U]
CO5	Develop a professional community to remove the barriers	[U]

REFERENCES

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

WEB RESOURCES

1. http://www.skolutveckling.se/publdb-portlet/fileDownload?publ_id=440&file=publication
2. www.pratham.org/images/resource%20working%20paper%202.pdf

(Dr. N. Shanmugasundaram)

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26PAD006 SDG NO: 4,8	PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS	L	T	P	C
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COURSE OBJECTIVES

1. To study selected verses from *Neetisatakam* to understand the principles of wisdom, virtue, pride, heroism, ethical conduct, and values that contribute to holistic personality development.
2. To internalize the teachings of the *Shrimad Bhagavad Gita* for cultivating the right attitude toward daily work, responsibilities, and self-discipline through focused study of key chapters and verses.
3. To develop a foundational understanding of life philosophy, moral values, and personal excellence through the Gita's guidance on character, self-control, and emotional stability.
4. To explore the attributes of role models as illustrated in the Gita and apply these attributes in personal and professional life.

MODULE I FOUNDATIONS OF HOLISTIC PERSONALITY FROM NEETISATAKAM 9

Introduction to Neetisatakam and its relevance in modern life. Wisdom-oriented personality traits: Verses 19, 20, 21, 22. Pride and heroism: Verses 29, 31, 32. Virtues and values: Verses 26, 28, 63, 65. Ethical don'ts: Verses 52, 53, 59. Recommended do's: Verses 71, 73, 75, 78.

MODULE II WORK ETHICS AND DUTY FROM THE BHAGAVAD GITA 9

Understanding the approach to daily duties and responsibilities. Chapter 2: Verses 41, 47, 48 – focus and detachment. Chapter 3: Verses 13, 21, 27, 35 – selfless action and societal responsibility. Chapter 6: Verses 5, 13, 17, 23, 35 – discipline, moderation, and mental clarity. Chapter 18: Verses 45, 46, 48 – excellence through one's duty.

MODULE III EMOTIONAL BALANCE AND SELF-GOVERNANCE 9

Insights into emotional intelligence and detachment from Chapter 2: Verses 56, 62, 68. Compassion and tolerance from Chapter 12: Verses 13–18. Attaining equanimity in relationships and conduct.

MODULE IV INNER STRENGTH AND DECISION-MAKING SKILLS 9

Exploration of the inner self and its qualities: Chapter 2 – Verse 17. Controlling desires and impulses: Chapter 3 – Verses 36, 37, 42. Wisdom and learning in action: Chapter 4 – Verses 18, 38, 39. Higher understanding of joy and choice: Chapter 18 – Verses 37, 38, 63.

MODULE V PERSONALITY TRAITS OF ROLE MODELS AND APPLICATION TO MODERN LIFE 9

Understanding the ideal personality through spiritual examples. Discussion of role models from scriptural verses. Reflection on personal growth, decision-making, self-management, and leadership through life enlightenment skills. Practical integration of verses into academic, professional, and personal life.

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TOTAL PERIODS: 45

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Interpret and apply ethical values and life lessons from Neetisatakam to develop a well-rounded personality.	[U]
CO2	Understand the Bhagavad Gita's teachings on duty, focus, and discipline for effective work-life management.	[U]
CO3	Develop emotional balance, tolerance, and empathy through the study of selected Gita verses.	[U]
CO4	Enhance decision-making and self-regulation by analyzing the philosophical foundation of inner strength and wisdom.	[U]
CO5	Reflect on spiritual role models and apply life enlightenment principles to improve personal and professional conduct.	[U]

REFERENCES

1. "Srimad Bhagavad Gita" by Swami Swarupananda Advaita Ashram (Publication Department), Kolkata, 2020.
2. Bhartrihari"s Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi, 1989.

WEB RESOURCES

1. https://onlinecourses.nptel.ac.in/noc22_hs77/preview

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