LORDS INSTITUTE OF ENGINEERING AND TECHNOLOGY
(An Autonomous Institution) DEPARTMENT OF CIVIL ENGINEERING
SCHEME OF INSTRUCTIONS &EXAMINATIONS [LR-24]
(w.e.f. Academic Year Tentative 2024 – 25)
M.E. (Civil Engineering) I – Semester
Specialization in Structural Engineering

S. No.	Course Code	Category	Course Title	Scheme of Instructions				Scheme of Examination			Credits
				L	T	P/D	Contact Hours/Week	Maximum Marks		Duration in Hours	
								CIE	SEE		
Theory Course											
1	P24SE101	PCC	Advanced Structural Analysis	3	-	-	3	40	60	3	3
2	P24SE102	PCC	Advanced Solid Mechanics	3	-	-	3	40	60	3	3
3	P24SE103	PCC	Advanced Theory& Design of Concrete Structures	3	-	-	3	40	60	3	3
4	-	PEC	Professional Elective – I	3	-	-	3	40	60	3	3
5	-	PEC	Professional Elective – II	3	-	-	3	40	60	3	3
6	P24MB111	MC	Research Methodology& IPR	3	-	-	3	40	60	3	3
Practical/Laboratory Course											
7	P24SE1L1	PCC	Advanced Concrete Technology Lab	-	-	2	2	50	-	3	1.0
Seminar											
8	P24SE1P1	Proj	Seminar	-	-	2	2	50	-	3	1.0
Total				**18**	**-**	**4**	**22**	**340**	**360**	**24**	**20**

L: Lecture (Hrs/Wk/Sem) **T**: Tutorial (Hrs/Wk/Sem) P **:** Practical **D**:Drawing(Hrs/Wk/Sem)

CIE: Continuous Internal Evaluation
MC: Mandatory Courses
PEC: Professional Elective Courses
SE: Structural Engineering
SEE: Semester End Examination
PCC: Program Core Courses
AD: Audit Course
MB: Master of Business

Note:
1. Each contact hour is a Clock Hour.
2. Thepractical class can be of three (clock hours) duration as per the requirement of a Particular Laboratory.

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SCHEME OF INSTRUCTIONS &EXAMINATIONS [LR-24]
(w.e.f. Academic Year Tentative 2024 – 25)
M.E. (Civil Engineering) II – Semester
Specialization in Structural Engineering

S. No	Course Code	Category	Course Title	Scheme of Instructions				Scheme of Examination			Credits
				L	T	P/D	Contact Hours/Week	Maximum Marks CIE	Maximum Marks SEE	Duration in Hours	
Theory Course											
1	P24SE201	PCC	Finite Element Method	3	-	-	3	40	60	3	3
2	P24SE202	PCC	Structural Dynamics	3	-	-	3	40	60	3	3
3	P24SE203	PCC	Design of Metal Structures	3	-	-	3	40	60	3	3
4	-	PEC	Professional Elective–III	3	-	-	3	40	60	3	3
5	-	PEC	Professional Elective-IV	3	-	-	3	40	60	3	3
Practical/Laboratory Course											
6	P24SE2L1	PCC	Structural Dynamics Lab	-	-	2	2	50	-	3	1.0
7	P24SE2L2	PCC	Structural Design Lab	-	-	2	2	50	-	3	1.0
Project											
8	P24SE2P1	PROJ	Mini Project	-	-	4	4	50	-	3	2
Total				**15**	**-**	**8**	**23**	**350**	**300**	**24**	**19**

L : Lecture(Hrs/Wk/Sem) **T**:Tutorial(Hrs/Wk/Sem)**P:**Practical **D**:Drawing(Hrs/Wk/Sem)

CIE: Continuous Internal Evaluation **SEE**: Semester End Examination
PCC: Program Core Courses **PEC**: Professional Elective Courses
AD: Audit Courses **PROJ**: Project
SE: Structural Engineering

Note:
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SCHEME OF INSTRUCTIONS &EXAMINATIONS [LR-24]
(w.e.f. Academic Year Tentative 2025 – 26)
M.E. (Civil Engineering) III – Semester
Specialization in Structural Engineering

S. No.	Course Code	Category	Course Title	Scheme of Instructions				Scheme of Examination			
				L	T	P/D	Contact Hours/Week	Maximum Marks		Duration in Hours	Credits
								CIE	SEE		
Theory Course											
1	-	AD	Audit Course–I	2	1	-	2	40	60	3	-
2	-	AD	Audit Course–II	2	1	-	3	40	60	3	-
3	-	OEC	Open Elective	3	-	-	3	40	60	3	3
Project											
4	P24SE3P1	PROJ	Dissertation–I	-	-	20	20	100	-	3	10
Total				**7**	**2**	**20**	**28**	**220**	**180**	**12**	**13**

L : Lecture(Hrs/Wk/Sem) **T**:Tutorial(Hrs/Wk/Sem)**P:**Practical **D**:Drawing(Hrs/Wk/Sem)

CIE: Continuous Internal Evaluation **SEE**: Semester End Examination
PEC: Professional Elective Courses **OEC**: Open Elective Courses
PROJ: Project **SE:** Structural Engineering

Note:
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SCHEME OF INSTRUCTIONS &EXAMINATIONS [LR-24]
(w.e.f. Academic Year Tentative 2025 – 26)
M.E. (Civil Engineering) IV – Semester
Specialization in Structural Engineering

S.No.	Course Code	Category	Course Title	Scheme of Instructions				Scheme of Examination			Credits
				L	T	P/D	Contact Hours/Week	Maximum Marks		Duration in Hours	
								CIE	SEE		
Project											
1	P24SE4P1	PROJ	Dissertation–II	-	-	32	32	50	150	-	16
Total				**-**	**-**	**32**	**32**	**50**	**150**	**-**	**16**

L:Lecture(Hrs/Wk/Sem) **T**:Tutorial(Hrs/Wk/Sem)**P:**Practical **D**:Drawing(Hrs/Wk/Sem)

CIE: Continuous Internal Evaluation **SEE**: Semester End Examination
PROJ: Project **SE:** Structural Engineering

Note:
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2. Thepractical class can be of three (clock hours) duration as per the requirement of a Particular Laboratory.

PROFESSIONAL ELECTIVE COURSES

S. No.	Course Code	Category	Course Title	Scheme of Instructions				Scheme of Examination			Credits
				L	T	P/ D	Contact Hours/Week	CIE	SEE	Duration in Hours	
Theory Course											
1	P24SE104	PEC 1	Theory of Plates	3	-	-	3	40	60	3	3
	P24SE105		Theory of Shells and Folded Plates	3	-	-	3	40	60	3	3
	P24SE106		Fracture Mechanism in Concrete Structures	3	-	-	3	40	60	3	3
2	P24SE107	PEC 2	Advanced Concrete Technology	3	-	-	3	40	60	3	3
	P24SE108		Retrofitting and Rehabilitation of Structures	3	-	-	3	40	60	3	3
	P24SE109		Theory and Applications of Cementitious Composites	3	-	-	3	40	60	3	3
3	P24SE203	PEC 3	Earthquake Resistant Design of Buildings	3	-	-	3	40	60	3	3
	P24SE204		Design of High-Rise Structures	3	-	-	3	40	60	3	3
	P24SE205		Structural Optimization	3	-	-	3	40	60	3	3
4	P24SE206	PEC 4	Design of Pre-stressed Concrete Structures	3	-	-	3	40	60	3	3
	P24SE207		Bridge Engineering	3	-	-	3	40	60	3	3
	P24SE208		Advanced Reinforced Concrete Design	3	-	-	3	40	60	3	3

PROFESSINAL ELECTIVES WITH THREE THREADS

S.No.	PE I	PE II	PE III	PE IV
1.	Theory of Plates	Advanced Concrete Technology	Earthquake Resistant Design of Buildings	Design of Pre-stressed Concrete Structures
2.	Theory of Shells and Folded Plates	Retrofitting and Rehabilitation of Structures	Design of High- Rise Structures	Bridge Engineering
3.	Fracture Mechanism in Concrete Structures	Theory and Applications of Cementitious Composites	Structural Optimization	Advanced Reinforced Concrete Design

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OPEN ELECTIVE COURSES

S. No.	Course Code	Course Title
1	P24ME301	Industrial Safety
2	P24MB311	Business Analytics
3	P24EC301	Embedded System Design
4	P24CE301	Cost Management of Engineering Projects**
5	P24EE309	Waste to Energy

** Subject isnot to be offered to the students of Civil Engineering Department.

List of subjects of Audit Course-I

S. No.	Course Code	Course Title
1	P24CE101	Disaster Management
2	P24EN102	Sanskrit for Technical Education
3	P24EN103	Value Education
4	P24EN101	English for Research Paper Writing

List of subjects of Audit Course-II

Course Code	Course Title
P24EN201	Constitution of Indian Fundamental Rights
P24EN202	Pedagogy Studies
P24EN203	Stress Management by Yoga
P24EN204	Personality Development through Life Enlightenment Skills

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M.E. (Civil Engineering) I – Semester
Specialization in Structural Engineering

S. No.	Course Code	Category	Course Title	Scheme of Instructions				Scheme of Examination			Credits
				L	T	P/D	Contact Hours/Week	Maximum Marks		Duration in Hours	
								CIE	SEE		
Theory Course											
1	P24SE101	PCC	Advanced Structural Analysis	3	-	-	3	40	60	3	3
2	P24SE102	PCC	Advanced Solid Mechanics	3	-	-	3	40	60	3	3
3	P24SE103	PCC	Advanced Theory& Design of Concrete Structures	3	-	-	3	40	60	3	3
4	-	PEC	Professional Elective – I	3	-	-	3	40	60	3	3
5	-	PEC	Professional Elective – II	3	-	-	3	40	60	3	3
6	P24MB111	MC	Research Methodology& IPR	3	-	-	3	40	60	3	3
Practical/Laboratory Course											
7	P24SE1L1	PCC	Advanced Concrete Technology Lab	-	-	2	2	50	-	3	1.0
Seminar											
8	P24SE1P1	Proj	Seminar	-	-	2	2	50	-	3	1.0
Total				**18**	**-**	**4**	**22**	**340**	**360**	**24**	**20**

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Course Code	Course Title						Core/Elective
P24SE101	ADVANCED STRUCTURAL ANALYSIS						Core
Prerequisite	Contact Hours per Week				CI E	SEE	Credits
	L	T	D	P			
Structural Analysis	3	-	-	-	40	60	3

Course Objectives

The objective of this course is to:

1. Understand the concepts of matrix methods of analysis and equip them with the knowledge to independently handle the problems of structural analysis.
2. Enhance the competency level in analysis of continuous beam, portal frames, pin jointed structures by flexibility and stiffness matrix methods.
3. Understand the formation of global stiffness matrix from local stiffness matrix and equation solving techniques using direct stiffness method.
4. Gain an insight into then online analysis of structures.
5. Learn the concepts of beams on elastic foundation.

Course Outcomes

After completing this course, the student will be able to:

1. Analyze the continuous beams, rigid jointed frames and pin jointed structures by stiffness method.
2. Analyze the continuous beams, rigid jointed frames and pin jointed structures by flexibility method.
3. Formulate the element and global stiffness matrices by direct stiffness method and learn equation solution techniques.
4. Understand and differentiate between the linear and nonlinear analyses.
5. Solve the problems pertaining to beams on elastic foundation.

UNIT-I

Introduction to Matrix Methods of Analysis: Static indeterminacy and kinematic indeterminacy, Coordinate systems, displacement and force transformation matrices, element and structure stiffness matrices, equivalent joint loads and fixed end forces.

Stiffness Method: Stiffness of prismatic member, Analysis of bar element, plane truss, continuous beams, plane frames and grid frames, also dealing with effect of settlements, internal hinges and guided fixed end supports.

UNIT-II

Flexibility Method: Flexibility of prismatic member, Analysis of bar element, plane truss, continuous beams, plane frames and grid frames, also dealing with effect of settlements, internal hinges and guided fixed end supports.

UNIT-III

Direct Stiffness Method: Assemblage of global stiffness matrix, Analysis of plane truss, continuous beams, plane frame and grid frames, also dealing with effect of settlements, internal hinges and guided fixed end supports.

UNIT-IV

Introduction to Nonlinear Analysis: Geometric and material nonlinearity, P-Δ effect, Effects of axial force on flexural stiffness –buckling of ideal columns, buckling behaviors of real columns,

Beam Column: Flexural behaviors of beam columns, flexural stiffness measures for braced prismatic beam columns, effect of axial tension, flexural stiffness measures for unbraced prismatic beam columns. Slope-deflection method of analysis–slope deflection equations for prismatic beam-columns, fixed end moments in beam- columns. Matrix method of Analysis–Stiffness matrix for prismatic beam column elements, estimation of critical elastic buckling loads, second order analysis.

UNIT-V

Beams on Elastic Foundations: Introduction-Modulus of foundation & Basic equation. Beams of infinite length under concentrated & uniformly distributed loads, Analysis of semi-infinite beams making use of functions for infinite beams.

Text Books:

1. Devdas Menon, "Structural Analysis", Narosa Book Distributors Pvt. Ltd, 2013.
2. Gupta S. P and G .S Pundit, "Theory of Structures", Vol. I & II, Tata McGraw Hill, 1999.

References:

1. Hibbeler, R. C., "Structural Analysis", Pearson, 2008.
2. Wang C. K., "Intermediate Structural Analysis" Tata McGraw – Hill Education 2010.
3. Norris C. H, Wilbur J. B. and Utku. S., "Elementary Structural Analysis", Tata McGraw Hill, 1991.
4. Sujit Kumar Roy and Subrata Chakrabarty, "Fundamentals of Structural Analysis" S. Chand & Co., 2010.
5. Reddy C. S., "Basic Structural Analysis", Tata McGraw Hill, 2015.

Course Code	Course Title						Core/Elective
P24SE102	ADVANCED SOLID MECHANICS						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Solid Mechanics	3	-	-	-	40	60	3

Course Objectives

The objectives of this course is to:

1. Understand the concepts of elasticity and equip them with the knowledge to independently handle the problems of elasticity.
2. Enhance the competency level and develop the self-confidence through quality assignments in theory of elasticity.
3. Inculcate the habit of researching and practicing in the field of elasticity.

Course Outcomes

After completing this course, the student will be able to:

1. Solve the problems of 3-D elasticity with confidence.
2. Work independently with the problems of 2-Delasticity in Cartesian/polar coordinates.
3. Familiarize with the use of Airy's stress function in 2-D problems of elasticity in Cartesian /polar coordinates.
4. Equip with the knowledge of various theories of torsion of prismatic bars of various cross sections and can solve the problems of torsion.
5. Interpret and apply the theory of elasticity to practical problems of structural engineering.

UNIT– I

Introduction: Definition and notation for forces and stresses, Components of stress and strain, Generalized Hooke's law, Stress-strain relations in three directions, Plane stress and plane strain, Equations of equilibrium and compatibility in two and three dimensions, Stress components on an oblique plane, Transformation of stress components under change of co-ordinate system.

UNIT–II

Principal stresses and principal planes: Stress invariants, Mean and Deviator stress, Strain energy per unit volume, Distortion strain energy per unit volume, Octahedral shear stress, Strain of a line element. Principal strains, Strain in variants, Volumetric strain, Principle of superposition, Reciprocal theorem.

UNIT–III

Two dimensional problems in Cartesian co-ordinates: Solution by polynomials, St. Venant's Principle, Uniqueness of solution, Stress components in terms of Airy's stress function. Applications to Cantilever, Simply supported beams with simple loading.

UNIT–IV

Two dimensional problems in Polar co-ordinates: Stress-strain components, Equilibrium equations, Compatibility equations, Applications using Airy's strain functions in polar co-ordinates for stress distributions symmetric about an axis, Effect of hole on stress distribution in a plate in tension, Stress due to load at a point on a semi-infinite straight boundary, Stresses in a circular disc under diametrical loading.

UNIT– V

Torsion: Torsion of various shapes of bars, Stress function method of solution applied to circular and elliptical bars, Torsion of rectangular bars, Solution of Torsional problems by energy method, Use of soap films in solving torsion problems, Prandtl's membrane analogy, Solution of torsion of rectangular bars by(i) Rayleigh Ritz method and(ii)Finite difference method.

Text Books:

1. L. S. Srinath, "Advanced mechanics of solids", Second edition, Tata McGraw-Hill Publishing co. ltd., 2003

2. L. Govindaraju ,TG Sitharaman, Applied elasticity for Engineers, NPTEL

References:

1. G. E. Dieter, "Mechanical metallurgy", third edition; Mc-Graw Hill, 1988.

2. E. P. Popov, "Engineering mechanics of Solids", Second edition, Prentice Hall, 1998.

3. M. H. Sadd,"Elasticity: theory, applications and numerics",Third edition, Elsevier Butterworth Heinemann publications, 2014.

4. 6. S. Anil Lal, Advanced Mechanics of Solids, Siva Publications and Distributions, 2017

5. S. P. Timoshenko and J N Goodier, "Theory of elasticity", third edition, McGraw Hill International, 1970.

Course Code	Course Title						Core / Elective
P24SE103	Advanced Theory & Design of Concrete Structures						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Design of Reinforced Concrete Structures	3	0	0	0	40	60	3

Course Objectives:

1) To comprehend the principles and applications of limit state design in reinforced concrete structures.
2) To analyze and categorize various types of loads and load combinations in accordance with current design codes.
3) To explore advanced design concepts for different structural elements, including beams, slabs, and columns.
4) To develop skills in the analysis of complex structural elements using both traditional methods and software tools.
5) To apply theoretical knowledge in the design and detailing of reinforced concrete structures, ensuring compliance with relevant standards

Course Outcomes:

After Completion of this course, the student will be able to

1) Explain and articulate the principles of limit state design and its significance in structural engineering.
2) Assess and determine the appropriate load combinations for various structural scenarios, utilizing relevant codes.
3) Design advanced structural elements, including slabs and columns, with attention to shear, bond, and torsion considerations.
4) Perform inelastic analysis of slabs and other structural elements using yield line and virtual work methods.
5) Produce detailed design documentation, including drawings and specifications, for reinforced concrete structures that comply with industry standards.

UNIT - I

Limit State Analysis of R.C. Structures: Introduction- Loads – Different types of Loads and load combinations – Different methods of Design- Working Stress Method and Limit State Method –-Materials - Characteristic Values – Reliability based methods of design - Partial safety factors –Stress Block Parameters - Plastic hinge, Redistribution of moments, moment rotation characteristics of RC member

UNIT - II

Limit state of Flexure: I.S. code provisions, loading pattern, Bending Moment Envelop, Application for Fixed Beams and Continuous Beams, Deep Beams and Corbels

UNIT - III

Inelastic Analysis of Slabs: Yield line criterion – Virtual work and equilibrium methods of analysis –For square, circular and Rectangular, with simple and continuous end conditions- Reinforcement details

Ribbed slabs: Analysis of the Slabs for Moment and Shears, Ultimate Moment of Resistance, Design for shear, Deflection, Arrangement of Reinforcements.

Flat slabs: Direct design method – Distribution of moments in column strips and middle strip-moment and shear transfer from slabs to columns – Shear in Flat Slabs-Check for one way and two-way shears Introduction to Equivalent frame method. Limitations of Direct design method, Distribution of moments in column strips and middle strip sketch showing reinforcement details.

UNIT - IV

Limit state of Shear, Bond and Torsion: Design for Shear, Bond and Torsion - Mechanism of shear and bond failure - Design of shear using limit state concept – Design for Bond – Anchorage and Development length of bars - Design of sections for torsion - Detailing of reinforcement

UNIT - V

Limit State of Compression: Design of Short and Long columns - slenderness limits, Methods of Design of Slender Columns, Additional Moment Method, Procedure for Design of Slender Columns.

Text Books:

1. "Reinforced Concrete Design" S. Unni krishna Pillai &Devdas Menon; Tata Mc. Graw- Hill Publishing Company Ltd. New Delhi 2010.
2. "Advanced Reinforced Concrete" P.C. Varghese Prentice Hall of INDIA Private Ltd. 2008.
3. "Design of Reinforced Concrete Structures" by N.Subramanian, Oxford University Press.
4. "Limit State Theory and Design of Reinforced Concrete" Dr. S. R. Karve and V.L Shah.Standard Publishers, PUNE 2004.
5. Design of concrete structures – Arthus H. Nelson, David Darwin, and Chorles W. Dolar, TataMc. Graw-Hill, 3rd Edition, 2005.

References:

1. Reinforced Concrete design by KennathLeet, Tata Mc. Graw-Hill International, editions, 2ndedition, 1991.
2. "Design Reinforced Concrete Foundations" P.C. Varghese Prentice Hall of INDIA Private Ltd.
3. IS 456- 2000 Plain and Reinforced concrete book of Practice.
4. SP 16 - Design Aids for Reinforced Concrete to IS 456
5. SP 34 - Hand Book as Concrete Reinforcement and retaining.

PROFESSIONAL ELECTIVE-I

Course Code	Course Title						Core/Elective
P24SE104	THEORY OF PLATES						PEC-1
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
THEORY OF ELASTICITY	3	-	-	-	40	60	3

Course Objectives

The objectives of this course is to:

1. Learn the analysis of rectangular and circular plates subjected to various loading conditions with different boundary conditions.
2. Understand fundamentals of buckling of plates.
3. Know the concepts of small deflection theory of laterally loaded plates.
4. Study the approximate methods of analysis of rectangular plates.
5. Derive the governing differential equations for orthotropic plates and apply them to practical problems.

Course Outcomes

After completing this course, the student will be able to:

1. Analyze the rectangular and circular plates subjected to various loading conditions.
2. Decipher the problems of buckling of plates with different edge conditions.
3. Workout the problems of small deflection theory of laterally loaded plates with different edge conditions.
4. Understand the various numerical and approximate methods for analysis of plate problems.
5. Apply the concepts of orthotropic plates to simply supported structures.

UNIT-I

Bending of Rectangular Plates: Pure and Cylindrical bending, Differential equation, cylindrical bending of uniformly loaded rectangular plates with simply supported and built-in edges, Relations between slope and curvature of slightly bent plates, Moment-curvature relations in pure bending. Strain energy in pure bending. **Bending of circular plates:** Symmetrical bending, Differential equation of equilibrium, uniformly loaded plates at center, Circular plates with circular holes at the center.

UNIT-II

Buckling of Plates: Differential equation for bending of plate under the combined action of in-plane loading and lateral loading, Calculation of critical loads, Buckling of simply supported rectangular plates uniformly compressed in one and two directions with different edge conditions.

UNIT-III

Small deflections of laterally loaded plates: Differential equation of equilibrium, Boundary conditions, Solution of simply supported rectangular plates under various loading conditions viz. uniformly distributed load (full or partial), Concentrated load by Navier's approach, Levy type solution for rectangular plates under U.D.L with all four edges simply supported or two opposite edges simply supported and other two fixed.

UNIT-IV

Approximate methods for Rectangular Plates: Finite difference method for simply supported or fixed

rectangular plates carrying UDL (full or partial) or central point load, Strain energy approaches, Rayleigh-Ritz method.

UNIT-V

Bending of Orthotropic Plates: Differential equation of the bent plate, Application of the theory to simply supported rectangular (i)Laminates;(ii) RC slabs(iii)Grids.

Textbooks:

1. S. Timoshenko and S. K. Woinowsky, "Theory of Plates and Shells", McGraw-Hill International, 2007

2. J. N. Reddy, "Theory and Analysis of Elastic Plates and Shells", CRC Press, 2006.

References:

1. E. Ventsel and T. Krauthammer, "Thin Plates and Shells", Marcel Dekker, Inc., 2001.

2. A. Ugural, "Stresses in Plates and Shells", McGraw Hill, 1999.

3. P. L. Gould, "Analysis of Shells and Plates", Springer-Verlag, 1988.

4. C. L.Dym., "Introduction to the Theory of Shells", Hempshire Publishing Corp., 1990.

5. Ugural, A. C. *Stresses in Plates and Shells*. 2nd ed. New York, NY: McGraw-Hill, 1998. ISBN: 0070657696.

Course Code	Course Title						Core/Elective
P24SE105	THEORY OF SHELLS AND FOLDED PLATES						PEC-1
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
THEORY OF ELASTICITY	3	-	-	-	40	60	3

Course Objectives

The objectives of this course is to:

1. Learn the analysis and design of cylindrical shells, short and long shells.
2. Study the concepts of bending theory using D.K.J. equations and Schorer theory.
3. Understand the beam theory and beam arch analysis.
4. Gain knowledge of the analysis and design of different shells of double curvature and axi-symmetrical shells by membrane theory.
5. AnalyzedifferenttypesoffoldedplatesusingSimpson'sandWhitney'smethods.

Course Outcomes

After completing this course, the student will be able to:

1. Analyze the cylindrical shells and design the short and long shells.
2. Solve the problems of bending theory using appropriate equations.
3. Evaluate and design the different shells using beam theory and membrane theory.
4. Analyze the numerous types of folded plates using pertinent method.
5. Analyze V-shaped folded plates by Simpson & whitney method.

UNIT-I

Introduction: Definition and classification of shells.

Cylindrical Shells: Membrane Theory, Equilibrium equations for differential shell elements, Calculation of stresses and displacementduetodeadloadsandsnowloadsforcircularcylindricalshell.

UNIT-II

Bending Theory: Necessity of bending theory (i) D.K.J theory assumption, Equilibrium equations for a differential element, Stress strain relations, Moment curvature relations, Derivation of D.K.J. differential and characteristics equations, Roots of the Characteristic equation, Expression for defection. (ii) Schorer theory – assumptions – Equilibrium equations for a differential shell element – stress strain relations – Moment curvature relations – Derivation of Schorer differential and characteristic equation – Roots of the characteristic equation – Expression of defection.

UNIT-III

Beam Theory of cylindrical shells: Assumptions and range of their validity – Outline of the beam arch analysis– Advantages of beams theory over other theories.

UNIT-IV

Shells of Doubles Curvature: Membrane theory of shells of revolution-Equilibrium equations for a differential shell element – Calculation of stresses in a spherical dome due to uniform load over the surface and due to concentrated load around a skylight opening. Shells of translation equilibrium equations for a differential shell element. Pucher's stress function, derivation of a differential equation from equations of equilibrium using Pucher's stress function calculation of stresses in hyperbolic parabolids with straight edges under uniform load over the surface.

UNIT-V

Folded Plates: Assumptions – Structural behavior – Resolutions of ridge loads – Edge shears – Stress distribution – Plate deflections and rotations. Effect of joint moments – Analysis of V shaped folded plates using(i)Simpson and(ii)Whitney methods.

Text Books:

1. S. Timoshenko and S. K. Woinowsky, "Theory of Plates and Shells", McGraw-Hill International, 2007

2. J. N. Reddy, "Theory and Analysis of Elastic Plates and Shells", CRC Press, 2006

References:

1. E. Ventsel and T. Krauthammer, "Thin Plates and Shells", Marcel Dekker, Inc., 2001.

2. A. Ugural, "Stresses in Plates and Shells", McGraw Hill, 1999.

3. P. L. Gould, "Analysis of Shells and Plates", Springer-Verlag, 1988.

4. C. L.Dym., "Introduction to the Theory of Shells", Hempshire Publishing Corp., 1990.

5. Thin Shells Theory and Problems, J. Ramchandran, Universitiespress,1993.

Course Code	Course Title						Core/Elective
P24SE106	FRACTURE MECHANISM IN CONCRETE STRUCTURES						PEC-1
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Concrete Technology	3	-	-	-	40	60	3

Course Objectives

The objectives of this course is to:

1 Identify and classify cracking of concrete structures based on fracture mechanics
2 Implement stress intensity factor for notched members
3 Apply fracture mechanics models to high strength concrete and FRC structures.
4 Compute J-integral for various sections understanding the concepts of LEFM

Course Outcomes

After completing this course, the student will be able to

1. To recognize cracks in concrete structures based on fracture mechanics
2. To recognize type of failures in concrete structures
3. To determine Stress intensity factors
4. To develop different material models
5. To develop numerical models

UNIT - I

Introduction**:** Basic fracture mechanics, crack in a structure, mechanisms of fracture and crack growth.

UNIT - II

Cleavage fracture, ductile fracture, fatigue cracking, environment assisted cracking, service failure analysis

UNIT - III

Linear elastic fracture mechanics, Griffith‟s Criteria, Stress intensity factors, Stress at crack tip, Concept of R curve, Review of concrete behavior in tension and compression- Fracture Process Zone-Basic frameworks for modeling of quasibrittle materials.

UNIT - IV

Concept of CTOD and CMD, Fracture Models for Concrete Materials-Fictitious crack model- Crack band model-Two parameter fracture model-Size effect model.

UNIT - V

Concrete Fracture Properties- Direct method-indirect method- Flexural tests on notched beams- Fracture energy & Fracture parameters using three-point bend test. Introduction to Damage Mechanics.

Text Books:

1. Fracture Mechanics, Suri C. T. and Jin Z.H., 1st Edition, Elsevier Academic Press, 2012.

2. . A. K. Chopra: Dynamics of Structures-Theory and Applications to Earthquake Engineering, Prentice-Hall of India Pvt. Ltd., New Delhi, 2001.

References:

1. M. Mukhopadhyay: Vibration, Dynamics and Structural Systems, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi, 1989.

2. Jai Krishna, A. R. Chandrasekaran and B. C. Chandra: Elements of Earthquake Engineering, South Asian Publishers Pvt. Ltd., New Delhi, 1994.

3. Mario Paz: Structural Dynamics – Theory and Computation (2nd Edition), CBS Publishers and Distributors, New Delhi, 2001.

4. Elementary Engineering Fracture Mechanics, Broek David, 3rd Rev. Ed. Springer, 1982.

5. Fracture Mechanics of Concrete Structures – Theory and Applications, Elf green L., RILEM Report, Chapman and Hall, 1989

PROFESSIONAL ELECTIVE-II

Course Code	Course Title						Core/Elective
P24SE107	ADVANCED CONCRETE TECHNOLOGY						PEC-2
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
CONCRETE TECHNOLOGY	3	-	-	-	40	60	3

Course Objectives

The objective of this course is to:

1. Learn the concept of cement and its properties, mechanical and thermal properties of aggregates.
2. Study the properties and testing of concrete in fresh and hardened state.
3. Learn the shrinkage and creep mechanisms, curing and durability of concrete.
4. Design concrete mix by various methods as per different codes.
5. Study the different types of admixtures, mix design, properties and applications of special concretes.

Course Outcomes

After completing this course, the student will be able to:

1. Learn hydration of cement and tests on properties of cement and aggregates.
2. Comprehend the properties and testing of concrete in fresh and hardened state.
3. Understand the shrinkage and creep mechanisms, curing and durability of concrete.
4. Design concrete mixes by various methods.
5. Familiarize with the types of admixtures and applications of special concretes.

UNIT-I

Importance of Bogue's compounds: Structure of a Hydrated Cement Paste, Volume of hydrated product, porosity of paste and concrete, transition Zone, Elastic Modulus, factors affecting strength and elasticity of concrete, Rheology of concrete in terms of Bingham's parameter.

UNIT-II

Properties of fresh concrete- workability-factors affecting workability - slump test-compaction factor test- Vee Bee consistometer test

Properties of hardened concrete - modulus of elasticity, compressive strength, split tensile strength, flexural strength- effect of water cement ratio – maturity concept- NDT Applications

Creep - factors affecting creep - effect of creep-

Shrinkage- factors affecting shrinkage - plastic shrinkage, drying shrinkage, autogenous shrinkage, carbonation shrinkage.

UNIT-III

Mix design: nominal mix- design mix – concept of mix design - variables of proportioning - general considerations - factors considered in the design of concrete mix- various methods of mix design - design of concrete mix as per IS 10262-2019 - Statistical quality control of concrete – mean strength – standard deviation – coefficient of variation – sampling - testing - acceptance criteria

UNIT- IV Micro Structure of Concrete: Introduction, Microstructure of concrete, Microstructure investigation methods, Microstructure of high-performance concrete, ITZ of the concrete, ITZ on the properties of the concrete, Effect of microstructure on strength and durability

UNIT-V

Admixtures: Classification of admixtures, chemical and mineral admixtures, influence of various admixtures on properties of concrete, their applications. Fly Ash Concrete: Mix design, properties and its applications.

High Strength Concrete: Mix design, properties and its applications.

Fiber Reinforced Concrete: Mix design, properties and its applications. Ferrocement, light weight concrete, high-density concrete, recycled aggregate concrete and their applications.

Text Books:

1. Neville A.M., "Properties of Concrete", Trans-Atlantic Publications, Inc.; 5e, 2016
2. Shetty M. S., Concrete Technology", S. Chand & Co., 2018

References:

1. R. Santha Kumar "Concrete Technology", Oxford Universities Press, 2018
2. Concrete–Microstructure–Properties and Material, Mehta. P.K and Paulo.J. M.M, (1997), McGraw- Hill.
3. Design of Concrete Mix, Krishna Raju. N., (1985), CBS Publications.
4. Mehta and Monteiro, Concrete-Micro structure, Properties and Materials", McGraw Hill Professional 2017
5. Lea, Chemistry of Cement and Concrete", Butterworth-Heinemann Ltd, 5e, 2017

Course Code	Course Title						Core/Elective
P24SE108	RETROFITTING AND REHABILITATION OF STRUCTURES						PEC-2
Prerequisite	Contact Hours per Week				CI E	SEE	Credits
	L	T	D	P			
-	3	-	-	-	40	60	3

Course Objectives

The objective of this course is to:

1. Learn the fundamentals of maintenance and repair strategies.
2. Study the quality assurance, serviceability and durability of concrete.
3. Know the various materials and techniques used for repair of structures.
4. Educate the different repair, strengthening, rehabilitation and retrofitting techniques.
5. Instruct the various health monitoring and demolition techniques.

Course Outcomes

After completing this course, the student will be able to:

1. Understand the fundamentals of maintenance and repair strategies.
2. Diagnose for serviceability and durability aspects of concrete.
3. Know the materials and techniques used for repair of structures.
4. Decide the appropriate repair, strengthening, rehabilitation and retrofitting technique required for a case study building.
5. Use an appropriate health monitoring and demolition techniques.

UNIT-I

Maintenance: Repair and Rehabilitation, Facets of Maintenance, importance of Maintenance various aspects of Inspection, Assessment procedure for evaluating damaged structure, causes of deterioration.

Repair Strategies: Causes of distress in concrete structures, Construction and design failures, Condition assessment and distress-diagnostic techniques, Assessment procedure for Inspection and evaluating a damaged structure.

UNIT-II

Serviceability and Durability of Concrete: Quality assurance for concrete construction, concrete properties– strength, permeability, thermal properties and cracking. – Effects due to climate, temperature, chemicals, corrosion–design and construction errors –Effects of cover thickness and cracking.

UNIT-III

Materials and Techniques for Repair: Special concretes and mortar, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, Sulphur infiltrated concrete, ferro cement, Fiber reinforced concrete. Bacterial concrete, Rust eliminators and polymers coating for rebars during repair, foamed concrete, mortar and dry pack, vacuum concrete, Gunite and Shotcrete, Epoxy injection, Mortar repair for cracks, shoring and underpinning. Methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coating and cathodic protection

UNIT- IV

Repair, Rehabilitation and Retrofitting Techniques: Repairs to overcome low member strength, Deflection, Cracking, Chemical disruption, weathering corrosion, wear, fire, leakage and marine exposure, Repair of Structure – Common Types of Repairs – Repair in Concrete Structures – Repairs in Under Water Structures – Guniting – Shot Create – Underpinning. Strengthening of Structures – Strengthening Methods – Retrofitting–Jacketing.

UNIT– V

Health Monitoring and Demolition Techniques: Long term health monitoring techniques, engineered demolition techniques for dilapidated structures, Use of Sensors–Building Instrumentation.

Text Books:

1. "Earthquake resistant design of structures" by Pankaj agarwal, Manish shrikande, PHI, 2006.

2. Concrete repair and maintenance Illustrated by Peter.H.Emmons, Galgotia publications Pvt. Ltd., 2001.

References:

1. Failures and repair of concrete structures by S.Champion, John Wiley and Sons, 1961.
2. Diagnosis and treatment of structures in distress by R.N.Raikar Published by R & D Centre of Structural Designers and Consultants Pvt.Ltd, Mumbai.
3. Handbook on repair and rehabilitation of RCC buildings, CPWD, Government of India.
4. Handbook on seismic retrofit of buildings, A. Chakrabarti et.al., Narosa Publishing House, 2010.
5. Repair and protection of concrete structures by Noel P.Mailvaganam, CRC Press,1991.

Course Code	Course Title						Core/Elective
P24SE109	Theory and Applications of Cementitious Composites						PEC-2
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Concrete Technology	3	-	-	-	40	60	3

Course Objectives

The objectives of this course is to:

1 Understand the mechanical properties of cement composites such as strength, stiffness, durability
2 Investigate the performance of cement composites under different loading conditions, environmental exposures, and long-term durability.
3 Design and Analyze Cement Composite Structural elements made from cement composites,
4. Apply Advanced Cementitious Materials
5. Study the Sustainability of Cement Composites:

Course Outcomes

After completing this course, the student will be able to:

1. Formulate constitutive behavior of composite materials – Ferrocement, SIFCON and Fiber Reinforced Concrete - by understanding their strain- stress behavior.
2. Classify the materials as per orthotropic and anisotropic behavior.
3. Estimate strain constants using theories applicable to composite materials.
4. Analyse structural elements made of cement composites.
5. Design structural elements made of cement composites.

UNIT – I

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

UNIT – II

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

UNIT – III

Cement Composites: Types of Cement Composites, Terminology, Constituent Materials And their Properties, Construction Techniques for Fiber Reinforced Concrete – Ferro cement, SIFCON, Polymer Concretes, Preparation of Reinforcement, Casting and Curing.

UNIT – IV

Mechanical Properties of Cement Composites: Behavior of Ferrocement, Fiber Reinforced Concrete in Tension, Compression, Flexure, Shear, Fatigue and Impact, Durability and Corrosion.

UNIT – V

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

Analysis and Design of Cement Composite Structural Elements – Ferro cement, SIFCON and Fiber Reinforced Concrete.

Text Books:

1. Fiber Reinforced Cement Composites by P.N. Balaguru and S.P. Shah

2. Cement-Based Composites: Materials, Mechanical Properties and Performance by Andrzej M. Brandt

3. Design and Control of Concrete Mixtures" by Steven H. Kosmatka, Beatrix Kerkhoff, and William C. Panarese

4. Handbook of Polymer-Modified Concrete and Mortars: Properties and Process Technology by Yoshihiko Ohama

References:

1. Mechanics of Composite Materials, Jones R. M, 2nd Ed., Taylor and Francis, BSP Books, 1998.

2. Ferrocement – Theory and Applications, Pama R. P., IFIC, 1980.

3. New Concrete Materials, Swamy R.N., 1stEd., Blackie, Academic and Professional, Chapman &Hall, 1983.

4. Concrete: Microstructure, Properties, and Materials" by P. Kumar Mehta and Paulo J.M. Monteiro

Course Code	Course Title						Core/Elective
P24MB111	RESEARCH METHODOLOGY AND IPR						MC
Prerequisite	Contact Hours per Week				CI E	SEE	Credits
	L	T	D	P			
-	3	-	-	-	40	60	3

Course Objectives

The objectives of this course is to:

1. Motivate to choose research as career
2. Formulate the research problem, prepare the research design
3. Identifyvarioussourcesforliteraturereviewanddatacollectionreportwriting
4. Equip with good methods to analyze the collected data
5. Know about IPR copyrights

Course Outcomes

After Completion of this course, the student will be able to:

1. Define research problem, review and asses the quality of literature from various sources
2. Improve the style and format of writing are pyrotechnical paper/Journal report, understand and develop various research designs
3. Collect the data by various methods: observation, interview, questionnaires
4. Analyze problem by statistical techniques: ANOVA, F-test, Chi-square
5. Understand apply for patent and copyrights

UNIT-I

Research Methodology: Objectives and motivation of research, Types of research, Research approaches, Significance of research, Research methods verses Methodology, Research process, Criteria of good research, Problems encountered by researchers in India, Benefits to the society in general, Defining the Research problem, Selection of research problem, Necessity of defining the problem

UNIT-II

Literature Survey and Report writing: Importance and purpose of Literature Survey, Sources of Information, Assessment of Quality of Journals and Articles, Need of Review, Guidelines for Review, Record of Research Review.

Report writing: Meaning of interpretation, Layout of research report, Types of reports, Mechanism of writing are port.

Research Proposal Preparation: Writing a Research Proposal and Research Report, Writing Research Grant Proposal.

UNIT-III

Research Design: Meaning of Research Design, Need of Research Design, Feature of a Good Design, Important Concepts Related to Research Design, Different Research Designs, Basic Principles of Experimental Design, Developing a Research Plan, Steps in sample design, Types of sample designs.

UNIT-IV

Data Collection and Analysis: Methods of data collection, Data organization, Methods of data grouping, Diagrammatic representation of data, Graphic representation of data, Importance of Parametric, Non-parametric test, Testing of variance of two normal populations, Use of Chi-square, ANOVA, F-test, z-test

UNIT-V

Intellectual Property Rights: Meaning, Nature, Classification and protection of Intellectual Property, the main forms of Intellectual Property, Concept of Patent, Patent document, Invention protection, Granting of patent, Rights of a patent, Licensing, Transfer of technology.

Text Books:

1. Ann M. Korner, Guide to Publishing a Scientific paper, Bioscript Press 2004.
2. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

References:

1. Research Methodology, Methods & Techniquel; C.R Kothari, New Age International Publishers, 2004
2. Research Methodology for Engineers, R.Ganesan, MJP Publishers, 2011
3. Statistical Methods: Concepts, Application and Computationl, Y.P. Agarwal, Sterling Publications Pvt. Ltd., New Delhi, 2004
4. Intellectual Property Rights and the Law, G.B.Reddy,5thEd.2005Gogia Law Agency
5. Indian Patents Law –Legal & Business Implications, Ajit Parule karand Sarita D'Souza, Macmillan India Ltd, 2006.

Course Code	Course Title						Core/Elective
P24SE2L1	ADVANCED CONCRETE LAB						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Concrete Technology	-	-	-	2	50	-	1.0

Course Objectives

The objectives of this course is to:

1. To input knowledge in studies about the factors of concrete components.
2. To gain the knowledge of properties of construction elements

Course Outcomes

After completing this course, the student will be able to:

1. UnderstandtherheologyofspecialConcrete-flyash-basedConcrete-geo-polymer Concrete and Fiber Reinforced Concrete.
2. High strength–Mix design
3. Conduct cube, cylinder strength and modulus of rupture of high strength
4. Conduct of NDT of concrete
5. Conduct on tests on fly-ash and geopolymer concrete.

List of Experiments

1. To design the mix for High Strength Concrete.
2. To determine fresh properties of High Strength Concrete. (Evaluate Fresh And Hardened Concrete)
3. Study of stress-strain curve of high strength concrete, correlation between cube strength, cylinder strength, split tensile strength and modulus of rupture.
4. Behavior of beams under flexure and shear.
5. Relation between compressive and modulus of rupture
6. Split tensile strength and modulus of rupture for fly-ash concrete/geo-polymer concrete.
7. Development of correlation between Non-Destructive and Destructive Tests using Rebound Hammer and UPV instruments
8. Compressive strength and flexural strength of tile confirming to IS 516 :1959

Text Books:

1. Neville A.M., "Properties of Concrete", Trans-Atlantic Publications, Inc.; 5e, 2016
2. Shetty M. S., Concrete Technology", S. Chand & Co., 2018

References:

1. R. Santha kumar ,, Concrete Technology", Oxford Universities Press, 2018
2. Concrete–Microstructure–Properties and Material, Mehta.P.K and Paulo.J.M.M, (1997),McGraw-Hill.
3. Design of Concrete Mix, Krishna Raju.N.,(1985),CBS Publications.
4. Mehta and Monteiro, Concrete-Micro structure, Properties and Materials", McGraw Hill Professional 2017
5. Lea, Chemistry of Cement and Concrete", Butterworth-Heinemann Ltd, 5e, 2017

Course Code	Course Title						Core/Elective
P24SE1P1	SEMINAR						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	2	50	-	1

Course Outcomes

After completing this course, the student will be able to:

1. Develop the habit of referring the journals for literature review.
2. Understand the gist of the research paper.
3. Identify the potential for further scope.
4. Present the work in an efficient manner.
5. Write the documentation in standard format.

Seminar topics may be chosen by the students with advice from the faculty members and the student shall read further relevant articles in the domain.

The seminar must be clearly structured, and the power point presentation shall include following aspects:

1. Introduction to the field
2. Literature survey
3. Consolidation of available information
4. Summary and Conclusions
5. References

Each student is required to:

1. Deliver the seminar for a maximum duration of 30 minutes, where the presentation should be for 20 minutes in PowerPoint, followed by Question and Answers session for 10minutes.
2. Submit the detailed report of the seminar in spiral bound in a précised format as suggested by the Department.

Evaluation Process:

Guidelines for awarding marks		
S. No.	**Description**	**Max. Marks**
1	Contents and relevance	10
2	Presentation skills	10
3	Preparation of PPT slides	05
4	Questions and answers	05
5	Report in a prescribed format	20

Note:

1. The seminar presentation should be is gist of at least five research papers from **Peer-reviewed** or **UGC recognized** journals.
2. **The seminar report should be in the following order:** Background of work, literature review, techniques used, prospective deliverables, discussion on results, conclusions, critical appraisal and reference.
3. At least two faculty members will be associated with the seminar presentation to evaluate and award marks.
4. Attendance of all the students for weekly seminar presentations is compulsory. If the student fails to secure minimum attendance as per O.U. rules, the marks awarded in the seminar presentation shall

LORDS INSTITUTE OF ENGINEERING AND TECHNOLOGY
(An Autonomous Institution)
DEPARTMENT OF CIVIL ENGINEERING
SCHEME OF INSTRUCTIONS &EXAMINATIONS [LR-24]
(w.e.f. Academic Year Tentative 2024 – 25)
M.E. (Civil Engineering) II – Semester
Specialization in Structural Engineering

S. No	Course Code	Category	Course Title	Scheme of Instructions				Scheme of Examination			Credits
				L	T	P/D	Contact Hours/Week	Maximum Marks CIE	Maximum Marks SEE	Duration in Hours	
Theory Course											
1	P24SE201	PCC	FiniteElement Method	3	-	-	3	40	60	3	3
2	P24SE202	PCC	Structural Dynamics	3	-	-	3	40	60	3	3
3	P24SE203	PCC	Design of Metal Structures	3	-	-	3	40	60	3	3
4	-	PEC	Professional Elective–III	3	-	-	3	40	60	3	3
5	-	PEC	Professional Elective-IV	3	-	-	3	40	60	3	3
Practical/Laboratory Course											
6	P24SE2L1	PCC	Structural Dynamics Lab	-	-	2	2	50	-	3	1.0
7	P24SE2L2	PCC	Structural Design Lab	-	-	2	2	50	-	3	1.0
Project											
8	P24SE2P1	PROJ	Mini Project	-	-	4	4	50	-	3	2
Total				**15**	**-**	**8**	**23**	**350**	**300**	**24**	**19**

L : Lecture(Hrs/Wk/Sem) **T**:Tutorial(Hrs/Wk/Sem)**P:**Practical **D**:Drawing(Hrs/Wk/Sem)

CIE: Continuous Internal Evaluation **SEE**: Semester End Examination
PCC: Program Core Courses **PEC**: Professional Elective Courses
AD: Audit Courses **PROJ**: Project
SE: Structural Engineering

Note:
1. Each contact hour is a Clock Hour.
2. Thepractical class can be of three (clock hours) duration as per the requirement of a Particular Laboratory.

Course Code	Course Title						Core/Elective
P24SE201	FINITE ELEMENT METHODS						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
SA-II	3	-	-	-	40	60	3

Course Objectives

The objective of this course is to:

1. Learn the rudiments of finite element analysis.
2. Study the fundamentals of domain discretization, interpolation, application of boundary conditions, assembly of global matrices, and solution of the resulting algebraic systems.
3. Explain the core concepts of variational and weighted residual methods in FEM.
4. Derive the element stiffness matrix for 1-D, 2-D and 3-D problems.
5. Formulate the simple structural problems into finite elements.

Course Outcomes

After completing this course, the student will be able to:

1. Build and Analyse the FEA models for various engineering problems.
2. Identify the information requirements and sources for analysis, design and evaluation.
3. Use the standard finite element software to solve the structural engineering problems.
4. Interpret the results obtained from FEA software, not only in terms of conclusions but also awareness of limitations.
5. Learn the concepts of Strain-displacement matrix and stiffness matrix.

UNIT– I

Introduction to FEM: Types of Problems – Types of Materials – Elastic / Inelastic situations – Types of forces: Body forces / Surface Traction / Point loads – Deformable bodies – Types of Deformations – Homogeneous / Non homogeneous Problems – Equations of equilibrium for elastic 2-D / 3-D continua - Equilibriumequationsfor2-D /3-Dboundary elements–Boundary conditions–Strain-displacement relation for 2-D/ 3-D– Stress-strainrelationfor2-D/3-D– Plane stress /Plane strain problems.

Virtual Work Formulation: Application to problems of plane trusses with static indeterminacy not exceeding three.

Finite Difference Method with Central Differences: Solving ODE's and PDE's with central differences. Application to beam and plate bending problems of simple geometry.

UNIT–II

Variational Formulation: Finite Element Formulation – Stationarity of Functional –Given the Functional or Differential equation –Number of elements limited to two.

Elements: Strain-displacement relation matrix / stiffness matrix / Minimum Potential Energy Approach/ Rayleigh-Ritz Method / introduction to natural coordinates / stiffness matrix of second order bar element /Axial bar subjected to point loads, body forces and surface traction forces/ Problems with kinematic indeterminacy not exceeding two.

Triangular Elements: Displacement models / criterion for convergence / geometric invariance / conforming and non-conforming elements - 3-node triangular elements (CST) / determination of strain-displacement matrix / area coordinates-shape functions / determination of element stiffness and load matrices, assembling global stiffness and load matrices/ Problems with kinematic indeterminacy not

exceeding three.

2nd Order triangular elements: Shape functions – degradation technique / strain-displacement matrix /Expression for stiffness matrix /Load matrices due to body forces and surface traction.

UNIT–III

Iso-Parametric Elements:

Quadrilateral elements: Construction of shape functions using natural coordinates / Strain-displacement matrices / Load matrices for body force and surface traction / Expressions for stiffness matrix, load matrices for 4-noded quadrilateral elements/ Gauss Quadrature of numerical integration / Problems with rectangular elements, kinematic indeterminacy not exceeding three.

2nd Order Quadrilateral elements: Determination of shape functions for 2nd order quadrilateral elementsandforelementsofwithserendipity/Strain-displacementmatrices /Load matrices for body force and surface traction.

UNIT–IV

Method of Weighted Residuals:

Galerkin's Method of Weighted Residuals: Application to problems of mathematics / structural engineering, number of trial functions not exceeding two.

Galerkin's Finite Element Method: Weak form of Trial Function – Application to problems of mathematics/ structural engineering, number of elements limited to two.

Axi-symmetric Problems: Strain-displacement relationship/stress-strain relationship / determination of stiffness matrix for 3-noded ring element and load matrices for body force and surface traction / Problems with kinematic indeterminacy not exceeding three for 3-noded ring elements only.

UNIT– V

Tetrahedron Elements: Volume coordinates, Strain-displacement matrix, stiffness matrix, load matrices due to body force and surface traction/ introduction to Hexahedron(brick)elements.

Non-linear Finite element analysis: Introduction – problems with material non-linearity – problems with geometric non-linearity –problems with both material and geometric non-linearity.

Introduction to MSC Nastran: Illustration on different modules of Nastran/Structural engineering applications of the package/Creation of a simple 1-D model, 2-D model and a 3-D model/ analysis and post processing of the results.

Text Books:

1. Introduction to Finite Elements in Engineering, Chandrupatla, T.R. And Belegundu, A.D,(2001).Prentice Hall of India, New Delhi.
2. Finite Element Analysis, Seshu.P,(2003).Prentice Hall of India Private Limited, New Delhi.

References:

1. Concepts and Application of Finite Element Analysis, Cook, R.D.(1981).John Wiley and Sons.
2. The Finite Element Method, Vol.1, Zienkiewicz, O.C. And Taylor, R.L,(1989).Mc Graw Hill Company Limited, London.
3. An Introduction to the Finite Element Method, Reddy, J.N,(1993).Mc Graw Hill, New York.
4. Fundamentals of Finite Element Analysis, David V.Hutton, (2005).Tata McGraw-Hill Publishing Company Limited, New Delhi.
5. Finite Element Procedures, Bathe, K.J,(2006),Prentice Hall of India, New Delhi.

Course Code	Course Title						Core/Elective
P24SE202	STRUCTURAL DYNAMICS						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ENGINEERING MECHANICS	3	-	-	-	40	60	3

Course Objectives

The objectives of this course is to:

1. Study the various types as well as characteristics of loading and formulate the equations of motion.
2. Learn the response of un-damped and damped SDOF and MDOF systems under various loadings.
3. Employ the approximate and iterative methods to model continuous vibratory systems.
4. Use the seismic codes in analysis and design of civil engineering structures.
5. Understand the dynamic response by numerical methods.

Course Outcomes

After completing this course, the student will be able to:

1. Know the fundamental theory of dynamic equation of motions and analysis methods for dynamic systems.
2. Understand the modeling approach of dynamic response in civil engineering applications.
3. Create the simple computer models for engineering structures using knowledge of structural dynamics.
4. Evaluate the dynamic response analysis results and understand the possible error sources. Interpret the dynamic analysis results for design, analysis and research purposes.
5. Apply the structural dynamics theory to earthquake analysis, response, and design of structures.

UNIT– I

Introduction to Structural Dynamics: Objectives of dynamic analysis, Types of prescribed dynamic loading, Characteristics of a dynamic problem, Methods of discretization, Lumped mass procedure /Consistent mass procedure/generalised displacements, Single degree freedom systems, Formulation of equation of motion, D'Alembert's principle / Method of virtual work / Hamilton's principle, Influence of gravity forces and ground motion on equation of motion, Generalised SDOF systems, Rigid body assemblage/distributed flexibility.

UNIT–II

Single Degree of Freedom Systems: Response of un-damped/damped free vibrations of SDOF systems, Un-damped/damped vibrations of SDOF systems subjected to harmonic loading, Dynamic equilibrium, Accelerometers, Displacement meters, Resonant response, Vibration isolation, Un- damped/damped vibrations of SDOF systems subjected periodic loading, Response of SDOF systems subjected impulse loads, Half-sine pulse/rectangular pulse/triangular pulse, Shock spectra, Approximate method of impulse load analysis, Un-damped, Damped vibrations of SDOF systems subjected general dynamic loading, Duhamel integral, Un-damped/damped vibrations of SDOF systems subjected arbitrary dynamic loading.

UNIT–III

Multi Degree Freedom Systems: Formulation of equations of motion, Evaluation of lumped mass matrix and consistent mass matrix, Evaluation of stiffness matrix.

Un-damped Free Vibrations: Analysis of frequency matrix and mode shape matrices using detrimental

equation/flexibility formulation/orthogonality conditions/ normalizing mode shapes/Analysis of dynamic response/normalcoordinates/Uncoupledequationsofmotionforun-dampedsystems/conditions for damping orthogonality, Mode super position procedure for damped forced vibrations, Time history analysis, Direct integration methods due to Newmark (average acceleration, linear acceleration),Wilsontheta correction.

UNIT–IV

Practical Vibration Analysis: Stodola method, Holtzer method–Fundamental mode only, Reduction of degrees of freedom, Basic concepts in matrix iteration.

Variational Formulation of Equations of Motion: Generalized coordinates, Lagrange's equations of motion, Application to simple un-damped and damped problems of 2-DOF systems.

UNIT– V

Distributed Parameter Systems: Partial differential equation of motion, Beam flexure (Elementary case), Undamped free vibrations (Elementary case), Analysis of dynamic response, Normal coordinates.

Earthquake Resistant Design: Brief exposure to relevant IS Codes of Practice, Response Spectra method.

Text Books:

1. Anil K Chopra, Dynamics of structures – Theory and applications to Earthquake Engineering, Prentice Hall Inc., 2007.

2. Mukobadhyay, "Vibrations, Structural Dynamics", Oxford IBH Publications., 2006

References:

1. Dynamics of Structures, Walter C. Hurty & MosheF. Rubinstein,(1964), Prentice Hall India.

2. Dynamics of Structures, Clough, Ray.W, and Penzien, Joseph(1982),Mc Graw Hill Company Limited, NewDelhi.
3. MarioPaz,(1987).Structural Dynamics, CBS Publishers.

4. Craig R.R. Jr., Structural Dynamics – An Introduction to Computer Methods, John Wiley and Sons, 1981

5. Thomson W.T., Theory of Vibration and Applications, Prentice Hall of India, 1992

Course code	Course Title						Core/Elective
P24SE203	Design of Metal Structures						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
STEEL STRUCTURES	3	-	-	-	40	60	3

Course Objectives

The objectives of this course is to:

1 To learn the fundamental principles and methodologies for designing steel tanks and grillage foundations.
2 To develop practical problem-solving skills related to the analysis and design of steel tanks and grillage foundations.
3 To studythe analysis and design concepts for various members of tubular structures, including tension and compression members.
4 To gain knowledge in the design and analysis of bunkers and silos using appropriate methods and techniques.
5 To understand the design principles and methodologies for transmission line towers, including load analysis and wind load calculations.
6 To learn the fundamentals of designing light-gauge steel structures, focusing on member behavior and connection details.

Course Outcomes

After completing this course, the student will be able to:

1. Design and detail rectangular plated and pressed steel tanks, incorporating relevant design codes and standards.
2. Propose suitable grillage foundations for various structures based on load requirements and site conditions.
3. Analyze and design hollow rectangular, square, and circular tubular members in trusses, including joint design.
4. Formulate the design of rectangular and square bunkers and silos using appropriate design theories and methods.
5. Propose geometries and perform load analysis and design for transmission line towers, ensuring compliance with IS codal provisions.

UNIT-I

Grillage Foundations: Introduction, Necessity of grillage foundation, Various types, Grillage foundations for single and double columns.

Tubular Structures: Introduction, Permissible stresses, Design considerations, Design of tension members, compression members and flexural members, Design of tubular trusses including joints.

UNIT-II

Bunkers and Silos: Introduction, General design principles, Design theories for bunkers and silos, detailed design of bunkers and silos.

UNIT-III

Steel Tanks: Introduction, Types, Loads, Permissible stresses, Detailed design of elevated rectangular and pressed steel tanks including columns.

UNIT-IV Transmission Line Towers: Classification, Economical spacing, Design loads, IS codal provisions, Calculation of wind loads, Permissible stresses, Overall arrangement and design procedure, detailed design including foundations.

UNIT-V

Design of Light Gauge Steel Structures: Introduction, Forms of light-gauge sections, Behaviour of compression elements, Effective width for load and deflection calculation, Behaviour of unstiffened and stiffened elements, Design of compression members, Design of laterally supported beams and laterally unsupported beams, Connections.

Text Books:

1. N. Subramanian Design of Steel Structures: Theory and Practice, Oxford University.
2. V. L. Shah and Veena Gore, Limit State Design of Steel Structures IS : 800-2007, Structures.

References:

1. Design of Steel Structures‖, S.K. Duggal, Tata McGraw Hill, 2009.
2. Design of Steel Structures‖, B.C Punmia Laxmi Publications, 2001.
3. Design of Steel Structures‖, Ram Chandra, Vol. I & II, Standard Book House, 1989.
4. Design of Steel Structures‖, P. Dayaratnam, Orient Longman Publications, 1987.
5. Design of Steel Structures‖, I.C. Syal and S. Singh, Standard Book House, 2000

PROFESSIONAL ELECTIVE-III

Course Code	Course Title						Core/Elective
P24SE203	EARTHQUAKE RESISTANT DESIGN OF BUILDINGS						PEC-3
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
RCC	3	-	-	-	40	60	3

Course Objectives

The objective of this course is to:

1. Learn the causes of earthquake and effects of ground motion and modelling of structures.
2. Study the response spectra and structural dynamics of MDOF systems.
3. Discover the different analysis and design approaches like equivalent lateral force method and in elastic time history analysis.
4. BetrainedintheductiledetailingofreinforcedconcretestructuresasperIS4326andIS13920.
5. Learn the seismic analysis of masonry buildings.

Course Outcomes

After completing this course, the student will be able to:

1. Apply the concepts of structural dynamics of MDOF systems for analysis of structures.
2. Model and analyse the structures to resist earthquake forces by different methods.
3. Design the various structural elements resisting earthquake forces as per IS Codes.
4. Practice ductile detailing of reinforced concrete and masonry buildings as per codal provisions.
5. To learn applications of earthquake resistance and design of masonry structures.

UNIT-I

Basics of Seismology: Earth and its interior, Plate Tectonics, Convection Currents, The Earth quake, Inter Plate Earthquake (Convergent Boundaries, Divergent Boundaries and Transform Boundaries), Intra Plate Earthquake (Faults and Types of Faults), Seismic Waves, Basic Terminology, Measuring Units and Instruments

Concepts of Earthquake Resistant Design of RCC Structures: Basic elements of earthquake resistant design, Identification of seismic damages in RCC buildings, Effect of structural irregularities on performance of RCC buildings during earthquakes, earthquake resistant building architecture. LFRS, Types of LFRS on Buildings

UNIT-II

Design forces for buildings Introduction; Equivalent static method; Mode superposition technique; Dynamic in elastic time history analysis; Advantages and disadvantages of these methods; Determination of lateral forces as per IS 1893(Part 1) – Equivalent static method, Model analysis using response spectrum

UNIT-III

Seismic Analysis and Modelling of RCC Structures: Code based procedure for determination of design lateral loads, Infill walls, Seismic analysis procedure as per IS 1893 code, Equivalent static force method, Response spectrum method, Time history analysis, Mathematical modelling of multi-storey RCC buildings.

UNIT-IV

Earthquake Resistant Design of RCC Structures: Ductility considerations, Earthquake resistant design

of multi-storey RCC buildings and shear walls based on IS13920 code, Capacity based design.

UNIT-V

Earthquake Resistant Design of Masonry Structures: Identification of damages and non-damages in masonry buildings, Elastic properties of structural masonry, Lateral load analysis of masonry buildings, Seismic analysis and design of one-storey and two-storey masonry buildings.

Text Books:

1. Pankaj Agarwal & Manish Shrikhande, "Earthquake Resistant Design of Structures", 5th Edition Prentice Hall of India, New Delhi, 2011.

2. S.K.Duggal, "Earthquake Resistant Design of Structures", Oxford University Press, 1st Edition, 2012.

References:

1. Earthquakes, WH Freeman and Company, Bruce A Bolt, NewYork,2004.
2. Earthquake Resistant Engineering Structures, C.A.Brebbia,WITPress,2011.
3. Earthquake- Resistant Structures : Design, Build and Retrofit, Mohiuddin Ali Khan, Elsevier Science & Technology, 2012.
4. IS 1893 (Part 1): 2016, Indian Standard "Criteria for Earthquake Resistant Design of Structures, Part 1, General provisions and Buildings (six revision) Bureau of Indian Standard, New Delhi. (or latest).
5. IS 13920: 2016 Indian Standard "Ductile Design and Detailing of Reinforced Concrete Structures, subjected to Seismic forces - Code of Practice, Bureau of Indian Standard, New Delhi. (or latest).

Course Code	Course Title						Core/Elective
P24SE204	DESIGN OF HIGH-RISE STRUCTURES						PCE-3
Prerequisite	Contact Hours per Week				CI E	SEE	Credits
	L	T	D	P			
RCC	3	-	-	-	40	60	3

Course Objectives

The objective of this course is to:

1. To study the functioning and behavior of high-rise buildings.
2. To understand the characteristics and effect of wind loads on buildings.
3. To understand the effect of earthquake on buildings and to learn the techniques for earthquake resistance.
4. To analyze tall buildings subjected to lateral loads.
5. Tounderstandtheinteractionbetweenthevariousstructuralcomponentsofhigh-risestructures.

Course Outcomes

After completing this course, the student will be able to:

1. Understand the concepts of high-rise building structures.
2. Analyze and design high rise structures subjected to wind loads.
3. Familiarize with the different structural systems used in high rise buildings.
4. Analyze and design high rise structures subjected to earthquake loads.
5. Understand the behavior and response of slab column frames.

UNIT-I

Introduction: Design Principles for Lateral Load resistance, ductility considerations in earthquake resistant design of concrete buildings, construction methods, choice of materials, cladding systems and their design principles, types of foundations for tall buildings.

UNIT-II

Wind: Introduction to wind, characteristics of wind, impact on structures, wind pressure, internal and external wind, dynamic action of wind, aerodynamic forces, natural frequencies, wind tunnels, types of wind tunnel tests, Introduction to computational fluid dynamics, behavior of tall buildings subjected to wind, National standards, maximum design loads for buildings and other structures. Calculation of wind loads, special winds, gust, windspeed data and importance. Wind resistant design.

UNIT-III

Earthquake: Introduction to earthquake, characteristic, impact of earthquake on ground, foundations and structural elements, response of elements attached to buildings, ground motion, quasi-static approach, dynamic analysis, performance criteria, Vibration Control – active control and passive control, liquefaction effects of earthquakes, Introduction to time history analysis and push over analysis.

UNIT-IV

Structural Systems: Necessity of special structural systems for tall buildings, Structural Systems for Steel Buildings - Braced frames, Staggered Truss System, Eccentric Bracing System, Outrigger & Belt truss system, Tube Systems; Structural Systems for Concrete Buildings - shear walls, frame tube structures, bundled tube structures; Design of shear wall as per IS code.

UNIT-V

Special Topics: Second order e effects of gravity loading, Creep and shrinkage in columns, Differential shortening of columns, Floor leveling problems, Panel zone effects, P-Delta analysis.

Text Books:

1. Designing Tall Buildings: Structure as Architecture Routledge, New york, 2012. Mark Sarkisian,

2. Reinforced Concrete Design of Tall Buildings, Taranath, B.S.,CRCPress,2010.

References:

1. Construction Technology for High Rise Buildings: Handboo, 2014, CreateSpace. Basem M.M.,

2. Mechanical and Electrical Services for High Rise Buildings: Handbook, 2014, CreateSpace. Basem M.M.

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

4. High-rise Manual : Typology and Design, Construction, and Technology Birkhuser, 2003. Johann Eisele & Ellen Kloft,

5. Tall Buildings: A Strategic Design Guide, RIBA & BCO, 2016. Nigel Clark and Bill Price,

Course Code	Course Title						Core/Elective
P24SE205	STRUCTURAL OPTIMIZATION						PCE-3
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	40	60	3

Course Objectives

The objective of this course is to:

1. Learn the optimization techniques and linear optimization.
2. Study the non-linear optimization and non-linear constrained optimization.
3. Understand the dynamic programming, decision theory and simulations.
4. Apply optimization techniques for simple structures.

Course Outcomes

After completing this course, the student will be able to:

1. Become confident at optimization techniques, linear optimization, algorithm, etc.
2. Learn the nonlinear optimization and one-dimensional minimization methods.
3. Study the non-linear optimization-II by different methods.
4. Use the optimization techniques for simple structures.
5. Know the structural optimization for different elements.

UNIT– I

Introduction to optimization: Introduction,

basic theory and elements of Optimization, Terminology and definitions, Basic principles and procedure of optimization, Engineering applications of Optimization.

Classical Methods of Optimization: Trial and error method, Monte-Carlo method, Lagrangian multiplier method, illustrative examples

Linear Programming: Introduction, terminology, formulation of LPP, graphical and algebraic methods of solving LPP, standard form and canonical form of linear programming, geometrical interpretation, illustrative examples.

UNIT–II

Linear Programming: Simplex methods, Artificial variable techniques, solution of simultaneous equations, Dual formulations -illustrative examples.

Network analysis: Modifications and improvements on CPM/PERT

Transportation and Assignment problem: Introduction, terminology, formulation and solution of mathematical models, illustrative examples.

UNIT–III

Non-Linear Programming: local and global optimum, problem formulation, Unconstrained and constrained methods of Optimization-Kuhn Tucker conditions, Lagrangian Multiplier methods, Graphical method, Univariate search method, Steepest Descent Methods, quadratic programming problem, Wolfs modified simplex method, illustrative examples.

UNIT–IV

Dynamic programming: Introduction, terminology, need and characteristics of dynamic programming, formulation, solution of LPP, applications, illustrative examples

Decision theory: Introduction, types, decision trees.

Simulation: Introduction, advantages, limitations, types, applications.

UNIT– V

Structural Optimization: Optimum structural design of rectangular timber beam, reinforced concrete rectangular, T and L beams, concrete mix proportioning, reinforced concrete deep beams, planner trusses, Procedure of optimization for structural grid and slab.

Text Books:

1. Rao, S.S. "Engineering Optimization: Theory and Practice", Fourth Edition, Wiley Eastern (P) Ltd., 2013

2. Chong, Edwin K.P. and Żak, S.H., An Introduction to Optimization, Second Edition. Wiley-Inter science, John Wiley & Sons, New York 2001.

References:

1. Belegundu, A.D. and Chandrupatla, T.R., Optimization Concepts and Applications in Engineering. Prentice Hall, Inc., Upper Saddle River, New Jersey, 1999.

2. Kirsch, U., Structural Optimization: Fundamentals and Applications, Springer-Verlag, New York, 1993.

3. Papalam bros, P.Y. and Wilde, D.J., Principles of Optimal Design: Modeling and Computation, Cambridge University Press, 2000.

4. Kirsch, U., Optimum Structural Design, McGraw-Hill Book Co., Inc., New York, New York, 1981.

5. Gill, P.E., Murray, W., and Wright, M.H., Practical Optimization, Academic Press, New York, New York, 1981.

PROFESSIONAL ELECTIVE -IV

Course Code	Course Title						Core/Elective
P24SE206	DESIGN OF PRESTRESSED CONCRETE STRUCTURES						PCE-4
Prerequisite	Contact Hours per Week				CI E	SEE	Credits
	L	T	D	P			
RCC	3	-	-	-	40	60	3

Course Objectives

The objective of this course is to impart knowledge of

1. Learn the concept of pre-stressed concrete, method sand systems of pre-stressing, losses of pre-stress.
2. Analyse and design the sections for flexure, torsion and shear using different methods.
3. Learn the design of sections for bond and anchorage and deflections of pre-stressed concrete beams.
4. Study the analysis and design of statically indeterminate beams.

Course Outcomes

After completing this course, the student will be able to:

1. Familiarize with fundamentals of pre-stressed concrete, methods and systems of pre-stressing and losses of pre-stress.
2. Analyse and design the sections for flexure, shear bond and anchorages.
3. Estimate the deflections of pre-stressed concrete elements.
4. Know the circular pre-stressing, analysis and design of statically indeterminate beams.
5. Solve the problems pertaining to axial members, slabs and grid floors.

UNIT-I

Introduction: Basic concepts, materials, permissible stress–Advantages and types of prestressing, Systems and devices of pre-stressing and post-tensioning, Prestressing steel

Losses in pre-stress: Loss of prestress in pre-tensioned and post-tensioned members–Analysis of sections for flexure

UNIT-II

Deflections: Importance of deflections, factors influencing deflections, codal provisions, short term and long-term deflections.

Shear: Shear in principal stresses – cracked and un-cracked sections- codal provisions–Design of shear reinforcement.

Torsion: Torsion for cracked and un-cracked sections, codal provisions and design.

UNIT-III

End Blocks: Nature of stresses, Stress distribution – IS Code Method -codal provisions - Design.

Continuous beams: Advantages of Continuous members – Code provisions–Design of two span Continuous beams – concordant cable profiles.

UNIT-IV

Tension Members: Introduction, Ties, Circular pre-stressing–Design of PSC pipes.

Compression Members: Introduction–Design of PSC columns.

UNIT-V

Slabs: Introduction – Types – rectangular and flat slabs – Codal provisions – Design of PSC floor slabs – one way and two-way slabs, and simple flat slabs. Grid Floors: Introduction.

Text Books:

1. Krishna Raju N., "Prestressed concrete", 5th Edition, Tata McGraw Hill Company, New Delhi, 2012
2. Pandit.G.S. and Gupta.S.P., "Prestressed Concrete", CBS Publishers and Distributers Pvt. Ltd, 2012

References:

1. Rajagopalan.N, "Prestressed Concrete", Narosa Publishing House, 2002.
2. Dayaratnam.P., "Prestressed Concrete Structures", Oxford and IBH, 2013
3. Lin T.Y. and Ned. H. Burns, "Design of prestressed Concrete Structures", Third Edition, Wiley India Pvt. Ltd., New Delhi, 2013.
4. IS 1343:1980, Code of Practice for Prestressed Concrete, Bureau of Indian Standards, New Delhi, 2012
5. IS 3370- Part 4 (2008) Indian standard Code of practice for concrete structures for the storage of liquid- Design tables, code of practice, bureau of Indian standards, new Delhi.

Course Code	Course Title						Core/Elective
P24SE207	BRIDGE ENGINEERING						PCE-4
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
RCC	3	-	-	-	40	60	3

Course Objectives

The objectives of this course is to:

1. Learn the hydraulic, geological and geo-technical aspects in bridge design.
2. Analyse, design and detail the bridge deck and box girder systems, steel and composite bridges.
3. Analyze and design the sub-structures, bridge bearings and various long span bridges.

Course Outcomes

After completing the course, the students will able to

1. Understand the fundamentals and codes of practice of bridge design.
2. Design the bridge deck and box girder systems using appropriate method.
3. Devise the steel truss and composite steel-concrete bridges.
4. Propose the sub-structure components such as pier, abutments, etc. and bridge bearings.
5. Design the various types of long span bridges, curved and skew bridges.

UNIT– I

Introduction: Types of bridges, materials of construction, codes of practice (Railway and Highway Bridges), aesthetics, loading standards (IRC, RDSO, AASHTO), recent developments box girder bridges, historical bridges (in India and overseas). Planning and layout of bridges, hydraulic design, geological and geo-technical considerations; Design aids, computer software, expert systems.

UNIT–II

Concrete Bridges: Bridge deck and approach slabs, Slab design methods, design of bridge deck systems, slab-beam systems (Guyon-Massonet and Hendry Jaeger Methods), box girder systems, analysis and design. Detailing of box girder systems.

UNIT–III

Steel and Composite Bridges: Introduction to composite bridges, Advantages and disadvantages, Orthotropic decks, box girders, composite steel-concrete bridges, analysis and design, truss bridges.

UNIT–IV

Sub-Structure: Piers, columns and towers, analysis and design, shallow and deep foundations, caissons, abutments and retaining walls.

Bridge appurtenances: Expansion joints, design of joints, types and functions of bearings, design of elastomeric bearings, railings, drainage system, lighting.

UNIT– V

Long span bridges: Design principles of continuous box girders, curved and skew bridges, cable stayed and suspension bridges, seismic resistant design, seismic isolation and damping devices. Construction techniques (cast in-situ, prefabricated, incremental launching, free cantilever construction), inspection, maintenance and rehabilitation, current design and construction practices.

Text Books:

1. Johnson Victor D., Essentials of Bridge Engineering, Oxford and IBH Publishing Co., New Delhi, 2009.

2. Jagadeesh. T.R. and Jayaram. M.A., "Design of Bridge Structures", Prentice Hall of India Pvt. Ltd, Learning Pvt. Ltd., 2013

References:

1. Phatak D.R., Bridge Engineering, Satya Prakashan, New Delhi, 1990.

2. Ponnuswamy S., Bridge Engineering, Tata McGraw-Hill, New Delhi, 1996.

3. Rajagopalan. N. Bridge Superstructure, Alpha Science International, 2006

Course Code	Course Title						Core/Elective
P24SE208	ADVANCED REINFORCED CONCRETE DESIGN						PCE-4
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
RCC	3	-	-	-	40	60	3

Course Objectives

The objectives of this course is to:

1. Learn the analysis and design of beams curved in plan and deep beams.
2. Design and detail the deep beams.
3. Analyze, design and detail the domes, water tanks, bunker sand silos.
4. Analyze and design the raft, pile and machine foundations.

Course Outcomes

After completing this course, the student will be able to:

1. Design the beams curved in plan and deep beams.
2. Propose the deep beams, domes and various type water tanks.
3. Differentiate and design the bunkers and silos.
4. Formulate the raft, pile and machine foundations.
5. Design principles for machine foundations.

UNIT-I

Beams Curved in Plan: Introduction - design principles – Terminologies, structural design of beams curved in plan of circular and rectangular type.

Deep Beams: Introduction to deep beams, Flexural and Shear stresses in deep beams, IS Code provisions, design of deep beams

UNIT-II

Analysis And Design of Flat Slabs: Introduction, Proportioning of flat slabs, Determination of bending moment by direct design method, slab reinforcement details. Design for punching shear.

Circular Slabs: Introduction, Slab freely supported at edges and carrying U.D.L, slabs fixed at edges and carting udl.

UNIT-III

Domes: Introduction, Stresses and forces in domes, Design of spherical and conical domes.

Water Tanks: Types, Codal specifications, Design of circular, Rectangular and Intze type water tanks.

UNIT-IV

Bunkers and Silos: Introduction, Design principles and theories Code provisions, design of square and circular bunkers, Design of cylindrical silos, IS specifications.

UNIT-V

Raft and Pile Foundations: Introduction, Need for the design, Design principles, Structural design of raft and pile foundations including the design of pile caps.

Machine Foundations: Introduction, Types, Design Principles, Case studies, Detailed designs.

Text Books:

1. Bhavikatti S. S. "Advance RCC Design", 3rd Edition, New Age International Private Limited, 2008

2. Krishnam Raju, N. "Design of Reinforced Concrete Structures", 2nd Edition, CBS Publishers and Distributors, New Delhi, 2007.

References:

1. Varghese P.C. "Advanced Reinforced Concrete Design", 2nd Edition, Prentice - Hall of India, , 2008

2. Indian Standard Code 456 2000, "Code of Practice for plan & reinforced centre", British Standard Code-2000.

3. Special Publications -16, "Design Aids for Reinforced Concrete", to IS: 456. GVP COLLEGE OF ENGINEERING (A) 2015 M.TECH -STRUCTURAL ENGINEERING 5

4. Purushothaman P, "Reinforced Concrete Structural Elements", 3rd Edition, Tata Mc Graw- Hill Publishing Co, 2004.

5. Pillai and Devadas Menon, "Reinforced Concrete Design", 2nd Edition, Tata McGraw Hill Publishing Co. Ltd., 2003.

Course Code	Course Title						Core/Elective
P24SE2L1	STRUCTURAL DYNAMICS LAB						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
STRUCTURAL DYNAMICS	-	-	-	2	50	-	1.0

Course Objectives

The objective of this course is to:

1. Understand the concept of modes of vibration Simply Supported Plate
2. Understand Rebar Corrosion Detection and Assessment Using Electro-Mechanical Impedance (EMI)Technique.

Course Outcomes

After the completion of the course, the student will be able to:

1. Understand the behavior of structures subjected to dynamic loadings like wind, earthquake and blasting.
2. Understand the dynamic characteristics of structures instrumented with smart piezo electric sensors.
3. Visualize shear lag effect and Rebar Corrosion
4. Draw response spectrum curve for given condition
5. Measure displacements using Photogrammetry.

List of Experiments:

Simulation based:

1. Free Vibration of S.D.O.F System
2. Forced Vibration of S.D.O.F System
3. Impulse Response of S.D.O.F System
4. Concept of Response Spectrum
5. Vibration of M.D.O.F System
6. Behavior of Rigid Blocks
7. Torsional Response of Building
8. Continuous Systems
9. Vibration Control
10. Modes of Vibration of Simply Supported Beam Under Flexure
11. Modes of Vibration of Simply Supported Plate
12. Damage Detection and Qualitative Quantification Using Electro-Mechanical Impedance (EMI)Technique.
13. Dynamics of Bandra Worli Sea Link Bridge
14. Piezo electric Energy Harvesting and Structural Health Monitoring Using Thin Surface Bonded PZT Patches.
15. Shear Lag Effect in Electro-Mechanical Impedance (EMI)Technique
16. Rebar Corrosion Detection and Assessment Using Electro-Mechanical Impedance (EMI)Technique.

Simulation based:

1. Vibration Characteristics of Aluminum Cantilever Beam Using Piezoelectric Sensors
2. Identification of High Frequency Axial Modes of Beam in "Free-Free" Condition Using Electro-Mechanical Impedance (EMI) Technique

3. Forced Excitation of Steel Beam Using Portable Shaker
4. Photogrammetry for displacement measurement.

e-resources:

1. http://sd-iiith.vlabs.ac.in/Introduction.html(ForExperiments1to9)
2. http://vssd-iitd.vlabs.ac.in/home.html(ForExperiments10to20)

Course Code	Course Title						Core/Elective
P24SE2L2	STRUCTURAL DESIGN LAB						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	2	50	-	1.0

Course Objectives

The objective of this course is to:

1. Learn the practical application of seismic force by static and dynamic methods.
2. Know the importance of wind coefficient methods on walls and roofs of rectangular building.

Course Outcomes

After completing this course, the student will be able to:

1. Design and detail all the structural components of frame buildings for seismic and wind force.
2. Design and detail complete multi-storey building.
3. Calculate the design wind forces on a RC building using force coefficient method.
4. Calculate the design wind forces on a RC building using Gust Factor Approach.
5. Design of a simple G+3 storied structure using any structural analysis

Syllabus Content:

Seismic & Wind Analysis and Design:

1. Calculation of design seismic force by static and dynamic methods of IS1893.
2. Calculation of lateral force distribution as per Torsion provisions of IS1893.
3. Beam design of an RC frame building as per IS 13920.
4. Column design of an RC frame building as per IS 13920.
5. Beam-columnjointdesignofanRCframebuildingasperIS13920.
6. Complete manual seismic analysis, design and detailing of a simple G+3 storied building and its comparison with any structural analysis and design software.
7. Calculation of wind pressure sand design forces on walls and roof of a rectangular building.
8. Calculation of design wind forces on a RC building using force coefficient method.
9. Calculation of design wind forces on a RC building using Gust Factor Approach.
10. Complete manual wind analysis and design of a simple G+3 storied structure using any structural analysis and design software and its comparison with any structural analysis and design software.

Note: All the experiments / assignments should be done manually by individual student and the analysis & design results should be compared using latest structural analysis and design software.

Software:

1. **ETABS**
2. **STAAD Pro Connect Edition**
3. **ANSYS**
4. **MATLAB**

Course Code	Course Title						Core/Elective
P24SE2P1	MINI PROJECT						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	4	50	-	2

Course Outcomes

After successful completion of the course, the students will be able to:

1. Formulate a specific problem and give solution
2. Develop model/models either theoretical/practical/numerical form
3. Solve, interpret/correlate the results and discussions
4. Conclude the results obtained
5. Write the documentation in standard format

Guidelines:

1. As part of the curriculum in the II- semester of the programme each student shall do a mini project, generally comprising about three to four weeks of prior reading, twelve weeks of active research, and finally a presentation of their work for assessment.
2. Each student will be allotted to a faculty supervisor for mentoring.
3. Mini projects should present students with an accessible challenge on which to demonstrate competence in research techniques, plus the opportunity to contribute something more original.
4. Mini projects shall have inter-disciplinary/ industry relevance.
5. The students can select a mathematical modeling based/Experimental investigations or Numerical modeling
6. All the investigations should be clearly stated and documented with the reasons/explanations.
7. The mini-project shall contain a clear statement of the research objectives, background of work, literature review, techniques used, prospective deliverables, and detailed discussion on results, conclusions and reference.

Departmental committee: Supervisor and a minimum of two faculty members Evaluation Guidelines:

Guidelines for awarding marks in CIE (Continuous Internal Evaluation): Max. Marks: 50		
Evaluation by	**Max. Marks**	**Evaluation Criteria / Parameter**
Supervisor	20	Progress and Review
	05	Report
Departmental Committee	05	Relevance of the Topic
	05	PPT Preparation
	05	Presentation
	05	Question and Answers
	05	Report Preparation

LORDS INSTITUTE OF ENGINEERING AND TECHNOLOGY
(An Autonomous Institution)
DEPARTMENT OF CIVIL ENGINEERING
SCHEME OF INSTRUCTIONS &EXAMINATIONS [LR-24]
(w.e.f. Academic Year Tentative 2025 – 26)
M.E. (Civil Engineering) III – Semester
Specialization in Structural Engineering

S. No.	Course Code	Category	Course Title	Scheme of Instructions				Scheme of Examination			
				L	T	P/D	Contact Hours/Week	Maximum Marks		Duration in Hours	Credits
								CIE	SEE		
Theory Course											
1	-	AD	Audit Course–I	2	1	-	2	40	60	3	-
2	-	AD	Audit Course–II	2	1	-	3	40	60	3	-
3	-	OEC	Open Elective	3	-	-	3	40	60	3	3
Project											
4	P24SE3P1	PROJ	Dissertation–I	-	-	20	20	100	-	3	10
Total				**7**	**2**	**20**	**28**	**220**	**180**	**12**	**13**

L : Lecture(Hrs/Wk/Sem) **T**:Tutorial(Hrs/Wk/Sem)**P:**Practical **D**:Drawing(Hrs/Wk/Sem)

CIE: Continuous Internal Evaluation **SEE**: Semester End Examination
PEC: Professional Elective Courses **OEC**: Open Elective Courses
PROJ: Project **SE:** Structural Engineering

Note:
1. Each contact hour is a Clock Hour.
2. Thepractical class can be of three (clock hours) duration as per therequirement of a Particular Laboratory.

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OPEN ELECTIVE COURSES

S. No.	Course Code	Course Title
1	P24ME301	Industrial Safety
2	P24MB311	Business Analytics
3	P24EC301	Embedded System Design
4	P24CE301	Cost Management of Engineering Projects**
5	P24EE309	Waste to Energy

** Subject isnot to be offered to the students of Civil Engineering Department.

List of subjects of Audit Course-I

S. No.	Course Code	Course Title
1	P24CE101	Disaster Management
2	P24EN102	Sanskrit for Technical Education
3	P24EN103	Value Education
4	P24EN101	English for Research Paper Writing

List of subjects of Audit Course-II

Course Code	Course Title
P24EN201	Constitution of Indian Fundamental Rights
P24EN202	Pedagogy Studies
P24EN203	Stress Management by Yoga
P24EN204	Personality Development through Life Enlightenment Skills

Audit Course-I

Course Code	Course Title						Core/Elective
P24CE101	DISASTER MANAGEMENT						Audit I
Prerequisite	Contact Hours per Week				CI E	SEE	Credits
	L	T	D	P			
-	2	-	-	-	40	60	-

Course Objectives:

The objectives of this course is to:

1. To impart knowledge in students about the nature, causes, consequences and mitigation measures of the various natural disasters
2. To enable the students to understand risks, vulnerabilities and human errors associated with human induced disasters
3. To enable the students to understand and assimilate the impacts of any disaster on the affected area depending on its position/location, environmental conditions, demographic, etc.

Course Outcomes

At the end of this course, students will be able to**:**

1. Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response
2. Critically evaluate disaster risk reduction and humanitarian response policy and Practice from multiple perspectives.
3. Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
4. Critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in.
5. Learn the concepts of structural & non-structural mitigation.

UNIT-I

Introduction: Disaster: Definition, Factors and Significance; Difference between Hazard and Disaster; Natural and Man-made Disasters: Difference, Nature, Types and Magnitude.

UNIT-II

Repercussions of Disasters and Hazards: Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem.

Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease and Epidemics, War and Conflicts.

UNIT-III

Disasters Prone Areas in India: Study of Seismic Zones; Areas Prone to Floods and Droughts, Landslides and Avalanches; Areas Proneto Cyclonic and Coastal Hazards with Special Reference to Tsunami; Post-Disaster Diseases and Epidemics

UNIT-IV

Disaster Preparedness: Monitoring of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk:

Application of Remote Sensing, Data from Meteorological and Other Agencies, Media Reports: Governmental and Community Preparedness.

UNIT-V

Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival. Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends in Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs of Disaster Mitigation in India.

Text Books:

1. Gupta A.K., Niar S.S and Chatterjee S. (2013) Disaster management and Risk Reduction, Role of Environmental Knowledge, Narosa Publishing House, Delhi.

2. Murthy D.B.N. (2012) Disaster Management, Deep and Deep Publication PVT. Ltd. New Delhi.

References:

1. Disaster Management Guidelines, GOI-UND Disaster Risk Program (2009-2012)

2. Damon, P. Copola, (2006) Introduction to International Disaster Management, Butterworth Heineman.

3. Modh S. (2010) Managing Natural Disasters, Mac Millan publishers India LTD.

4. Disasters in India Studies of grim reality, Anu Kapur & others, 2005, 283 pages, Rawat Publishers, Jaipur

5. Encyclopedia of disaster management, Vol I, II and IIIL Disaster management policy and administration, S L Goyal, Deep & Deep, New Delhi, 2006

Course Code	Course Title						Core/Elective
P24EN102	SANSKRIT FOR TECHNICAL KNOWLEDGE						Audit-I
Prerequisite	Contact Hours per Week				CI E	SEE	Credits
	L	T	D	P			
-	2	-	-	-	40	60	-

Course Objectives

The objectives of this course is to:

1. To get a working knowledge in illustrious Sanskrit, the scientific language in the world
2. To make the novice Learn the Sanskrit to develop the logic in mathematics, science & other subjects
3. To explore the huge knowledge from ancient Indian literature

Course Outcomes

At the end of this course, students will be able to**:**

1. Develop passion towards Sanskrit language
2. Decipher the latent engineering principles from Sanskrit literature
3. Correlates the technological concepts with the ancient Sanskrit history.
4. Develop knowledge for the technological progress
5. Explore the avenue for research in engineering with aid of Sanskrit

UNIT-I

Introduction to Sanskrit Language: Sanskrit Alphabets-vowels-consonants- significance of Amarakosa-parts of Speech-Morphology-creation of new words-significance of synonyms-sandhi-samasa-sutras-activeandpassiveVoice-Past/Present/FutureTense-Syntax-SimpleSentences(elementarytreatmentonly)

UNIT-II

Role of Sanskrit in Basic Sciences: Brahmagupta's lemmas (second degree indeterminate equations), sumof squares of n-terms of AP- sulba, sutram or baudhayana theorem (origination of Pythagoras theorem)-value of pie-Madhava's sine and cosine theory (origination of Taylor's series).The measurement system-time-mass-length-temp, Matter elasticity-optics- peedo flight (origination of Michaelson and Morley theory).

UNIT-III

Role of Sanskrit in Engineering-I (Civil, Mechanical, Electrical and Electronics Engineering): Buildingconstruction-soiltesting-mortar-townplanning-Machinedefinition-crucible-furnace-airblower-Generation of electricity in a cell-magnetism-Solar system-Sun: The source of energy, the earth-Pingala chanda sutram (origination of digital logic system)

UNIT-IV

RoleofSanskritinEngineering-II(ComputerScienceEngineering&InformationTechnology): Computer languages and the Sanskrit languages-computer command words and the Vedic command words-analogy of pramana in memamsa with operators in computer language-Sanskrit analogy of physical sequence and logical sequence, programming.

UNIT-V

Role of Sanskrit in Engineering-III (Bio-technology and Chemical Engineering): Classification of plants- plants, the living-plants have senses-classification of living creatures, Chemical laboratory location and layout- equipment-distillation vessel-kosthiyanthram.

Text Books:

1. A Higher Sanskrit Grammar: For the Use of School and College Students, M.R.Kale, Motilal Banarsi dass Publishers, 2015.

2. Pride of India, Samskrita Bharati Publisher, ISBN:81-8727627-4,2007.

References:

1. History of Classical Sanskrit Literature, M.Krishnamachariar,TTDPress,1937.

2. Language, Linguistics and Literature :The Indian Perspective, Kapail Kapoor, ISBN-10:8171880649,1994.

3. Vedas the source of ultimate science, Shri Rama Verma, Nag publishers, 2005.

4. Pride of India: A Glimpse Into India's Scientific Heritage, Samskrita Bharati, 2006

5. Vijaya Patham, B S Sarma, Pragnabharathi, 2020

Course Code	Course Title						Core/Elective
P24EN103	VALUE EDUCATION						Audit I
Prerequisite	Contact Hours per Week				CI E	SEE	Credits
	L	T	D	P			
-	2	-	-	-	40	60	-

Course Objectives

The objectives of this course is to:

1. Understand the need for and importance of Values for self-development and for National development.
2. Imbibe good human values and Morals
3. Cultivate individual and National character.

Course Outcomes

After completion of the course, students will be able to:

1. Gain necessary Knowledge for self-development
2. Learn the importance of Human values and their application in day-to-day professional life.
3. Appreciate the need for and importance of interpersonal skills for successful career and social life
4. Emphasizetheroleofpersonalandsocialresponsibilityofanindividualforall-roundgrowth.
5. Develop a perspective based on spiritual outlook and respect women, other religious practices, equality, non-violence and universal brotherhood.

UNIT-I

Human Values, Ethics and Morals: Concept of Values, Indian concept of humanism, human values; Values for self-development, social values, individual attitudes; Work ethics, moral and non-moral behaviour, standards and principles based on religion, culture and tradition.

UNIT-II

Value Cultivation, and Self-management: Need for and Importance of cultivation of values such as Sense-of Duty, Devotion to work, Self-reliance, Confidence, Concentration, Integrity &discipline, and Truthfulness.

UNIT-III

Spiritual outlook and social values: Personality and Behavior, Scientific attitude and Spiritual(soul)outlook; Cultivation of Social Values Such as Positive Thinking, Punctuality, Love & Kindness, avoiding fault finding in others, Reduction of anger, forgiveness, Dignity of labour, True friendship, Universal brother hood and religious tolerance.

UNIT-IV

Values in Holy Books: Self-management and good health; internal & external cleanliness, Holy books versus Blind faith, Character and Competence, Equality, Nonviolence, Humility, Role of Women.

UNIT-V

Dharma, Karma and Guna: Concept of soul; Science of Reincarnation, Character and Conduct, Concept of Dharma; Cause and Effect based Karma Theory; The qualities of Devine and Devilish; Satwic, Rajasic and Tamasic gunas.

Text Books:

1. Nagarazan. A Text Book on Professional Ethics and Human Values. New Age International limited Publishers, 2006.

2. Dr.Abdul kalam. My Journey-Transforming Dreams into Actions. Rupa Publications, 2013.

References:

1. Mani Jacob. Resource Book for Value Education. Institute of Value Education, 2002.
2. Eddie de Jong. Goal Setting for Success. CreateSpace Independent Publishing, 2014.
3. Warren G.Bennis. On Becoming a Leader. Basic Books, 2009.
4. Suresh Agarwal. Social Problems in India. Rajat Publications, 2015.
5. Biswaranjan Mohanty. Constitution, Government and Politics in India. New Century Publication, 2009.

Course Code	Course Title						Core/Elective
P24EN101	ENGLISH FOR RESEARCH PAPERWRITING						Audit-I
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
BASIC ENGLISH	2	-	-	-	40	60	-

Course Objectives

The objectives of this course is to:

1. Understand that how to improve your writing skills and level of readability
2. Understand the nuances of language and vocabulary in writing a Research Paper.
3. Develop the content, structure and format of writing a research paper.
4. Produce original research papers without plagiarism

Course Outcomes

After completing this course, the student will be able to:

1. Interpret the nuances of research paper writing.
2. Differentiate the research paper format and citation of sources.
3. To review the research papers and articles in a scientific manner.
4. Avoid plagiarism and be able to develop their writing skills in presenting the research work.
5. Create a research paper and acquire the knowledge of how and where to publish their original research papers.

UNIT-I

Academic Writing: Meaning & Definition of a research paper– Purpose of a research paper – Scope – Benefits, Limitations– outcomes.

UNIT-II

Research Paper Format: Title – Abstract – Introduction – Discussion – Findings, Conclusion – Style of Indentation– Font size/Font types– Indexing–Citation of sources.

UNIT-III

Research Methodology: Methods (Qualitative–Quantitative) Review of Literature. Criticizing, Paraphrasing& Plagiarism.

UNIT-IV

Process of Writing a research paper: Choosing a topic - Thesis Statement – Outline – Organizing notes - Language of Research – Word order, Paragraphs – Writing first draft –Revising/Editing - The final draft and proof reading.

UNIT-V

Research Paper Publication: Reputed Journals– National/International –ISSN No, No. of volumes, Scopus Index/UGC Journals – Free publications - Paid Journal publications – Advantages/Benefits

Presentation Skills: Developing Persuasive Presentations, Structure of Presentation, Presentation Slides, Presentation Delivery, role of the audience, what to search and cite, how to establish credibility.

Text Books:

1. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011
2. Goldbort R Writing for Science, Yale University Press (available on Google Books) 2006

References:

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

Audit Course-II

Course Code	Course Title						Core/Elective
P24EN201	Constitution Of India and Fundamental Rights						Audit II
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	2	-	-	-	40	60	-

Course Objectives

The objective of this course is to:

1. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective and to address the growth of Indian opinion regarding modern Indian intellectuals constitutional role and entitlement to civil and economic rights as well as the emergence of nation hood in the early years of Indian nationalism.

Course Outcomes

After completing this course, the student will be able to:

1. Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
2. Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
3. Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adults suffrage in the Indian Constitution.
4. DiscussthepassageoftheHinduCodeBillof1956.
5. Learn the importance of local administration.

UNIT-I

History of Making of the Indian Constitution: History, Drafting Committee, (Composition & Working) Philosophy of the Indian Constitution : Preamble, Salient Features.

UNIT-II

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

UNIT-III

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

UNIT-IV

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

UNIT-V

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

Text Books:

1. M.V.Pylee, "Introduction to the Constitution of India",4th Edition, Vikas publication,2005.

2. Durga Das Basu(DD Basu) , "Introduction to the constitution of India",(Student Edition),19th edition, Prentice-Hall EEE, 2008.

References:

1.J.N.Pandey, The Constitutional Law of India, Allahabad; Central Law Agency,(55th edn.) 2018.

2. Arora & Mukherji, Federalism in India, Origin and Developments, Vikas Publishing House, New Delhi, 1992.

3. K B Merunandan, Bharatada Samvidhana Ondu Parichaya, Bangalore, Meragu Publications, 2015.

4. K.Sharma, Introduction to the Constitution of India, Prentice Hall of India, NewDelhi, 2002.

5. P.M Bakshi, Constitution of India, Universal Law Publishing House, NewDelhi, 1999.

Course Code	Course Title						Core/Elective
P24EN202	Pedagogy Studies						Audit II
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	2	-	-	-	40	60	-

Course Objectives

The objective of this course is to:

1. To present the basic concepts of design and policies of pedagogy studies.
2. To provide understanding of the abilities and dispositions with regard to teaching techniques, curriculum design and assessment practices.
3. To familiarize various theories of learning and their connection to teaching practice.
4. To create awareness about the practices followed by DFID, other agencies and other researchers.
5. To provide understanding of critical evidence gaps that guides the professional development

Course Outcomes

After completing this course, the student will be able to:

1. Illustrate the pedagogical practices followed by teachers in developing countries both in formal and informal classrooms.
2. Examine the effectiveness of pedagogical practices.
3. Understand the concept, characteristics and types of educational research and perspectives of research.
4. Describe the role of classroom practices, curriculum and barriers to learning.
5. Understand Research gaps and learn the future directions.

UNIT-I

Introduction and Methodology: Aims and rationale, Policy background, Conceptual framework and terminology-Theories of learning, Curriculum, Teacher education-Conceptual framework, Research questions, Overview of methodology and Searching.

UNIT-II

Thematic Overview: Pedagogical practices followed by teachers in formal and informal classrooms in developing countries- Curriculum, Teacher education

UNIT-III

Evidence on the Effectiveness of Pedagogical Practices: Methodology for the in depth stage: quality assessment of included studies - How can teacher education (curriculum and Practicum) and the school curriculum and guidance material best support effective pedagogy? - Theory of change - Strength and nature of the body of evidence for effective pedagogical practices - Pedagogic theory and pedagogical approaches –Teachers attitudes and beliefs and pedagogic strategies.

UNIT-IV

Professional Development: alignment with classroom practices and follow up support - Support from the head teacher and the community – Curriculum and assessment - Barriers to learning: Limited resources and large class sizes.

UNIT-V

Research Gaps and Future Directions: Research design – Contexts – Pedagogy - Teacher education - Curriculum and assessment– Dissemination and research impact.

Text Books:

1. Batra, P. (Ed.) (2010). Social Science Learning in Schools: Perspective and Challenges. New Delhi: Sage.

2. Bruner, J. (1996). In The Culture of Education. Cambridge: Harvard University Press, 2: Folk Pedagogy, 44-65.

References:

1. Classroom Interaction in Kenyan Primary Schools, Ackers J, Hardman F,Compare‖, 31 (2): 245 – 261, 2001.

2. Curricular Reform in Schools: The importance of evaluation, Journal of CurriculumStudies,Agarwal M, 36 (3):361 – 379,2004.

3. Dewey, J. (1897). My Pedagogic Creed. School Journal, Vol. 54.

4. Driver, R. (1981). Pupils' Alternative Frameworks in Science. European Journal of Science Education. 3(1), 93-101.

5. Holt, J. (1990). Learning All the Time. New York: Addison-Wesley Publishing Co.

Course Code	Course Title						Core/Elective
P24EN203	STRESS MANAGEMENT BY YOGA						Audit II
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	2	-	-	-	40	60	-

Course Objectives

The objective of this course is to:

1. Creating awareness about different types of stress and the role of yoga in the management of stress.
2. Promotion of positive health and overall wellbeing (Physical, mental, emotional, social and spiritual).
3. Prevention of stress related health problems by yoga practice.

Course Outcomes

After completing the course, the students will be able to:

1. Understand yoga and its benefits.
2. Enhance Physical strength and flexibility.
3. Learn to relax and focus.
4. Relieve physical and mental tension through asanas.
5. Improve work performance and efficiency.

UNIT-I

Meaning and Definition of Yoga – Historical perspective of Yoga-Principles of Astanga Yoga by Patanjali.

UNIT-II

Meaning and Definition of Stress-Types of stress-Eustress and Distress. Anticipatory Anxiety and Intense Anxiety and depression. Meaning of Management- Stress Management.

UNIT-III

Concept of Stress According to Yoga-Stress assessment methods-Role of Asana, Pranayama and Meditation in the management of stress

UNIT- IV

Asanas-(5Asanasineachposture)-Warmup-StandingAsanas-SittingAsanas-ProneAsanas-Supineasanas-Surya Namaskar.

UNIT-V

Pranayama-Anulomand Vilom Pranayama-Nadishudhi Pranayama-Kapalabhati Pranayama-Bhramari Pranayama-Nadanusandhana Pranayama.

Meditation Techniques: Om Meditation-Cyclic meditation: Instant Relaxation technique (QRT), Quick Relaxation Technique (QRT), Deep Relaxation Technique (DRT)

Text Books:

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

2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, AdvaitaAshrama (Publication Department), Kolkata

References:

1. Andrews, Linda Wasmer., (2005). Stress Control for peace of Mind. London: Greenwich Editions

2. Lalvani, Vimla., (1998). Yoga for stress. London: Hamlyn Nagendra, H.R., and Nagarathana, R., (2004). Yoga perspective in stress management. Bangalore: Swami Vivekananda Yoga Prakashana.

3. Nagendra, H.R., and Nagarathana, R., (2004). Yoga practices for anxiety & depression. Bangalore: Swami Sukhabodhanandha Yoga Prakashana.

4. Sukhabodhanandha, Swami., (2002). Stress Management. Banglore: Prasanna trust.

5. Udupa, K.N., (1996). Stress management by Yoga. NewDelhi: Motilal Banaridass Publishers Private Limited.

Course Code	Course Title						Core/Elective
P24EN204	PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS						Audit II
Prerequisite	Contact Hours per Week				CI E	SEE	Credits
	L	T	D	P			
-	2	-	-	-	40	60	-

Course Objectives

The objective of this course is to:

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

Course Outcomes

At completing this course, students will be able to**:**

1. Develop their personality and achieve their highest goal of life.
2. Lead the nation and mankind to peace and prosperity.
3. Practice emotional self-regulation.
4. Develop a positive approach to work and duties.
5. Develop a versatile personality.

UNIT-I

Neetisatakam – Holistic Development of Personality - Verses 19, 20, 21, 22 (Wisdom) - Verses 29, 31, 32(Pride and Heroism) -Verses 26,28,63,65(Virtue)

UNIT-II

Neetisatakam – Holistic Development of Personality (cont'd) - Verses 52, 53, 59 (don'ts) - Verses71,73,75& 78 (do's) -Approach to day to day works and duties.

UNIT-III

Introduction to Bhagavadgeetha for Personality Development - Shrimad Bhagavadgeetha: Chapter 2 –Verses41,47,48-Chapter3–Verses13,21,27,35-Chapter6–Verses5,13,17,23,35-Chapter18–Verses 45,46,48Chapter–6:Verses5,13,17,23,35;Chapter–18:Verses45,46,48

UNIT- IV

Statements of Basic Knowledge - Shrimad Bhagavadgeetha: Chapter 2- Verses 56, 62,68 - Chapter 12 – Verses13,14, 15,16,17,18 -Personality of Role model from Shrimad Bhagawat Geeta.

UNIT-V

Role of Bhagavad geetha in the Present Scenario - Chapter 2 – Verses 17 - Chapter 3 – Verses 36, 37, 42 -Chapter 4– Verses18, 38,39 -Chapter18 –Verses37, 38, 63.

Text Books:

1. Pravesh Kumar. All about Self- Motivation. New Delhi. Goodwill Publishing House. 2005.

2. Smith, B . Body Language. Delhi: Rohan Book Company. 2004

References:

1. Andrews, Sudhir. How to Succeed at Interviews. 21st (rep.) New Delhi.Tata McGraw-Hill 1988.

2. Heller, Robert.Effective leadership. Essential Manager series. Dk Publishing, 2002

3. Hindle, Tim. Reducing Stress. Essential Manager series. Dk Publishing, 2003

4. Lucas, Stephen. Art of Public Speaking. New Delhi. Tata - Mc-Graw Hill. 2001

5. Mile, D.J Power of positive thinking. Delhi. Rohan Book Company, (2004).

P24SE3P1 **DISSERTATION-I**

Instruction:3 periods per week Duration of SEE: --
CIE:100mark SEE:--
Credits:10

Objectives:

1. Identification of the research problem
2. Discussion of literature survey.

Outcomes:

1. Identification of the objectives of the Research Problem.
2. Ability to update the latest literature in chosen area of research & establishment of the scope of work.
3. Development of the methodology for the chosen research problem and perform basic theoretical /Experiment studies.

Each student will be attached to a faculty member/guide for project. The student will carry out the project which may be development of Software / Hardware / Simulation studies / Design analysis /Experimental related to his/her specialization. The work will be monitored regularly by the guide. At the end of the semester student will write the report on the work done and submit to the guide. Student has to present his/her work before two faculty members (one guide and other to be appointed by chairman BOS) on a fixed day during last week of the semester in which project is offered. The sessional marks will be awarded jointly by these examiners based on the report, presentation and viva voice.

LORDS INSTITUTE OF ENGINEERING AND TECHNOLOGY
(An Autonomous Institution)
DEPARTMENT OF CIVIL ENGINEERING
SCHEME OF INSTRUCTIONS &EXAMINATIONS [LR-24]
(w.e.f. Academic Year Tentative 2025 – 26)
M.E. (Civil Engineering) IV – Semester
Specialization in Structural Engineering

S.No.	Course Code	Category	Course Title	Scheme of Instructions				Scheme of Examination			Credits
				L	T	P/D	Contact Hours/Week	Maximum Marks		Duration in Hours	
								CIE	SEE		
Project											
1	P24SE4P1	PROJ	Dissertation–II	-	-	32	32	50	150	-	16
Total				**-**	**-**	**32**	**32**	**50**	**150**	**-**	**16**

L: Lecture (Hrs/Wk/Sem) **T**:Tutorial(Hrs/Wk/Sem)**P:**Practical **D**:Drawing(Hrs/Wk/Sem)

CIE: Continuous Internal Evaluation **SEE**: Semester End Examination
PROJ: Project **SE:** Structural Engineering

Note:
1. Each contact hours a Clock Hour.
2. Thepractical class can be of three (clock hours) duration as per the requirement of a Particular Laboratory.

P24SE4P1 **DISSERTATION-II**

Instruction:32 periods per week Duration of SEE: --
CIE: -- 50 SEE:-- 150 marks
Credits:16

Objectives:

1. Identification of the research problem
2. Discussion of literature survey.

Outcomes:

1. Expand the defined Research Problem for the dissertation work.
2. Conduct of Laboratory/analytical/software studies
3. Analysis of Data, development of models, offer solutions to the research problem and provide conclusions of the work.

The student will carry out the project under allotted supervisor, which may be development of Software / Hardware / Simulation studies / Design analysis / Experimental related to his/her specialization. The work will be monitored regularly by the guide. At the end of the semester student will write the report on the work done and submit to the guide. Student has to present his/her work before two faculty members (one guide and other to be appointed by chairman BOS) on a fixed day during last week of the semester in which project is offered. The final marks will be allotted based on the report, presentation and viva voce conducted by the external examiner whose name is suggested by Chairman BOS.