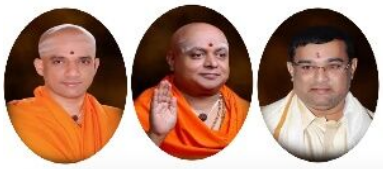

|| Jai Sri Gurudev ||

Sri Adichunchanagiri Shikshana Trust (R)

SJB Institute of Technology

An AUTONOMOUS INSTITUTION UNDER VISVESVARAYA TECHNOLOGICAL UNIVERSITY

Approved by AICTE, 2(f) and 12(B) recognized by UGC, New Delhi
Accredited by NAAC, Accredited by NBA, Certified by ISO 9001 - 2015

PG Autonomous Scheme & Syllabus

Programme: M.Tech

Civil Engineering - Structural Engineering

SCHEME 2023

I to IV Semester

SERVICE TO MANKIND IS SERVICE TO GOD

His Divine Soul Padmabhushana

Sri Sri Sri Dr. Balagangadharanath MahaSwamiji

Founder President, Sri Adichunchanagiri Shikshana Trust®

Belief in God is not ignorance or illusion. It is a belief that there is an unseen, ineffable Power that transcends all our

His Holiness Parama Pujya

Sri Sri Sri Dr. Nirmalanandanatha MahaSwamiji

President, Sri Adichunchanagiri Shikshana Trust ®

True richness is the generosity of heart. Cultivate it and work to help the less fortunate ones in life.

Revered Sri Sri Dr. Prakashanatha Swamiji

Managing Director, BGS & SJB Group of Institutions & Hospitals

People and prosperity follow the path which the leaders take. So, the elders and leaders should make sure that they give the right lead and take.

Syllabus Book for MTech Structural Engineering

Syllabus for 1st to 4th Semester

The syllabus, scheme and guidelines are provided in detail.
The syllabus, scheme and guidelines are subjected to changes if any needed.
The updates will be done and intimated timely.

The Syllabus book is available on	www.sjbit.edu.in
For any queries, please write to	academicdean@sjbit.edu.in

UPDATES

Release / Revision	Date	Remarks
Release	06/02/2024	First uploading, Version 1
Version 2	15/03/2024	Correction of Teaching hours per week
Version 3	05/04/2024	CIE and SEE guidelines modified

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Sri Adichunchanagiri Shikshana Trust (R)

SJB Institute of Technology

BGS Health and Education City, Dr. Vishnuvardhana Road, Kengeri, Bengaluru-560060
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Autonomous Institute affiliated to Visvesvaraya Technological University, Belagavi
Accredited by NAAC with 'A+'grade, Certified by ISO 9001 - 2015
Recognized by UGC, New Delhi with 2(f) & 12 (B)

AUTONOMOUS SCHEME - MTech Structural Engineering First Year CSE

SCHEME: 2023 **Aca. Year.: 2023-24**

SL No	Course Type	Course type series	Course Code	Course Title	Teaching Dept.	QP setting dept	Credits	Teaching Hrs/Week				Examinations				
								L	T	P	S	CIE Marks	SEE			Tot. Marks
								Lecture	Tutorial	Practical	PBL/ABL/ SL/Othrs.		Dur.	Th. Mrks	Lab. Mrks.	
SEM: I																
1	BSC	1	23CSET11	Optimization Techniques	CV	CV	**3**	3	0	0		50	3	50	-	100
2	IPCC	2	23CSEI12	Advanced Design of RC Structures	CV	CV	**4**	3	0	2		50	3	50	-	100
3	PCC	3	23CSET13	Matrix methods of Structural Analysis	CV	CV	**3**	3	0	0		50	3	50	-	100
4	PCC	4	23CSET14	Mechanics of Deformable Bodies	CV	CV	**3**	3	0	0		50	3	50	-	100
5	PCC	5	23CSET15	Structural Dynamics	CV	CV	**3**	3	0	0	2	50	3	50	-	100
6	PCC	6	23CSET16	Research Methodology and IPR	CV	CV	**3**	3	0	0		50	3	50	-	100
7	PCCL	7	23CSEL17	Structural Engineering Lab	CV	CV	**2**	1	0	2		50	3	-	50	100
						SEM-I Total	**21**	**19**	**0**	**4**	**2**	**350**		**300**	**50**	**700**
SEM: II																
1	PCC	1	23CSET21	Advanced Design of Steel Structures	CV	CV	**3**	3	0	0	2	50	3	50	-	100
2	IPCC	2	23CSEI22	Finite Element Method of Analysis	CV	CV	**4**	3	0	2		50	3	50	-	100
3	PEC	3	23CSEP21x	Professional elective 1	CV	CV	**3**	3	0	0		50	3	50	-	100
4	PEC	4	23CSEP22x	Professional elective 2	CV	CV	**3**	3	0	0		50	3	50	-	100
5	PRJ	5	23CSEPR25	Mini Project with Seminar	CV	CV	**4**	0	0	0	@PBL	50	3	50	-	100
6	PCCL	6	23CSEL26	Advanced Computation Laboratory	CV	CV	**2**	1	0	2		50	3	-	50	100
						SEM-II Total	**19**	**13**	**0**	**4**	**2**	**300**		**250**	**50**	**600**
						FIRST YEAR TOTAL	**40**									

BSC: Basic science course,PCC: Professional core. IPCC-Integrated Professional Core Courses, PCCL-Professional Core Course lab, PEC: Professional elective course,PRJ:Project,INT:Internship(G),SLC: Self learning course,L-Lecture, P-Practical, T/SDA-Tutorial / Skill Development Activities(Hours are for Interaction between faculty and students)

PEC-1		PEC- 2	
Course Code	**Course Title**	**Course Code**	**Course Title**
23CSEP211	Theory of Plates and Shells	23CSEP221	Stability of Structures
23CSEP212	Design of Precast & Composite Structures	23CSEP222	Design of High-Rise Structures
23CSEP213	Earthquake resistant Structures	23CSEP223	Design of Masonry Structures
23CSEP214	Advanced structural analysis	23CSEP224	Reliability Analysis of Structures

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AUTONOMOUS SCHEME - MTech Structural Engineering Second Year CSE

SCHEME: 2023 **Aca. Year.: 2024-25**

SL No	Course Type	Course type series	Course Code	Course Title	Teaching Dept.	QP setting dept	Credits	Teaching Hrs/Week				Examinations				
								L	T	P	S	CIE Marks	SEE			Tot. Marks
								Lecture	Tutorial	Practical	PBL/ABL/ SL/othrs.		Dur.	Th. Mrks	Lab. Mrks.	
SEM: III																
1	PCC	1	23CSET31	Design of Bridges	CV	CV	**4**	3	2	0		50	3	50	-	100
2	PEC	2	23CSEP33X	Professional elective 3	CV	CV	**3**	3	0	0		50	3	50	-	100
3	PEC	3	23CSEP34X	Professional elective 4	CV	CV	**3**	3	0	0		50	3	50	-	100
4	PRJ	4	23CSEPR34	Project Work phase 1	CV	CV	**3**	0	0	0	@PBL	50	3	50	-	100
5	PRJ	5	23CSEPR35	Societal Project	CV	CV	**3**	0	0	0	6	50	3	50	-	100
6	INT	6	23CSEG36	Internship			**6**	(06 weeks between II and III semesters.)				50	3	-	50	100
						SEM-I Total	**22**	**9**	**2**	**0**	**6**	**300**		**250**	**50**	**600**

PEC-3		PEC-4	
Course Code	**Course Title**	**Course Code**	**Course Title**
23CSEP331	Design Concepts of Substructures	23CSEP341	Special Concrete
23CSEP332	Composite materials	23CSEP342	Prefabricated Structures
23CSEP333	Design of Industrial Structures	23CSEP343	Fracture Mechanics
23CSEP334	Structural Health Monitoring	23CSEP344	Repair and Rehabilitation of Structures

SEM: IV																
1	PRJ	2	23CSEPR41	Project work phase 2			18	-	-	-	@PBL	100	03	-	100	200
2	SLC	1	23CSES1y	Self learning course - 1	NPTEL	NPTEL	**PP/NP**	0	0	0						
3	SLC	2	23CSES2y	Self learning course - 2	NPTEL	NPTEL	**PP/NP**	0	0	0						
						SEM-II Total	**18**	**-**	**-**			**100**			**100**	**200**
						SECOND YEAR TOTAL	**40**									

BSC: Basic science course,PCC: Professional core. IPCC-Integrated Professional Core Courses, PCCL-Professional Core Course lab, PEC: Professional elective course,PRJ:Project,INT:Internship(G),SLC: Self learning course,L-Lecture, P-Practical, T/SDA-Tutorial / Skill Development Activities(Hours are for Interaction between faculty and students)

Table content

Semester:	I	**Course Type:**	**BSC**		
Course Title: OPTIMIZATION TECHNIQUES					
Course Code:	23CSET11			**Credits:**	3
Teaching Hours/Week (L:T:P:O)			3:0:0:0	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	**Theory**			**Exam Hours:**	3 hours

I. Course Objectives:

Learn the need and concepts of design optimization.
Implement optimization concepts in structural engineering problems.
Evaluate different methods of optimization.

II. Teaching-Learning Process (General Instructions):

Chalk and Talk using writing boards, PPT and videos.

III. COURSE CONTENT

Module-1:	8 hours

Introduction to optimization: Engineering applications of optimization, Formulation of structural optimization problems as programming problems. Optimization Techniques: Classical optimization techniques, single variable optimization, multivariable optimization with no constraints, unconstrained minimization techniques and algorithms constrained optimization solutions by penalty function techniques, Lagrange multipliers techniques and feasibility techniques.

RBT Levels: L1, L2, L3

Module-2:	8 hours

Linear Programming: Introduction, standard form of linear programming, geometry of linear programming problems, solution of a system of linear simultaneous equations, pivotal production of general systems of equations, simplex algorithms, revised simpler methods, duality in linear programming.

RBT Levels: L1, L2, L3

Module-3:	8 hours

Non-linear programming: Introduction, one dimensional minimization methods, elimination methods, Fibonacci method, golden section method, interpolation methods, quadratic and cubic methods, Unconstrained optimization methods, direct search methods, random search methods, descent methods

RBT Levels: L1, L2, L3

Module-4:	8 hours

Constrained optimization techniques such as direct methods, the complex methods, cutting plane method, exterior penalty function methods for structural engineering problems. Formulation and solution of structural optimization problems by different technique

RBT Levels: L1, L2, L3

Module-5:	8 hours

Geometric programming & Dynamic programming: conversion of NLP as a sequence of LP / geometric programming. Dynamic programming: Dynamic programming conversion of NLP as a sequence of LP/ Dynamic programming**.**

RBT Levels: L1, L2, L3

IV. COURSE OUTCOMES

CO1	Formulate structural optimization problems.
CO2	Carry out linear programming by solving a system of linear simultaneous equations.
CO3	Apply different non-linear programming methods
CO4	Apply constrained optimization techniques for structural engineering problems.
CO5	Undertake geometric and dynamic programming techniques to structural engg. problems.

V. CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1	2	2	2										2			
CO2	2	2	2										2			
CO3	2	2	2										2			
CO4	2	2	2										2			

VI. Assessment Details (CIE & SEE)

General Rules: Refer Annexure Section 1

Continuous Internal Evaluation (CIE): Refer Annexure Section 1

Semester End Examination (SEE): Refer Annexure Section 1

VII. Learning Resources

Reference Books:

1	Optimum Structural Design	Spunt L	1971	Prentice Hall
2	Optimization – Theory and Practice	Rao S. S.	1978	Wiley Eastern Ltd
3	Optimum Structural Design,	Uri Kirsch	1981	McGraw Hill, New York
4	Operation Research	Bronson R. and, Govind sami N	2017	Schaum's Outline Series
5	Structural optimization using sequential linear programming	Bhavikatti S. S	2003	Vikas publishing

VII(c): Web links and Video Lectures (e-Resources):

https://www.youtube.com/watch?v=wEdZLKMMZ8o&list=PLwdnzlV3ogoXKKb9nABDWYltTDgi37lYD

https://www.youtube.com/watch?v=GMTvoKRfxQw&list=PLGbjwqYC00hsy6XGalOBAphm2tdeLbgK0

https://www.youtube.com/watch?v=fszNBvdfKrY

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

Conduction of technical seminars on recent research activities

Group Discussion

Semester:	I	**Course Type:**	IPCC		
Course Title: ADVANCED DESIGN OF RC STRUCTURES					
Course Code:	23CSEI12			**Credits:**	4
Teaching Hours/Week (L:T:P:O)			3:0:2:0	**Total Hours:**	40+ Practical sessions
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	**Theory**			**Exam Hours:**	3 hours

I. Course Objectives:

The objective of this course is to make students to learn principles of Structural Design, to design different types of structures and to detail the structures. To evaluate performance of the structures

II. Teaching-Learning Process (General Instructions):

Chalk and Talk using writing boards, PPT and videos.

III. COURSE CONTENT

Module-1: 8 hours

- Design of R C slabs by yield line method
- Design of flat slabs

RBT Levels: L1, L2, L3, L4, L5

Module-2: 8 hours

- Design of grid or coffered floors
- Design of continuous beams with redistribution of moments

Lab Experiment: **RBT Levels: L1, L2, L3, L4, L5**

Module-3: 8 hours

- Design of R C Chimneys

Lab Experiment: Excel programming to compute Chimneys.

RBT Levels: L1, L2, L3, L4, L5

Module-4: 8 hours

- Design of R C silos
- Design of R C bunkers

Lab Experiment: Excel programming to Compute Bunkers and Silos

RBT Levels: L1, L2, L3, L4, L5

Module-5: 8 hours

Introduction, Requirements of good formwork, Materials for forms, choice of formwork, Loads on formwork, Permissible stresses for timber, Design of formwork, Shuttering for columns, Shuttering for slabs and beams, Erection of Formwork, Action prior to and during concreting, Striking of forms. Recent developments in form work.

RBT Levels: L1, L2, L3, L4, L5

III(b). PRACTICAL PART

SL NO	Experiments / Programs / Problems (insert rows as many required)
1	Excel programming to compute Concrete Mix Design, Excel programming to simple Flat Slab
2	Excel programming to compute continuous beam, Excel programming to compute coffered floor
3	Excel programming to compute Chimneys.
4	Excel programming to Compute Bunkers and Silos.

IV.COURSE OUTCOMES

CO1	Achieve Knowledge of design and development of problem-solving skills
CO2	Understand the principles of Structural Design.
CO3	Design and develop analytical skills.
CO4	Summarize the principles of Structural Design and detailing
CO5	Understand the structural performance.

V.CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1	2	2	2				2					1	2			
CO2	2	2	2				2					1	2			
CO3	2	2	2									1	2			
CO4	2	2	2									1	2			
CO5	2	2	2									1				

VI. Assessment Details (CIE & SEE)

General Rules: Refer Annexure Section 2

Continuous Internal Evaluation (CIE): Refer Annexure Section 2

Semester End Examination (SEE): Refer Annexure Section 2

VII. Learning Resources

VII (a). Reference Books:

1	Krishna Raju	Advanced R.C. Design	1986	CBS Publishers and Distributors
2	S. Pillai, Devdas Menon	Reinforced Concrete Design	1999	Tata McGraw-Hill, 3rd Edition
3	Varghese. P.C	Advanced Reinforced Concrete design	2007	Prentice, Hall of India
4	Gambhir M. L	Design of Reinforced Concrete Structures	2008	, PHI Pvt. Ltd. New Delhi

VII(b): Web links and Video Lectures (e-Resources):

https://youtu.be/undsd92MM8w?si=kKmYkPb9TeAYtdaS
https://youtu.be/ba3mZhOpsTM?si=lwd8EK2NKPv-qvdJ
https://youtu.be/uyuPmBGX32g?si=w-mRZEOJNm5cz8c3

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

Conduction of technical seminars on recent research activities
Group Discussion
Site visit

Semester:	**I**	**Course Type:**	PCC		
Course Title: Matrix Methods of Structural Analysis					
Course Code:	23CSET13			**Credits:**	3
Teaching Hours/Week (L:T:P:O)			3:0:0:0	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	3 Hours

I. Course Objectives:

- To understand basic concepts of Matrix Methods of Structural Analysis.
- To analyse the behaviour of plane trusses, continuous beams, and portal frames.

II.Teaching-Learning Process (General Instructions):

- Blackboard Teaching
- Power Point Presentation
- Group Discussion
- Videos

III.COURSE CONTENT

Module-1 — **8 Hours**

Basic concepts of structural analysis and methods of solving simultaneous equations: Introduction, Types of framed structures, Static and Kinematic Indeterminacy, Equilibrium equations, Compatibility conditions, Principle of superposition, Energy principles, Equivalent joint loads, Methods of solving linear simultaneous equations- Gauss elimination method, Cholesky method and Gauss-Seidel method.

RBT Levels: L1, L2, L3

Module-2 — **8 Hours**

Fundamentals of Flexibility and Stiffness Methods: Concepts of stiffness and flexibility, Local and Global coordinates, Development of element flexibility and element stiffness matrices for truss, beam and grid elements, Force-transformation matrix, Development of global flexibility matrix for continuous beams, plane trusses and rigid plane frames, Displacement-transformation matrix, Development of global stiffness matrix for continuous beams, plane trusses and rigid plane frames.

RBT Levels: L1, L2, L3

Module-3 — **8 Hours**

Analysis using Flexibility Method: Analysis of continuous beams, plane trusses and rigid plane frames by Force Transformation Method.

RBT Levels: L2, L3, L4

Module-4	**8 Hours**

Analysis using Stiffness Method: Analysis of continuous beams, plane trusses and rigid plane frames by Displacement Transformation Method.

RBT Levels: L2, L3, L4

Module-5	**8 Hours**

Direct Stiffness Method: Stiffness matrix for truss element in local and global coordinates, Analysis of plane trusses, Stiffness matrix for beam element, Analysis of continuous beams and orthogonal frames.

RBT Levels: L2, L3, L4

IV.COURSE OUTCOMES

CO1	Formulate force displacement relation by flexibility and stiffness method
CO2	Analyze the plane trusses, continuous beams and portal frames transformation approach
CO3	Analyse the structures by direct stiffness method

V.CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2
CO1	3	3											1	
CO2	3	3											1	
CO3	3	3											1	

VI. Assessment Details (CIE & SEE)

Continuous Internal Evaluation (CIE): Refer Annexure Section 1

Semester End Examination (SEE): Refer Annexure Section 1

VIII. Learning Resources

VII(a): Reference Books:

1	Matrix Analysis of Framed Structures	Weaver, W., and Gere, J.M	Second Edition, 2004	CBS Publishers and distributors Pvt. Ltd.
2	Computational Structural Mechanics	Rajasekaran, S., and Sankarasubramanian, G.	First Edition, 2001	PHI, New Delhi
3	Introduction to Matrix Methods of Structural Analysis	Martin, H, C	First Edition, 1966	McGraw-Hill, New York
4	Matrix Computer Analysis of Structures	Rubinstein, M.F.	First Edition, 1966	Prentice-Hall, Englewood Cliffs, New Jersey,

VII(b): Web links and Video Lectures (e-Resources):

https://www.youtube.com/watch?v=Wa9ZSWlrpnk&list=PLbRMhDVUMngeZatm4MIOKG4sHxXuB_yri
https://www.youtube.com/watch?v=oMSoFeCZL5k&list=PL8pjaLEv3XhmeAp8aEWfp7t2bf2Nh2dYy

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

- Conduction of technical seminars on recent research activities
- Group Discussion

Semester:	I	**Course Type:**	PCC		
Course Title: Mechanics of Deformable Bodies					
Course Code:	23CSET14			**Credits:**	3
Teaching Hours/Week (L:T:P:O)			3:0:0:0	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	3 Hours

I. Course Objectives:

The objective of this course is to make students to learn principles of Analysis of Stress and Strain, To predict the stress-strain behaviour of continuum. To evaluate the stress and strain parameters and their inter relations of the continuum

II. Teaching-Learning Process (General Instructions):

- Blackboard Teaching
- Power Point Presentation
- Group Discussion
- Videos

III. COURSE CONTENT

III(a). Theory PART

Module-1: (Mention title)	8 Hours

Theory of Elasticity: Introduction: Definition of stress and strain and strain at a point, components of stress and strain at appoint of Cartesian and polar coordinates. Constitutive relations, equilibrium equations, compatibility equations and boundary conditions in 2-D and 3-D cases.

RBT Levels: L1, L2, L3

Module-2:	8 Hours

Transformation of stress and strain at a point, Principal stresses and principal strains, invariants of stress and strain, hydrostatic and deviatric stress, spherical and deviatric strains max. Shear strain.

RBT Levels: : L1, L2, L3

Module-3:	8 Hours

Plane stress and plane strain: Airy's stress function approach to 2-D problems of elasticity, simple problems of bending of beams. Solution of axisymmetric problems, stress concentration due to the presence of a circular hole in plates.

RBT Levels: : L1, L2, L3

Module-4:	8 Hours

Elementary problems of elasticity in three dimensions, stretching of a prismatic bar by its own weight, twist of circular shafts, torsion of non-circular sections, membrane analogy, Propagation of waves in solid media. Applications of finite difference equations in elasticity.

RBT Levels: : L1, L2, L3

Module-5:	8 Hours

Theory of Plasticity: Stress – strain diagram in simple tension, perfectly elastic, Rigid – Perfectly plastic, Linear work – hardening, Elastic Perfectly plastic, Elastic Linear work hardening materials, Failure theories, yield conditions, stress – space representation of yield criteria through Westergard stress space, Tresca and Von-Mises criteria of yielding.

RBT Levels: : L1, L2, L3

IV. COURSE OUTCOMES

On completion of this course, students will be able to:

CO1	Achieve Knowledge of design and development of problem solving skills.
CO2	Understand the principles of stress-strain behaviour of continuum
CO3	Design and develop analytical skills.
CO4	Describe the continuum in 2 and 3- dimensions
CO5	Understand the concepts of elasticity and plasticity

V. CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1	3	2									1					
CO2	3	2	1							1	2					
CO3	3	3	2	1						2	2					
CO4	3	2	1							2	2					
CO5	2	2								2	2					

VI. Assessment Details (CIE & SEE)

General Rules: Refer Annexure Section 1

Continuous Internal Evaluation (CIE): Refer Annexure Section 1

Semester End Examination (SEE): Refer Annexure Section 1

VII. Learning Resources

VII(a): Textbooks: (Insert or delete rows as per requirement)

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1	Theory of elasticity	Timoshenko and Goodier	III Edition, 1983	McGraw Hill Book Company
2	Theory of Elasticity	Sadhu Singh	1981	Khanna Publishers
3	Advanced Mechanics of solids	Srinath L. S.,	10th Print 1994	Tata McGraw Hill Publishing Co.

VII(b): Reference Books: (Insert or delete rows as per requirement)

1	Theory of Elasticity	Verma P. D. S	1997	Khanna Publishers
2	Continuum Mechanics fundamentals	Valliappan. S,	1981	Oxford and IBH

VII(c): Web links and Video Lectures (e-Resources):
https://youtu.be/KzFFvIsx3mw?si=A0GE1axB7NBCYgaK https://youtu.be/L2kDK8F1vzo?si=6r3xHx-QFmaRp183 https://youtu.be/DzyIEz3dKXQ?si=_lYSgDh1CgFLMJhU https://youtu.be/RBZqVPTL4Ps?si=dkylBKu8UNQoPXdH
VIII: Activity Based Learning / Practical Based Learning/Experiential learning:
Seminar, Assignments, Quiz

Semester:	I	**Course Type:**	PCC		
Course Title: STRUCTURAL DYNAMICS					
Course Code:	23CSET15			**Credits:**	3
Teaching Hours/Week (L:T:P:O)			**3:0:0:2**	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	**Theory**			**Exam Hours:**	3 Hours

I. Course Objectives:

1. The objective of this course is to make students to learn principles of Structural Dynamics.
2. To implement these principles through different methods and to apply the same for free and forced vibration of structures.
3. To evaluate the dynamic characteristics of the structures.

II. Teaching-Learning Process (General Instructions):

Chalk and Talk using writing boards, PPT and videos.

III.COURSE CONTENT

Module-1:	8 Hours

Introduction: Introduction to dynamic problems of Civil Engineering, Concept of degrees of freedom, D'Alemberts principle, Principle of virtual displacement and energy, Single degree of freedom systems, Examples of Single degree of freedom systems in Engineering, Free vibration of damped and undamped systems.

RBT Levels: L1, L2, L3

Module-2:	8 Hours

Single degree of freedom systems:

Response of Single-degree-of-freedom systems to harmonic loading including support motion, vibration isolation, transmissibility. Numerical methods applied to Single-degree-of-freedom systems – Duhamel integral. Principle of vibration measuring instruments– seismometer and accelerometer.

RBT Levels: L1, L2, L3, L4

Module-3:	8 Hours

Dynamics of multi-Degree of freedom system:

Dynamics of Multi-degree freedom systems: Mathematical models of multi-degree-of-freedom systems, Shear building concept, free vibration of undamped multi-degree-offreedom systems – Natural frequencies and mode shapes – Orthogonality of modes.

RBT Levels: L1, L2, L3, L4

Module-4:	8 Hours

Response of shear building:
Response of Shear buildings for harmonic loading without damping using normal mode approach. Response of Shear buildings for forced vibration for harmonic loading with damping using normal mode approach.
RBT Levels: L1, L2, L3, L4

Module-5:	8 Hours

Approximate methods: Rayleigh's method, Dunkarley's method, Stodola's method.

Dynamics of Continuous systems: Flexural vibration of beams with different end conditions.

RBT Levels: L1, L2, L3, L4

IV.COURSE OUTCOMES

CO1	Achieve Knowledge of design and development of problem-solving skills.
CO2	Understand the principles of Structural Dynamics.
CO3	Design and develop analytical skills.
CO4	Summarize the Solution techniques for dynamics of Multi-degree freedom systems
CO5	Understand the concepts of damping in structures.

V.CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1																
CO2																
CO3																
CO4																

VI.Assessment Details (CIE & SEE)

General Rules: Refer Annexure Section 1

Continuous Internal Evaluation (CIE): Refer Annexure Section 1

Semester End Examination (SEE): Refer Annexure Section 1

VII. Learning Resources

VII(a). Reference Books:

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1	Structural Dynamics-Vibrations and Systems	Madhujit Mukyopadhyaya	2008	ANE Books
2	Theory of vibration with applications	William Thomson	4th edition, 1996	CRC Press
3	Structural Dynamics: Theory and Computation	Mario Paz	2nd Edition	CBS Publisher

VII(b): Web links and Video Lectures (e-Resources):

https://www.youtube.com/watch?v=6cbuMonSrfw&t=27s
https://www.youtube.com/watch?v=GhmTtLGxPrY
https://www.youtube.com/watch?v=mP79BkYccFU
https://www.youtube.com/watch?v=IRfWDBMN4yU
https://www.youtube.com/watch?v=CpXyjlYxeV4
https://www.youtube.com/watch?v=Qspo4ZQ9cIw

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

• Conduction of technical seminars on recent research activities
• Group Discussion

Semester:	I	**Course Type:**	PCC		
Course Title: Research methodology and IPR					
Course Code:	23CSET16			**Credits:**	3
Teaching Hours/Week (L:T:P:O)			3:0:0:0	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	**Theory**			**Exam Hours:**	3 Hours

I. Course Objectives:

1.To understand the process of research & identify good research and the problems encountered by researchers.

2. To collect various research design & features of a good design in order to apply in design of experiments.

3. To test the hypotheses, interpret and writing research reports.

II. Teaching-Learning Process (General Instructions):

Chalk and Talk using writing boards, PPT and videos.

III.COURSE CONTENT

Module-1: 8 Hours

Research Methodology: Introduction, Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Importance of Knowing How Research is Done, Research Process, Criteria of Good Research, and Problems Encountered by Researchers in India.

Defining the Research Problem: Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem, An Illustration

RBT Levels: L1, L2

Module-2: 8 Hours

Reviewing the literature: Place of the literature review in research, Bringing clarity and focus to your research problem, Improving research methodology, Broadening knowledge base in research area, Enabling contextual findings, How to review the literature, searching the existing literature, reviewing the selected literature, Developing a theoretical framework, Developing a conceptual framework, Writing about the literature reviewed.

Research Design: Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs, Important Experimental Designs.

RBT Levels: L1, L2

Module-3:	8 Hours

Design of Sampling: Introduction, Sample Design, Sampling and Non-sampling Errors, Sample Survey versus Census Survey, Types of Sampling Designs.

Measurement and Scaling: Qualitative and Quantitative Data, Classifications of Measurement Scales, Goodness of Measurement Scales, Sources of Error in Measurement Tools, Scaling, Scale Classification Bases, Scaling Technics, Multidimensional Scaling, Deciding the Scale.

Data Collection: Experimental and Surveys, Collection of Primary Data, Collection of Secondary Data, Selection of Appropriate Method for Data Collection, Case Study Method

RBT Levels: L1, L2

Module-4:	8 Hours

Testing of Hypotheses: Hypothesis, Basic Concepts Concerning Testing of Hypotheses, Testing of Hypothesis, Test Statistics and Critical Region, Critical Value and Decision Rule, Procedure for Hypothesis Testing, Hypothesis Testing for Mean, Proportion, Variance, for Difference of Two Mean, for Difference of Two Proportions, for Difference of Two Variances, P-Value approach, Power of Test, Limitations of the Tests of Hypothesis

RBT Levels: L1, L2

Module-5:	8 Hours

Interpretation and Report Writing: Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports**.**

Intellectual Property: The Concept, Intellectual Property System in India**, Protection of** Intellectual Property under TRIPS, Copyright and Related Rights, Trademarks, Geographical indications, Industrial Designs, Patents, Patentable Subject Matter, Rights Conferred, Exceptions, Term of protection, Conditions on Patent Applicants, Process Patents, Other Use without Authorization of the Right Holder, Layout-Designs of Integrated Circuits, Protection of Undisclosed Information, Enforcement of Intellectual Property Rights, UNSECO**.**

RBT Levels: L1, L2

IV.COURSE OUTCOMES After studying this course, students will be able to:

CO1	Discuss research methodology and the technique of defining a research problem
CO2	Explain the functions of the literature review in research, carrying out a literature search, developing theoretical and conceptual frameworks and writing a review
CO3	Explain various research designs, sampling designs, measurement and scaling techniques and also different methods of data collections.
CO4	Explain several parametric tests of hypotheses, art of interpretation and writing research reports & discuss various forms of the intellectual property & its relevance

V.CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1	3	2										1	2			
CO2	3	2	2						2	3		1	2			
CO3	3	2	3	3	2							1	2			
CO4	3	2	3	3	2					3		1	2			

VI. Assessment Details (CIE & SEE)

General Rules: Refer Annexure Section 1

Continuous Internal Evaluation (CIE): Refer Annexure Section 1

Semester End Examination (SEE): Refer Annexure Section 1

VII. Learning Resources				
VII (a): Reference Books:				
1	Research Methodology: Methods and Techniques	C.R. Kothari, Gaurav Garg	Edition 4 & 2013	New Age International
2	Research Methodology a step-by-step guide for beginners	Ranjit Kumar	Edition 3 & 2011	SAGE
3	Research Methods: the concise knowledge base	Trochim,	Edition 1 &2005	Atomic Dog Publishing
4	Conducting Research Literature Reviews	Fink A	Edition 1 &2009	SAGE
VII(b): Web links and Video Lectures (e-Resources):				
https://www.youtube.com/watch?v=E2gGF1rburw https://www.youtube.com/watch?v=yplWZs3dqNQ https://www.youtube.com/watch?v=WvduZOWoft0&t=831				
VIII: Activity Based Learning / Practical Based Learning/Experiential learning:				
• Conduction of technical seminars on recent research activities • Group Discussion				

M.Tech Structural Engineering

Semester:	I	**Course Type:**	PCCL		
Course Title: Structural Engineering Lab					
Course Code:	23CSEL17			**Credits:**	02
Teaching Hours/Week (L:T:P:O)			1:0:2:0	**Total Hours:**	42
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Practical			**Exam Hours:**	3 Hours

I. Course Objectives:

To learn principles of design of experiments

To investigate the performance of structural elements.

To evaluate the different testing methods and equipment's.

II. Teaching-Learning Process (General Instructions):

Chalk and Talk using writing boards, PPT and videos.

III. PRACTICAL PART

Sl. No.	Experiments / Programs / Problems
1	Experiments on Concrete, including Mix design
2	Testing of beams for deflection, flexure and shear
3	Experiments on vibration of multi storey frame models for Natural frequency and modes.
4	Use of Non-destructive testing (NDT) equipments– Rebound hammer, Ultra sonic pulse velocity meter and Profometer

IV. COURSE OUTCOMES

CO1	Achieve Knowledge of design and development of experimenting skills.
CO2	Understand the principles of design of experiments
CO3	Summarize the testing methods and equipment's.

V. CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1	2						2	1					1			
CO2	3	2											1			
CO3	3	2											1			

VI. Assessment Details (CIE & SEE)				
General Rules: Refer Annexure Section 3				
Continuous Internal Evaluation (CIE): Refer Annexure Section 3				
Semester End Examination (SEE): Refer Annexure Section 3				
VII. Learning Resources				
VI (a) Reference Books:				
1	Advanced Structural Engineering Laboratory Manual	Dr. S.K. Panigrahi	2022	S.K. Kataria & Sons
2	Structural Engg. Models and Methods for Statics, Instability and Inelasticity	Adnan Ibrahimbegovic , Rosa-Adela Mejia-Nava	2023	Springer
VIi(b): Web links and Video Lectures (e-Resources):				
https://www.youtube.com/watch?v=cGTebUY2xQc&list=PLNJ364_NfpLWcp0Hck9f2rOJUIudOlaYi https://youtu.be/dbawcyjAhSI?si=e0Vz-KQfyIo1dNuU				
VIIi: Activity Based Learning / Practical Based Learning/Experiential learning:				
Mention suggested Activities like seminar, assignments, quiz, case studies, mini projects, industry visit, self-study activities, group discussions, etc				

Semester:	II	**Course Type:**	PCC		
Course Title:	ADVANCED DESIGN OF STEEL STRUCTURES				
Course Code:	23CSET21			**Credits:**	03
Teaching Hours/Week (L:T:P:O)			3:0:0:2	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	3 Hours

I. Course Objectives:

This course will enable students to

- Carry out the designs of steel structures made from hot-rolled and cold-formed structural steel.
- Become Proficient in applying the code provisions for design of columns, beams, beam-columns junctions, etc.

II.Teaching-Learning Process:

Chalk and Talk using writing boards, PPT and videos.

III.COURSE CONTENT

Module-1:	8 Hours

Laterally Unrestrained Beams: Lateral Buckling of Beams, Factors affecting lateral stability, IS 800 code provisions, Design Approach. Lateral buckling strength of Cantilever beams, continuous beams, beams with continuous and discrete lateral restraints, Mono-symmetricandnon-uniformbeams–DesignExamples.Conceptsof-ShearCenter, Warping, Uniform and Non-Uniform torsion.

RBT Levels: L1, L2, L3 L4, L5

Module-2:	8 Hours

Beam- Columns in Frames: Behaviour of Short and Long Beam - Columns, Effects of Slenderness Ratio and Axial Force on Modes of Failure, Biaxial bending, Strength of Beam Columns, Sway and Non-Sway Frames, Strength and Stability of rigid jointed frames, Effective Length of Columns-, Methods in IS 800 – Examples.

RBT Levels: L1, L2, L3 L4, L5

Module-3:	8 Hours

Steel Beams with Web Openings: Shape of the web openings, practical guidelines, and Force distribution and failure patterns, Analysis of beams with perforated thin and thick webs, Design of laterally restrained castellated beams for given sectional properties, Vierendeel girders (design for given analysis results)

RBT Levels: L1, L2, L3 L4, L5

Module-4:	8 Hours

Cold formed steel sections: Techniques and properties, Advantages, Typical profiles, Stiffened and unstiffened elements, Local buckling effects, effective section properties, IS 801& 811 code provisions, numerical examples- beam design, column design.

RBT Levels: L1 L2 L3

Module-5:	8 Hours

Fire resistance: Fire resistance level, Period of Structural Adequacy, Properties of steel with temperature, Limiting Steel temperature, Protected and unprotected members, Methods of fire protection, Fire resistance ratings- Numerical Examples.

RBT Levels: L1 L2 L3

IV.COURSE OUTCOMES

CO1	Analyse the laterally unrestrained beams as per Codal provisions.
CO2	Carry out designs of steel columns and beam-column joints in frames.
CO3	Design castellated beams for given sectional properties.
CO4	Design of beams and columns made up of cold formed steel sections.
CO5	Learn different aspects of fire resistance in steel structures.

V.CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1																
CO2																
CO3																
CO4																

VI Assessment Details (CIE & SEE)

General Rules: Refer Annexure Section 1

Continuous Internal Evaluation (CIE): Refer Annexure Section 1

Semester End Examination (SEE): Refer Annexure Section 1

VII. Learning Resources

VII(a): Reference Books:

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1	Design of Steel Structures	N. Subramanian	2008	Oxford, IBH
2	Design of Steel Structures	Duggal, S. K	2000.	Tata McGraw-Hill
3	IS 800: 2007, IS 801-2010, IS 811-1987			
4	BS 5950 Part- 8, SP 6 (5)-1980			

VII(b): Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=qJV5zdx7NJs
- https://www.youtube.com/watch?v=5eZneS83pBg&list=PLyqSpQzTE6M_nweVk5N8okOAVl0BNPUXX
- INSDAG Teaching Resource Chapter 11 to 20: www.steel-insdag.org

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

- Conduction of technical seminars on recent research activities
- Group Discussion

Semester:	II	**Course Type:**	IPCC		
Course Title: FINITE ELEMENT METHOD OF ANALYSIS					
Course Code:	23CSEI22			**Credits:**	4
Teaching Hours/Week (L: T:P:O)			3:0:2:0	**Total Hours:**	50
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	3 Hours

I. Course Objectives:

- To provide the fundamental concepts of the theory of the finite element method
- To develop proficiency in the application of the finite element method (modeling, analysis, and interpretation of results) to realistic engineering problems through the use of softwares.

II. Teaching-Learning Process (General Instructions):

Chalk and Talk using writing boards, PPT and videos.

III.COURSE CONTENT

Module-1:	8 Hours

Basic concepts of elasticity – kinematics and static variables for various types of structural problems – approximate method of structural analysis – Rayleigh-Ritz method – Difference between Finite Difference Method and Finite Element Method – variational method and minimization of energy approach for element formulation – principles of finite element method – advantages & disadvantages – finite element procedure – finite elements both first and second order elements used for one-, two- and three-dimensional problems**.**

RBT Levels: L1 L2 L3

Module-2:	8 Hours

Nodal displacement parameters – convergence criteria – compatibility requirements – geometric invariance – shape function – polynomial form of displacement function – generalized and natural coordinates – Lagrangian interpolation function.

RBT Levels: L2, L3, L4

Module-3:	8 Hours

Isoperimetric elements, Internal nodes and higher order elements, Serendipity and Lagrangian family of Finite Elements, Sub-parametric and Super- parametric elements, Condensation of internal nodes, Jacobian transformation Matrix, Development of strain-displacement matrix and stiffness matrix, consistent load vector, numerical integration.

RBT Levels: L2, L3, L4, L5

Module-4:	8 Hours

Application of Finite Element Method for the analysis of one- & two-dimensional problems: Analysis of plane trusses and beams, Application to plane stress/strain, Axisymmetric problems using CST and Quadrilateral Elements.

RBT Levels: L2, L3, L4, L5

Module-5:	8 Hours

Application to Plates and Shells, Non-linearity: material, geometric and combined non- linearity, Techniques for Nonlinear Analysis.

RBT Levels: L2, L3,

IV PRACTICAL COMPONENT

1	Analysis and Design of Simple Multi-storeyed structure using any commercially available FEA packages
2	Analysis and Design of Simple Multi-storeyed structure with earthquake load using any commercially available FEA packages
3	Analysis and Design of Simple shell structure using any commercially available FEA packages
4	Analysis and Design of Simple plate structure using any commercially available FEA packages
5	Analysis and Design of Simple overhead RCC water tanks using any commercially available FEA packages
6	Analysis and Design of simple bridge decks under IRC loading using any commercially available FEA packages
7	Analysis of Unrestrained steel beams as per IS 800-2007 norms using Excel spread sheets / MatLab programming soft-computing techniques.

V.COURSE OUTCOMES

CO1	Explain the basic theory behind the finite element method.
CO2	Formulate force-displacements relations for 2-D elements.
CO3	Use the finite element method to analyze real structures.
CO4	Use a Finite Element based program for structural analysis.

VI.CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1	3											1	1			
CO2	3	2	2									1	1			
CO3	3	2	2	2	2							1	1			
CO4	3	2	2	2								1	1			

VII. Assessment Details (CIE & SEE)

General Rules: Refer Annexure Section 2

Continuous Internal Evaluation (CIE): Refer Annexure Section 2

Semester End Examination (SEE): Refer Annexure Section 2

VII.Learning Resources				
VII(a): Reference Books:				
Sl. No.	**Title of the Book**	**Name of the author**	**Edition and Year**	**Name of the publisher**
1	The Finite Element Method	O.C Zienkiewicz and R.L Taylor	2005	Butterwoth
2	Finite Element Procedures	KJ Bathe	2002	Prentice Hall
3	An Introduction to Finite Element Methods	Reddy, J	2013	McGraw Hill Co
VII(b): Web links and Video Lectures (e-Resources):				
https://youtu.be/UOp6JeiJctA https://youtu.be/lbghRDnb-LQ?list=PLFA5C164D77D3B971 https://youtu.be/MUHFtrqmNVQ?list=PLFA5C164D77D3B971 https://youtu.be/mAGYJJ5ljBM?list=PLFA5C164D77D3B971 https://youtu.be/bQagf5uWA3Q?list=PLFA5C164D77D3B971 https://youtu.be/xLmZ8Ri2oqc?list=PLFA5C164D77D3B971				
VIII: Activity Based Learning / Practical Based Learning/Experiential learning:				
Seminar, Assignments, Quiz				

Semester:	II	**Course Type:**	PEC		
Course Title: THEORY OF PLATES AND SHELLS					
Course Code:	23CSEP211			**Credits:**	03
Teaching Hours/Week (L:T:P:O)			3:0:0:0	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	3 Hours

I. Course Objectives:

This course will enable students to

- learn different methods of analysis and design of plates and shells
- To critically detail the plates, folded plates and shells. To evaluate the performance of spatial structures.

II.Teaching-Learning Process (General Instructions):

Chalk and Talk using writing boards, PPT and videos.

III. COURSE CONTENT

Module-1:	8 Hours

Introduction to plate theory, small deflection of laterally loaded thin rectangular plates for pure bending. Navier's and Levy's solution for various lateral loading and boundary conditions (No derivation), Numerical examples

RBT Levels: L1, L2

Module-2:	8 Hours

Energy methods for rectangular and circular plates with clamped edges subjected to symmetric loadings.

RBT Levels: L2, L3

Module-3:	8 Hours

Introduction to curved surfaces and classification of shells, Membrane theory of spherical shells, cylindrical shells, hyperbolic paraboloids, elliptic paraboloid and conoids

RBT Levels: L2, L3

Module-4:	8 Hours

Axially symmetric bending of shells of revolution, Closed cylindrical shells, water tanks, spherical shells and Geckler's approximation. Bending theory of doubly curved shallow shells.

RBT Levels: L2 L3

Module-5:	8 Hours

Axially symmetric bending of shells of revolution, closed cylindrical shells, water tanks, spherical shells and Geckler's approximation. Bending theory of doubly curved shallow shells.

RBT Levels: L2 L3 L4

IV.COURSE OUTCOMES

CO1	Achieve Knowledge of design and development of problem-solving skills
CO2	Understand the principles of Analysis and Design
CO3	Design and develop analytical skills.
CO4	Summarize the performance of shells
CO5	Understand the concepts of energy principle.

V.CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1	2	2	2										2			
CO2	2	2	2										2			
CO3	2	2	2										2			
CO4	2	2	2										2			

VI. Assessment Details (CIE & SEE)

General Rules: Refer Annexure Section 1

Continuous Internal Evaluation (CIE): Refer Annexure Section 1

Semester End Examination (SEE): Refer Annexure Section 1

VIII. Learning Resources

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
VII(a): Reference Books:				
1	Theory of Plates and ShellS	Timoshenko, S. and Woinowsky-Krieger	2nd Edition	McGraw-Hill Co., New York,
2	Design and Constructions of Concrete Shell Roofs	Ramaswamy G.S.	1986.	CBS Publishers and Distributors – New Delhi
3	Stresses in Plates and Shells	Ugural, A. C.	2nd edition, 1999.	McGraw-Hill
4	Theory and analysis of plates - classical and numerical methods	R. Szilard	1994	Prentice Hall

VII(b): Web links and Video Lectures (e-Resources):

https://archive.nptel.ac.in/courses/105/103/105103209/

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

- Conduction of technical seminars on recent research activities
- Group Discussion

Semester:	II	**Course Type:**	PEC		
Course Title:	Design of Precast & Composite Structures				
Course Code:	23CSEP212			**Credits:**	3
Teaching Hours/Week (L: T:P:O)			3:0:0:0	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	3 Hours

I.Course Objectives:

1. Understand the concepts and techniques of precast construction.
2. Select or design precast elements suitable for project specific requirements.
3. Design precast systems to ensure integrity and safety of the structure and to avoid progressive collapse.
4. Design composite floors and beam elements.

II. Teaching-Learning Process (General Instructions):

Chalk and Talk using writing boards, PPT and videos.

III. COURSE CONTENT

Module-1:	8 Hours

Introduction: Concepts , components, Structural Systems and Design of precast concrete floors Need and types of precast construction, Modular coordination, Precast elements- Floor, Beams, Columns and walls. Structural Systems and connections.

Design of precast Concrete Floors: Theoretical and Design Examples of Hollow core slabs, Precast Concrete Planks, floor with composite toppings with and without props.

Textbook:

Self-Learning:

RBT Levels: L1,L2

Module-2:	8 Hours

Design of precast reinforced and prestressed Concrete beams : Theoretical and Design Examples of ITB – Full section precast, Semi Precast, propped and unpropped conditions. Design of RC Nibs

RBT Levels: L3, L4

Module-3:	8 Hours

Design of precast concrete columns and walls: Design of braced and unbraced columns with corbels subjected to pattern and full loading. Design of Corbels Design of RC walls subjected to Vertical, Horizontal loads and moments, Design of vertical ties and horizontal joints.

RBT Levels: L3, L4

Module-4:	8 Hours

Design of Precast Connections and Structural Integrity Beam bearing, Beam half Joint, Steel Inserts, Socket Connection, Structural integrity, Avoidance of progressive collapse, Design of Structural Ties.

RBT Levels: L3, L4

Module-5:	8 Hours

Design of Steel Concrete Composite Floors and Beams Composite Floors: Profiled Sheeting with concrete topping, Design method, Bending and Shear Resistance of Composite Slabs, Serviceability Criteria, Design Example

Composite Beams: Elastic Behaviour, Ultimate Load behaviour of Composite beams, Stresses and deflection in service and vibration, Design Example of Simply Supported beams.

RBT Levels: L3, L4

IV. COURSE OUTCOMES

CO1	Explain the need for precast elements in building construction.
CO2	Design precast reinforced and prestressed concrete beams for different conditions.
CO3	Design precast concrete columns and walls.
CO4	Analyse and design composite floors and beams

V. CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1																
CO2																
CO3																
CO4																

VI. Assessment Details (CIE & SEE)

General Rules: Refer Annexure Section 1

Continuous Internal Evaluation (CIE): Refer Annexure Section 1

Semester End Examination (SEE): Refer Annexure Section 1

VII. Learning Resources

VII(a): Reference Books:

1	Precast Concrete – Design and applications	Hass A.M.	1983	Applied Science
2	Plant cast, Precast and Prestressed concrete	David Sheppard	1989	McGraw Hill
3	Composite Structure of Steel and Concrete (Volume 1)	R.P. Johnson	1994	Blackwell Scientific Publication (Second Edition)
4	NBC – 2005 (Part I to Part VII)		IS 15916- 2011, IS 11447, IS6061 – I and III	BIS Publications

VII(b): Web links and Video Lectures (e-Resources):

https://onlinecourses.nptel.ac.in/noc20_ar04/preview.

https://www.youtube.com/watch?v=fRqxXkxApSY.

- INSDAG Teaching Resource Chapter 21 to 27: www.steel-insdag.org
- IS: 11384-1985, Code of Practice for Composite Construction in Structural Steel and Concrete.

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

Seminar, Assignments, Quiz.

Semester:	**II**	**Course Type:**	PEC		
Course Title: EARTHQUAKE RESISTANT STRUCTURES					
Course Code:	23CSEP213			**Credits:**	03
Teaching Hours/Week (L:T:P:O)			3:0:0:0	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	3 Hours

I. Course Objectives:

1. The objective of this course is to make students to learn principles of engineering seismology,
2. To design the reinforced concrete buildings for earthquake resistance. To evaluate the seismic response of the structures.

II.Teaching-Learning Process (General Instructions):

Chalk and talk, videos, Power Point presentation, animations.

III.COURSE CONTENT

Module-1:	8 Hours

Introduction: Introduction to engineering seismology, Geological and tectonic features of India, Origin and propagation of seismic waves, characteristics of earthquake and its quantification – Magnitude and Intensity scales, seismic instruments. Earthquake Hazards in India, Earthquake Risk Evaluation and Mitigation. Structural behavior under gravity and seismic loads, Lateral load resisting structural systems, Requirements of efficient earthquake resistant structural system, damping devises, base isolation systems.

RBT Levels: L1 L2

Module-2:	8 Hours

The Response history and strong motion characteristics. Response Spectrum – elastic and inelastic response spectra, tripartite (D-V-A) response spectrum, use of response spectrum in earthquake resistant design. Computation of seismic forces in multi-storied buildings – using procedures (Equivalent lateral force and dynamic analysis) as per IS1893.

RBT Levels: L2 L3

Module-3:	8 Hours

Structural Configuration for earthquake resistant design, Concept of plan irregularities and vertical irregularities, Soft storey, Torsion in buildings. Design provisions for these in IS1893. Effect of infill masonry walls on frames, modeling concepts of infill masonry walls.
Behaviour of masonry buildings during earthquakes, failure patterns, strength of masonry in shear and flexure, Slenderness concept of masonry walls, concepts for earthquake resistant masonry buildings – codal provisions.

RBT Levels: L2 L3

Module-4:	8 Hours

Design of Reinforced concrete buildings for earthquake resistance-Load combinations, Ductility and energy absorption in buildings. Confinement of concrete for ductility, design of columns and beams for ductility, ductile detailing provisions as per IS1893. Structural behavior, design and ductile detailing of shear walls.

RBT Levels: L2 L3

Module-5:	8 Hours

Seismic response control concepts – Seismic demand, seismic capacity, Overview of linear and nonlinear procedures of seismic analysis. Performance Based Seismic Engineering methodology, Seismic evaluation and retrofitting of structures.

RBT Levels: L2 L3

IV.COURSE OUTCOMES

CO1	Achieve Knowledge of design and development of problem-solving skills.
CO2	Understand the principles of engineering seismology.
CO3	Design and develop analytical skills.
CO4	Summarize the Seismic evaluation and retrofitting of structures.
CO5	Understand the concepts of earthquake resistance of reinforced concrete buildings.

V.CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1																
CO2																
CO3																
CO4																
CO5																

VI.Assessment Details (CIE & SEE)

General Rules: Refer Annexure Section 1

Continuous Internal Evaluation (CIE): Refer Annexure Section 1

Semester End Examination (SEE): Refer Annexure Section 1

VII.Learning Resources

VII(a): Reference Books:

1	Dynamics of structures –	Anil K. Chopra	2 and 2012	Pearson Education

	Theory and Applications			
2	Structural dynamics - Theory and computations	Mario Paz	2 and 2004	CBS Publisher and Distributors
3	Earthquake Resistant Design of Building Structures	Vinod Hosur	2012	Wiley

VII(b): Web links and Video Lectures (e-Resources):
https://archive.nptel.ac.in/courses/105/107/105107204/.
https://onlinecourses.nptel.ac.in/noc24_ce09/preview

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

Seminar, Assignments, Quiz

Semester:	II	**Course Type:**	**PEC**		
Course Title: ADVANCED STRUCTURAL ANALYSIS					
Course Code:	23CSEP214			**Credits:**	3
Teaching Hours/Week (L:T:P:O)			3:0:0:0	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	3 Hours

I. Course Objectives:

Analysis of curved beams, Beams on elastic foundation, shear centre and unsymmetrical bending and buckling of non-prismatic columns and beam columns.

II.Teaching-Learning Process (General Instructions):

Chalk and talk, videos, Power Point presentation, animations.

III.COURSE CONTENT

Module-1: 8Hours

Curved Beams: Curved beams, Introduction, assumptions, derivation of Winkler Bach equation, Radius to the neutral surface of simple geometric figures, Limitation, Stress distribution in open curved members such as Hooks and chain links, Stress distribution in closed rings and chain links. Deformations of open and closed rings.

RBT Levels: L1 L2 L3

Module-2: 8 Hours

Beams on Elastic Foundations: Governing differential equation for elastic line, Interpretation of constants, Infinite beam with point load, moment & UDL with problems. Semi- infinite beams with point load and moment UDL with problems over fixed and hinged support conditions.

RBT Levels: L1 L2 L3

Module-3: **8** Hours

Shear Centre: Concept of shear center in torsion induced bending of beams, expression to the Shear Centre for Symmetrical and Unsymmetrical Sections, Derivation of shear centre for angles, channel, semicircular and built-up sections with numerical problems.

RBT Levels: L1 L2 L3

Module-4: **8** Hours

Unsymmetrical Bending: Theory behind unsymmetrical bending, Assumptions, obtaining the stresses in beams, simply supported and cantilever unsymmetrical beams subjected to inclined loading, Deflections of unsymmetrical simply supported and cantilever beams with numerical problems.

RBT Levels: L1 L2 L3

Module-5: **8** Hours

Buckling of Non Prismatic Columns and Beam-Column: Principle behind Euler's theory of buckling, Governing differential equation applied to buckling of columns and evaluation of constants for various boundary conditions, Obtaining the characteristic equation for the buckling load of non-

prismatic compound columns, Analysis of Beam- column, conceptual theory of magnification stresses and deformations subjected to axial and different types of lateral loads with numerical problems..

RBT Levels: L1 L2 L3

IV.COURSE OUTCOMES

CO1	Apply Winkler Bach and Strain Energy principles to obtain stresses and deformation in curved members.
CO2	Derive the expressions to Foundation pressure, Deflection, Slope, BM and SF of infinite and semi-infinite Beams resting on Elastic Foundation.
CO3	Obtain the equations for the shear centre for symmetrical and unsymmetrical from fundamentals.
CO4	Extrapolate the bending theory to calculate the stresses and deformations in unsymmetrical bending
CO5	Develop the characteristic equation for the buckling load of compound column and stresses and deformations in beam-column.

V.CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1	2	2	2										2			
CO2	2	2	2										2			
CO3	2	2	2										2			
CO4	2	2	2										2			

VI. Assessment Details (CIE & SEE)

General Rules: Refer Annexure Section 1

Continuous Internal Evaluation (CIE): Refer Annexure Section 1

Semester End Examination (SEE): Refer Annexure Section 1

VII. Learning Resources

VII.(a) Reference Books:

1	Advanced mechanics of solids and structures	Krishna Raju N & Gururaj D R	1998	NAROSA Publishers Company Delhi.
2	Advanced Mechanics of Solids", Tenth Print, ,.	Srinath L. S	1992	Tata McGraw Hill publishing company. New Delhi
3	Optimum Structural Design	Uri Kirsch	1994	McGraw Hill, New York
4	Advanced theory of structures and Matrix Method	Vazirani V N and Ratwani M M	1995	Khanna publishers
5	Indeterminate Structural Analysis	Sterling Kinney	1996	Oxford & IBH publishers

VII(b): Web links and Video Lectures (e-Resources):

https://www.youtube.com/watch?v=s4CN6aVKhPo&list=PLEE5D02698EAAF2C0

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

Conduction of technical seminars on recent research activities
Group Discussion
Site visit

Semester:	II	**Course Type:**	**PEC**		
Course Title: STABILITY OF STRUCTURES					
Course Code:	23CSEP221			**Credits:**	03
Teaching Hours/Week (L:T:P:O)			3:0:0:0	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	3 Hours

I. Course Objectives:

This course will enable students to
To learn principles of stability of structures
To analyse the structural elements for stability.
To evaluate the use of strain energy in plate bending and stability.

II. Teaching-Learning Process (General Instructions):

Chalk and talk, videos, Power Point presentation, animations.

III. COURSE CONTENT

Module-1: 8 Hours

Beam – Column Differential equation. Beam column subjected to (i) lateral concentrated load, (ii) several concentrated loads, (iii) continuous lateral load. Application of trigonometric series, Euler's formulation using fourth order differential equation for pined – pined, fixed – fixed, fixed – free and fixed – pinned column.

RBT Levels: L1, L2, L3

Module-2: 8 Hours

Buckling of frames and continuous beams. Elastic Energy method: Approximate calculation of critical loads for a cantilever. Exact critical load for hinged – hinged column using energy approach. Buckling of bar on elastic foundation. Buckling of cantilever column under distributed loads. Determination of critical loads by successive approximation. Bars with varying cross section. Effect of shear force on critical load. Column subjected to pulsating forces.

RBT Levels: L1, L2, L3 L4

Module-3: 8 Hours

Stability analysis by finite element approach Derivation of shape function for a two nodded Bernoulli–Euler beam element (lateral and translation of) – element stiffness and element geometric stiffness matrices – assembled stiffness and geometric stiffness matrices for a discretised column with different boundary condition – calculation of critical loads fora discretised (two elements) column (both ends built in). Buckling of pin jointed frames (maximum of two active DOF) – symmetrical single bay portal frame.

RBT Levels: L1, L2, L3 L4

Module-4:	8 Hours
Lateral buckling of beams Differential equation –pure bending – cantilever beam with tip load – simply supported beam of I section subjected to central concentrated load. Pure Torsion of thin – walled bars of open cross-section. Non – uniform Torsion of thin – walled bars of open cross-section. **RBT Levels: L1 L2 L3**	
Module-5:	8 Hours
Expression for strain energy in plate bending with in plate forces (linear and non – linear). Buckling of simply supported rectangular plate– uniaxial load and biaxial load. Buckling of uniformly compressed rectangular plate simply supported along two opposite sides perpendicular to the direction of compression and having various edge condition along the other two sides. **RBT Levels: L1 L2 L3**	

IV. COURSE OUTCOMES

CO1	Analyse the beam column for various load conditions.
CO2	Analyse frames and continuous beams for buckling.
CO3	carryout Stability analysis by finite element approach.
CO4	Derive differential equation for lateral buckling of beams.
CO5	Arrive Expression for strain energy in plate bending with in plate forces.

V. CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1																
CO2																
CO3																
CO4																

VI. Assessment Details (CIE & SEE)

General Rules: Refer Annexure Section 1

Continuous Internal Evaluation (CIE): Refer Annexure Section 1

Semester End Examination (SEE): Refer Annexure Section 1

VII. Learning Resources

VII(a): Textbooks:

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1	Theory of Elastic Stability	Stephen P. Timoshenko, James M. Gere	2008	McGraw-Hill, New Delhi.
2	Principles of Structural Stability	Zeiglar.H	2000	Blasdell Publication
3	Concepts and Applications of Finite Element Analysis	Robert D Cook et al	2001	John Wiley and Sons, New York
4	Computational Structural Mechanics	Rajasekaran. S	2001	Prentice-Hall, India.

VII(b): Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=un_Fjz_dfXI&list=PLFEqFwyPC3WwDLI6jtt2xXVPw2ygj0Jxz
- https://www.youtube.com/watch?v=_ypvXxOesm4
- INSDAG Teaching Resource Chapter 11 to 20: www.steel-insdag.org

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

- Conduction of technical seminars on recent research activities
- Group Discussion

Semester:	II	**Course Type:**	PEC		
Course Title: Design of High-Rise Structures					
Course Code:	23CSEP222			**Credits:**	3
Teaching Hours/Week (L:T:P:O)			3-0-0-0	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	3 Hours

I.Course Objectives:

- To understand the various structural systems for high rise structures.
- To evaluate the behavior of structure under dynamic loading.
- To analyse and design of advanced structures.
- To apply the advanced method of analysis of such structures and modelling these structures in various software with pros and cons.

II.Teaching-Learning Process:

Chalk and talk, videos, Power Point presentation, animations.

III.COURSE CONTENT

Module-1: Analysis and Design of RC and Steel Chimney — 8 Hours

Design Factors, Stresses due to Temperature, Components & Safety Ladders, Analysis and Design of RC and Steel Chimney, Foundation design for Varied Soil Strata.

RBT Levels: K3

Module-2: Design of transmission/ TV tower, Mast and trestles — 8 Hours

Types of Loads & Tower Configuration, bracing system, Analysis and Design for Vertical & Transverse Loads.

RBT Levels: K3

Module-3: Tall Buildings — 8 Hours

General Consideration for Design of Tall Structures
Requirements of Tall Buildings, Factors affecting Tall Structures, Structural Concept.
Design Criteria & Loadings for Tall Buildings
Design Philosophy, National & International Codal Provisions for Loading, Strength & Stability, Stiffness & Drift Limitations, Effects of Creep, Shrinkage, Temperature, Fire etc., Human Comfort Criteria. Gravity Load, Live Load Reduction, Construction Load, Wind Load-Static &
Dynamic Methods, Earthquake Load-Concept & Procedure of Equivalent Lateral Load, Response Spectrum & Modal Analysis, Load Combinations.

RBT Levels: K2

Module-4: Structural Forms & Systems:	8 Hours

Structural Forms & Systems:

Concrete Structures

Rigid Frame, Braced Frame, Infilled Frame, Flat Plate-Slab, Shear Wall, Coupled Shear Wall, Flat Slab with Shear Wall, Shear Wall Frame Interaction, Framed Tube Structural System, Core Supported Structures, Outrigger, Belt Truss, Buttress Core System for Tall Building. Various Floor Systems.

Steel Structures

Rigid Frame, Semi-Rigid Frame, Braced Frame, Eccentric Braced Frame System, Buckling Restrained Brace Frame, Steel Plate Shear Wall, Interacting System of Braced and Rigid Frame, Staggered Truss System, Core Outrigger & Belt Truss System, Framed Tube System, Bundled Tube. Various Floor Systems.

Composite Structure

Various Composite Members, Composite Subsystems like Ordinary & Special Moment Frames, Composite Braced Frame, Composite Eccentric Braced Frame, Composite Tube Systems, Vertically Mix Systems. Various Floor Systems

RBT Levels: K2

Module-5: Modelling of Tall Structures for Analysis & Design	8 Hours

Different Approach of Analysis, Assumptions & Behaviour, Modelling for Approximate Analysis- Modelling of Slabs, Continuum Analysis, Modelling for Exact Analysis of Plane Frame, Plane Shear Wall, 3-D Frame & Wall Structures, P-Delta Effects, Wall Opening Effect.

Braced Frame -Types, Behaviour, Method of Analysis & Drift Estimation.

Rigid Frame - Behaviour, Approximate Analysis of member Forces by Gravity and Lateral Loads, Drift Estimation. Computer Analysis of Rigid Frame.

Shear Wall & Coupled Shear Wall – Behaviors, Method of Analysis.

RBT Levels: K2

IV COURSE OUTCOMES

CO1	Analyse and Design of RC and Steel Chimney
CO2	Design transmission/ TV tower, Mast and trestles
CO3	Explain the design criterion, design philosophy and loadings in tall structures
CO4	Outline the behaviour of Structural Forms & Systems
CO5	Discuss the Modelling of Tall Structures for Analysis & Design

V.CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1	3	3											3			
CO2	3	3											3			
CO3	3	3											3			
CO4	3	3											3			
CO5	3	3											3			

VI. Assessment Details (CIE & SEE)

General Rules: Refer Annexure Section 1

Continuous Internal Evaluation (CIE): Refer Annexure Section 1

Semester End Examination (SEE): Refer Annexure Section 1

VII.Learning Resources

VII.(a): Reference Books:

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1	Structural Design of Multi-storeyed Buildings	Varyani U. H.	2, 2014	South Asian Publishers
2	Design of Multi Storeyed Buildings	Health monitoring of structural materials and components-Methods with Applications	2007	CPWD Publications
3	Advanced Reinforced Concrete Design	Varghese P. C.	2, 2005	Prentice Hall of India, New Delhi
4	Tall Building Structures	Smith Byran S. and Coull Alex	1, 1997	Wiley India
5	Structural Analysis and Design of Tall Buildings	Taranath B. S.	1, 2011	McGraw Hill

VII(b): Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=un_Fjz_dfXI&list=PLFEqFwyPC3WwDLI6jtt2xXVPw2ygj0Jxz
- https://www.youtube.com/watch?v=_ypvXxOesm4
- INSDAG Teaching Resource Chapter 11 to 20: www.steel-insdag.org

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

- Conduction of technical seminars on recent research activities
- Group Discussion

M.Tech Structural Engineering

Semester:	II	**Course Type:**	PEC		
Course Title: DESIGN OF MASONRY STRUCTURES					
Course Code:	23CSEP223			**Credits:**	3
Teaching Hours/Week (L:T:P:O)			3:0:0:0	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	3 Hours

I. Course Objectives:

To learn performance of masonry structures
To design the masonry structures for earthquake resistance.
To evaluate the strength and stability of the masonry structures

II.Teaching-Learning Process (General Instructions):

Chalk and talk, videos, Power Point presentation, animations.

II. COURSE CONTENT

Module-1: 8 Hours

Introduction, Masonry units, materials and types: History of masonry, Masonry units – Brick- Types of bricks, Tests conducted on bricks. Other masonry units - stone, clay block, concrete block, laterite block, stabilized mud block masonry units Masonry materials – Classification and properties of mortars, selection of mortars. Cracks - Cracks in masonry structures, Type of crack, causes and prevention of crack.

RBT Levels: L1 L2 L3

Module-2: 8 Hours

Strength of Masonry in Compression: Behaviour of Masonry under compression, strength and elastic properties, influence of masonry unit and mortar Characteristics, effect of masonry unit height on compressive strength, influence of masonry bonding patterns on strength, prediction of strength of masonry in Indian context, Failure theories of masonry under Compression. Effects of slenderness and eccentricity, effect of rate of absorption, effect of curing, effect of ageing, workmanship on compressive strength

Masonry Bond Strength and Masonry in Shear and Flexure: Bond between masonry unit and mortar, tests for determining flexural and shear bond strengths, factors affecting bond strength, effect of bond strength on compressive strength, orthotropic strength properties of masonry in flexure, shear strength of masonry, test procedures for evaluating flexural and shear strength.

RBT Levels: L1 L2 L3

Module-3: 8 Hours

Design of load bearing masonry wall Permissible stresses**,**Types of walls, permissible compressive stress, stress reduction and shape modification factors, increase in permissible stresses for eccentric vertical and lateral load, permissible tensile stress, and shear stresses. Design Considerations: Effective height of walls and columns, openings in walls, effective length,

effective thickness, slenderness ratio, eccentricity, load dispersion, arching action in lintels. Problems on design considerations for solid walls, cavity walls, wall with pillars.

Load considerations and design of Masonry subjected to axial loads: Design criteria, design examples of walls under UDL, solid walls, cavity walls, solid wall supported at the ends by cross wall, walls with piers.

RBT Levels: L1 L2 L3

Module-4:	8 Hours

Design of walls subjected to concentrated axial loads: Solid walls, cavity walls, solid wall supported at the ends by cross wall, walls with piers, design of wall with openings. Design of walls subjected to eccentric loads: Design criteria – stress distribution under eccentric loads – problems on eccentrically loaded solid walls, cavity walls, walls with piers.

Design of Laterally and transversely loaded walls: Design criteria, design of solid wall under wind loading, design of shear wall – design of compound walls.

RBT Levels: L1 L2 L3

Module-5:	8 Hours

Earthquake resistant masonry buildings: Behaviour of masonry during earthquakes, concepts and design procedure for earthquake resistant masonry, BIS codal provisions. In- filled frames: Types – modes of failures.

Reinforced brick masonry Methods of reinforcing masonry, Analysis of reinforced Masonry under axial, flexural and shear loading.

RBT Levels: L1 L2 L3

IV.COURSE OUTCOMES

CO1	Achieve Knowledge on properties of masonry units.
CO2	Evaluate Strength of Masonry in Compression, shear and flexure.
CO3	Design of load bearing masonry wall.
CO4	Design of wall subjected to axial, transverse and lateral loads.
CO5	Evaluate the strength and stability of the reinforced masonry structures.

V.CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1	2	2	2										2			
CO2	2	2	2										2			
CO3	2	2	2										2			
CO4	2	2	2										2			

VI.Assessment Details (CIE & SEE)

General Rules: Refer Annexure Section 1

Continuous Internal Evaluation (CIE): Refer Annexure Section 1

Semester End Examination (SEE): Refer Annexure Section 1

VII.Learning Resources

VII.(a) Reference Books:

1	Structural Masonry	Hendry, A.W.	1990	Macmillan Education Ltd
2	Structural masonry	K.S. Jagadish	1992	I.K. International
3	Brick and Reinforced Brick Structures	Dayaratnam P	1987	McGraw Hill, New York
4	Building and Construction Materials	M. L. Gambhir	1995	Mc Graw Hill education Pvt.Ltd
5	Handbook On Masonry Design and Construction	-	1996	BIS

VII(b): Web links and Video Lectures (e-Resources):
https://www.youtube.com/watch?v=s4CN6aVKhPo&list=PLEE5D02698EAAF2C0.
VIII: Activity Based Learning / Practical Based Learning/Experiential learning:
Conduction of technical seminars on recent research activities Group Discussion Site visit

Semester:	II	**Course Type:**	PEC		
Course Title: RELIABILITY ANALYSIS OF STRUCTURES					
Course Code:	23CSEP224			**Credits:**	3
Teaching Hours/Week (L:T:P:O)			3:0:0:0	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	3 Hours

I.Course Objectives:

To impart the concept knowledge on data analysis and probability in the context of structural engineering. To demonstrate uncertainty in structural engineering with respect to randomness of variables and knowledge of probability distributions. To demonstrate principles of structural reliability in order to assess safety due to randomness of variables. To perform computations of structural reliability using various methods at component and system level.

II.Teaching-Learning Process (General Instructions):

Chalk and talk, videos, Power Point presentation, animations.

III. COURSE CONTENT

Module-1: 8 Hours

Preliminary Data Analysis: Graphical representation- Histogram, frequency polygon, Measures of central tendency- grouped and ungrouped data, measures of dispersion, measures of asymmetry. Curve fitting and Correlation: Fitting a straight line, curve of the form y = abx, and parabola, Coefficient of correlation.

RBT Levels: L1 L2 L3

Module-2: 8 Hours

Probability Concepts: Random Events-Sample space and events, Venn diagram and event space, Measures of probability interpretation, probability axioms, addition rule, multiplication rule, conditional probability, probability tree diagram, statistical independence, total probability theorem and Baye's theorem.

RBT Levels: L1 L2 L3

Module-3: 8 Hours

Random variables: Probability mass function, probability density function, Mathematical expectation, Chebyshev's theorem. Probability distributions: Discrete distributions- Binomial and Poison distributions, Continuous distributions- Normal, Log normal distributions.

RBT Levels: L1 L2 L3

Module-4: 8 Hours

Reliability Analysis: Measures of reliability-factor of safety, safety margin, reliability index, performance function and limiting state. Reliability Methods-First Order Second Moment Method (FOSM), Point Estimate Method (PEM), and Advanced First Order Second Moment Method (Hasofer-Lind's method).

RBT Levels: L1 L2 L3

Module-5:	8 Hours

Simulation Techniques: Monte Carlo simulation- Statistical experiments, Confidence limits, sample size and accuracy, Generation of random numbers- random numbers with standard uniform distribution, continuous random variables (normal and lognormal), discrete random variables. System reliability: series, parallel and combined systems.

RBT Levels: L1 L2 L3

IV. COURSE OUTCOMES

CO1	Understand the concepts of statistics for probabilistic analysis and importance of uncertainty in structural analysis and design.
CO2	Apply the theoretical principles of randomness of variables in structural engineering through density functions.
CO3	Analyze components of structure to assess safety using concepts related to structural reliability by various methods
CO4	Evaluate the safety reliability index at system level.

V. CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1	2	2	2										2			
CO2	2	2	2										2			
CO3	2	2	2										2			
CO4	2	2	2										2			

VI. Assessment Details (CIE & SEE)

General Rules: Refer Annexure Section 1

Continuous Internal Evaluation (CIE): Refer Annexure Section 1

Semester End Examination (SEE): Refer Annexure Section 1

VII. Learning Resources

VII .(a) Reference Books:

1	Structural Reliability Analysis and design	Ranganathan R	1999	Jaico publishing house
2	Reliability based Analysis and Design for Civil Engineers	Devaraj & Ravindra. R	2017	I.K. International
3	Probability concepts in engineering planning and design, Volume –I, II	Ang, A. H. S., and Tang, W. H.	1984	John Wiley and sons, Inc, New York.
4	Reliability based design in civil engineering.	Milton, E. Harr	1987	Mc Graw Hill education Pvt. Ltd
5	Statistics, “Probability and reliability for Civil and Environmental Engineers	Nathabandu, T., Kottegoda, and Renzo Rosso	1998	Mc Graw Hill international edition, Singapore

VII(b): Web links and Video Lectures (e-Resources):

https://www.youtube.com/watch?v=uutg8jKrL9w
https://www.youtube.com/watch?v=OwuT0B2Uywc&list=PLFEqFwyPC3WwjTp4KDuannMGGtAUVnfE4
https://www.youtube.com/watch?v=n-YMzb6xTsA&list=PLOnJQiDsowogZnvfY3HUR34pjrH7hZLpD

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

Conduction of technical seminars on recent research activities
Group Discussion
Site visit

Semester:	II	**Course Type:**	PCCL		
Course Title: Advanced Computation Laboratory					
Course Code:	23CSEL26			**Credits:**	02
Teaching Hours/Week (L:T:P:O)			1:0:2:0	**Total Hours:**	42
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Practical			**Exam Hours:**	3 Hours

I. Course Objectives:

To analyze the structure using FE based Software.
To learn principles of design
To investigate the performance of structural elements
To design the structural components using excel sheets.

II. Teaching-Learning Process (General Instructions):

Chalk and talk, videos, Power Point presentation, animations.

Sl. No.	Experiments / Programs / Problems
1	Static and Dynamic analysis and design of Multistorey Building structures using any FE based software.
2	Design of RCC and Steel Tall structures using any FE based software.
3	Analysis of folded plates and shells using any FE software.
4	Preparation of EXCEL sheets for structural design.

III. COURSE OUTCOMES

CO1	Achieve Knowledge of design and development of programming skills
CO2	Understand the principles of structural analysis and design
CO3	Summarize the performance of structures for static and dynamic forces.

IV. CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1	2						2	1					1			
CO2	3	2											1			
CO3	3	2											1			

V. Assessment Details (CIE & SEE)				
General Rules: Refer Annexure Section 3				
Continuous Internal Evaluation (CIE): Refer Annexure Section 3				
Semester End Examination (SEE): Refer Annexure Section 3				
VI. Learning Resources				
VI.(a) Reference Books:				
1	Advanced Structural Engineering Laboratory Manual	Dr. S.K. Panigrahi	2022	S.K. Kataria & Sons
2	Structural Engg. Models and Methods for Statics, Instability and Inelasticity	Adnan Ibrahimbegovic , Rosa-Adela Mejia-Nava	2023	Springer
VI(b): Web links and Video Lectures (e-Resources):				
https://www.youtube.com/watch?v=cGTebUY2xQc&list=PLNJ364_NfpLWcp0Hck9f2rOJUIudOlaYi				
VII: Activity Based Learning / Practical Based Learning/Experiential learning:				
Seminar, Assignments, Quiz				

Semester:	III	**Course Type:**	PCC		
Course Title: DESIGN OF BRIDGES					
Course Code:	23CSET31			**Credits:**	3
Teaching Hours/Week (L:T:P:O)			3:0:0:0	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	3 Hours

I. Course Objectives:

Eexposed to the Engineering aspects of concrete bridges.
Various loads that act on the bridges as per IRC.
Analysis for the maximum BM and SF at critical section using load distributing theories.
Design of various components using limit state method with reinforcement details.

II.Teaching-Learning Process (General Instructions):

Chalk and talk, videos, Power Point presentation, animations.

III.COURSE CONTENT

Module-1: 8 Hours

Introduction & Design of Slab Culvert: Bridge Engineering and its development in past, Ideal site selection for Bridges, Bridge classifications, Forces acting on Bridge. Analysis for maximum BM and SF at critical sections for Dead and Live load as per IRC class A, B, AA tracked and wheeled vehicles. Structural design of slab culvert using limit state method with reinforcement details.

RBT Levels: L1 L2 L3

Module-2: 8 Hours

Box Culvert: Introduction to box culvert, advantage of structural continuity, Analysis for maximum BM and SF at critical sections using moment distribution method for various load combinations such as Dead, Surcharge, Soil, Water and Live load as per IRC class A, B, AA tracked and wheeled vehicles. Structural design of box culvert using limit state method with reinforcement details.

RBT Levels: L1 L2 L3

Module-3: 8 Hours

T Beam Bridge: Components of T Beam Bridge, Load transfer mechanism, Proportioning the of Components, Analysis of Slab using Pigeauds Method for maximum BM and SF at critical sections for Dead and Live load as per IRC class A, B, AA tracked and wheeled vehicles and design of Slab using limit state method with reinforcement details. Analysis of Cross Girder for maximum BM and SF at critical sections for Dead and Live load as per IRC class A, B, AA tracked and wheeled vehicles and design of slab using limit state method with reinforcement details. Analysis of Main Girder using Courbon's Method for maximum BM and SF at critical sections for Dead and Live load as per IRC class A, B, AA tracked and wheeled vehicles and design of Main Girder using limit state method with reinforcement details.

RBT Levels: L1 L2 L3

Module-4:	8 Hours
PSC Bridge: Introduction to Pre & Post Tensioning, Proportioning of Components, Analysis & Structural Design of Slab, Analysis of Main Girder Using Courbon's Method for IRC Class AA, Tracked vehicle, Calculations of Prestressing Force, Calculations of Stresses, Cable profile, Design of End Block, Detailing of Main Girder. **RBT Levels: L1 L2 L3**	
Module-5:	8 Hours
Balanced Cantilever Bridge: Introduction & Proportioning of Components, Analysis of Main Girder Using Courbon's Method for IRC Class AA, Tracked vehicle Design of Simply Supported Portion, Cantilever Portion, Articulation, using limit state method with reinforcement details. **RBT Levels: L1 L2 L3**	

IV.COURSE OUTCOMES

CO1	Describe historical growth, select ideal site and bridge, calculate values of design parameters of slab culvert at critical section as per IRC, design and detailing required for the execution of the project.
CO2	Carry out analysis of box culvert as per IRC to obtain the values of design parameters and to design and detail the components following IS code procedure.
CO3	Demonstrate the use of Pigeauds Method and Courbon's Method in the analysis of T beam bridge as per IRC, design to obtain the safe dimensions various components, optimum reinforcement required following IS code procedure.
CO4	Display the use of Courbon's Method in the analysis of PSC bridge as per IRC, design to obtain the safe value of prestressing force, obtain the dimensions of various components to keep the stresses within codal provisions following IS code procedure.
CO5	Analysis a balanced cantilever bridge as per IRC and to obtain the safe values of design parameters and to design and detail the components as per IS code procedure.

V.CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1	2	2	2										2			
CO2	2	2	2										2			
CO3	2	2	2										2			
CO4	2	2	2										2			

VI. Assessment Details (CIE & SEE)

General Rules: Refer Annexure Section 1

Continuous Internal Evaluation (CIE): Refer Annexure Section 1

Semester End Examination (SEE): Refer Annexure Section 1

VII. Learning Resources

VII.(a) Reference Books:

1	Essentials of Bridge Engineering	Dr D Johnson Victor	1998	Oxford & IBH Publishing Co
2	Design of Bridges	Dr N Krishna Raju	1992	Oxford & IBH Publishing Co
3	Principles and Practice of Bridge Engineering	S P Bindra	1994	Dhanpat Rai & Sons
4	IRC 6 -1966	-	-	The Indian Road Congress New Delhi
5	IRC 21 - 1966	-	-	The Indian Road Congress New Delhi

VII(b): Web links and Video Lectures (e-Resources):
https://www.youtube.com/watch?v=RB2k5hSYO3U&list=PLXKZsEFKU__HHtsCMaAIPB3tr5Ht2Bdge https://www.youtube.com/watch?v=RB2k5hSYO3U&list=PL3MO67NH2XxJxMvfgAgdohx5-ksPZruA8
VIII: Activity Based Learning / Practical Based Learning/Experiential learning:
Conduction of technical seminars on recent research activities Group Discussion Site visit

Semester:	III	**Course Type:**	**PEC**		
Course Title: DESIGN CONCEPTS OF SUBSTRUCTURES					
Course Code:	23CSEP331			**Credits:**	3
Teaching Hours/Week (L:T:P:O)			3:0:0:0	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	3 Hours

I. Course Objectives:

The objective of this course is to make students to learn principles of subsoil exploration, To design the sub structures. To evaluate the soil shear strength parameters.

II.Teaching-Learning Process (General Instructions):

Chalk and talk, videos, Power Point presentation, animations.

III. COURSE CONTENT

Module-1: 8 Hours

Introduction, Site investigation, Insitu testing of soils, Subsoil exploration, Classification of foundations systems. General requirement of foundations, Selection of foundations, Computations of Loads, Design concepts.

RBT Levels: L1 L2 L3

Module-2: 8 Hours

Concept of soil shear strength parameters Settlement Analysis of footings, Shallow foundations in clay, Shallow foundation in sand & C Φ soils, Footings on layered soils and sloping ground, Design for Eccentric or Moment Loads.

RBT Levels: L1 L2 L3

Module-3: 8 Hours

Types of rafts, bearing capacity & settlements of raft foundation, Rigid methods, Flexible methods, soil structure interaction, different methods of modelling the soil. Combined footings (rectangular & trapezoidal), strap footings & wall footings, Raft – super structure interaction effects & general concepts of structural design, Basement slabs

RBT Levels: L1 L2 L3

Module-4: 8 Hours

Deep Foundations: Load Transfer in Deep Foundations, Types of Deep Foundations, Ultimate bearing capacity of different types of piles in different soil conditions, laterally loaded piles, tension piles & batter piles, Pile groups: Bearing capacity, settlement, uplift capacity, load distribution between piles, Proportioning and design concepts of piles. **RBT Levels: L1 L2 L3**

Module-5: 8 Hours

Types of caissons, Analysis of well foundations, Design principles, well construction and sinking. Foundations for tower structures: Introduction, Forces on tower foundations, Selection of foundation type, Stability and design considerations, Ring foundations – general concepts.

RBT Levels: L1 L2 L3

IV.COURSE OUTCOMES

CO1	Achieve Knowledge of site investigation and design concepts of foundation.
CO2	Understand the concepts of Settlement analysis.
CO3	Design various types of shallow foundation
CO4	Design pile foundation
CO5	Understand design concept of caisson, tower foundation and ring foundation.

V.CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1	2	2	2										2			
CO2	2	2	2										2			
CO3	2	2	2										2			
CO4	2	2	2										2			

VI. Assessment Details (CIE & SEE)

General Rules: Refer Annexure Section 1

Continuous Internal Evaluation (CIE): Refer Annexure Section 1

Semester End Examination (SEE): Refer Annexure Section 1

VII. Learning Resources

VII.(a). Reference Books:

1	Analysis & Design of Substructures	Swami Saran	1998	Oxford & IBH Pub. Co. Pvt. Ltd.
2	Design of Foundation Systems	Nainan P Kurian	1992	Narosa Publishing House
3	Optimum Structural Design	Uri Kirsch	1981	McGraw Hill, New York
4	Foundation Engineering	R.B. Peck, W.E. Hanson & T.H. Thorburn	1984	Wiley Eastern Ltd
5	Foundation Analysis and Design	J.E. Bowles	1996	McGraw-Hill Int. Editions

VII(b): Web links and Video Lectures (e-Resources):

https://www.youtube.com/watch?v=lsYFtwwlHIw&list=PLbRMhDVUMngeiZjKPTPEFl1CByXmYX3Kv
https://youtu.be/6mAaqD7BdmI?si=UqCWRiQVxOd6Xnfd
https://youtu.be/p3tzvx9-E_I?si=YIvSr3CbDF22MJv7

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

Conduction of technical seminars on recent research activities
Group Discussion
Site visit

Semester:	III	**Course Type:**	PEC		
Course Title: Composites Structures					
Course Code:	23CSEP332			**Credits:**	3
Teaching Hours/Week (L:T:P:O)			3-0-0-0	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	3 Hours

I.Course Objectives:

1) To compute the mechanical properties of fiber reinforced composites by knowing the properties of constituent materials.
2) To analyse and design composite laminates with different configuration.

II.Teaching-Learning Process :

Chalk and talk, videos, Power Point presentation, animations.

III.COURSE CONTENT

Module-1: Introduction to Composite Materials — 8 Hours

Introduction to composite materials: Definition, classification, and characteristics of composite Materials – fibrous composites, laminated composites, particulate composites. Constituents of composite materials: Reinforcements, Matrix, Coupling agents, coatings & fillers.
Reinforcements: Introduction, Glass Fibers, Boron Fibers, Carbon Fibers, Organic Fibers, Ceramic Fibers, Whiskers, Other Non-oxide Reinforcements, Comparison of Fibers
Matrix Materials: Polymers, Metals and Ceramic Matrix Materials.

RBT Levels: L2

Module-2: Macro mechanical Analysis of a Lamina — 8 Hours

Hooke's Law for Different Types of Materials: Anisotropic Material, Monoclinic Material, Orthotropic Material (Orthogonally Anisotropic)/Specially Orthotropic, Transversely Isotropic Material, Isotropic Material, Hooke's Law for a Two-Dimensional Unidirectional Lamina: Plane Stress Assumption, Reduction of Hooke's Law in Three Dimensions to Two Dimensions, Relationship of Compliance and Stiffness Matrix to Engineering Elastic Constants of a Lamina, Hooke's Law for a Two-Dimensional Angle Lamina, Engineering Constants of an Angle Lamina, Invariant Form of Stiffness and Compliance Matrices for an Angle Lamina,

RBT Levels: L3

Module-3: Micromechanical Analysis of a Lamina — 8 Hours

Volume and Mass Fractions, Density, and Void Content, Evaluation of the Four Elastic Moduli, Strength of Materials Approach, Semi-Empirical Models, Elasticity Approach, Ultimate Strengths of a Unidirectional Lamina, Longitudinal Tensile Strength, Longitudinal Compressive Strength, Transverse Tensile Strength, Transverse Compressive Strength, In-Plane Shear Strength, Coefficients of Thermal Expansion, Coefficients of Moisture Expansion. Numerical examples

RBT Levels: L3

Module-4: Macro mechanical Analysis of Laminates	8 Hours
Macro mechanical Analysis of Laminates, Laminate Code, Stress-Strain Relations for a Laminate: One-Dimensional Isotropic Beam Stress-Strain Relation, Strain-Displacement Equations, Strain and Stress in a Laminate, Force and Moment Resultants Related to Midplane Strains and Curvatures, In-Plane and Flexural Modulus of a Laminate, In-Plane Engineering Constants of a Laminate, Flexural Engineering Constants of a Laminate, Hygrothermal Effects in a Laminate, Hygrothermal Stresses and Strains, Coefficients of Thermal and Moisture Expansion of Laminates, Warpage of Laminates. Numerical examples.	
RBT Levels: L3	
Module-5: Failure, Analysis, and Design of Laminates	8 Hours
Special Cases of Laminates: Symmetric Laminates, Cross-Ply Laminates, Angle Ply Laminates, Antisymmetric Laminates, Balanced Laminate, Quasi-Isotropic Laminates. Failure Criterion for a Laminate. Design of a Laminated Composite, Design of a Laminated Composite, Sandwich Composites: Long-Term Environmental Effects, Interlaminar Stresses, Impact Resistance, Fracture Resistance, Fatigue Resistance.	
RBT Levels: L3	

IV.COURSE OUTCOMES

CO1	Explain the classification of composite materials
CO2	Compute the mechanical properties of composite lamina
CO3	Obtain the strength of an arbitrarily oriented lamina.
CO4	Calculate the stresses and strains in a laminate
CO5	Analyse and design laminates configuration for the given load

V.CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1	3												3			
CO2	3	3											3			
CO3	3	3											3			
CO4	3	3											3			
CO5	3	3											3			

VI. Assessment Details (CIE & SEE)

General Rules: Refer Annexure Section 1

Continuous Internal Evaluation (CIE): Refer Annexure Section 1

Semester End Examination (SEE): Refer Annexure Section 1

VII. Learning Resources

VII.(a): Reference Books:

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1	Mechanics of composite materials	Robert M. Jones	2, 1999	Taylor & Francis
2	Mechanics of Composite Materials	Autar K. Kaw	2, 2006	CRC Press

3	Engineering Mechanics of Composite Materials	Isaac M. Daniel, Ori Ishai	3, 2007	Oxford University Press
4	Mechanics of Composite Materials and Structures	Madhujit Mukhopadhyay	2, 2005	Universities Press,India
5	Composite Science and Engineering	`K. K. Chawla	3, 2012	Springer Verlag

VII(b): Web links and Video Lectures (e-Resources):

https://archive.nptel.ac.in/courses/112/103/112103308/#
https://archive.nptel.ac.in/courses/112/104/112104229/
https://youtu.be/M3QP9TztJ9A?si=l3jTcbwTkGqcMG0F
https://youtu.be/k1TbYCfEPLk?si=4EXEffvyIwtBdgbN

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

Seminar, Assignments, Quiz

Semester:	III	**Course Type:**	PEC		
Course Title: DESIGN OF INDUSTRIAL STRUCTURES					
Course Code:	23CSEP333			**Credits:**	3
Teaching Hours/Week (L:T:P:O)			3:0:0:0	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	3 Hours

I. Course Objectives:

To learn principles of Design of industrial building,
To design different components of industrial structures and to detail the structures.
To evaluate the performance of the Pre-engineered buildings

II.Teaching-Learning Process (General Instructions):

Chalk and talk, videos, Power Point presentation, animations.

III.COURSE CONTENT

Module-1:	8 Hours

Analysis of industrial building for Gravity and Wind load. Analysis and design of framing components namely, girders, trusses, gable frames

RBT Levels: L2 L3 L4

Module-2:	8 Hours

Analysis and design of gantry column (stepped column / column with bracket), purlins, girts, bracings including all connections.

RBT Levels: L2 L3 L4

Module-3:	8 Hours

Analysis of transmission line towers for wind load and design of towers including all connections.

RBT Levels: L2 L3 L4

Module-4:	8 Hours

Forms of light gauge sections, Effective width computation of unstiffened, stiffened, multiple stiffened compression elements of cold formed light gauge sections. Concept of local buckling of thin elements. Limiting width to thickness ratio. Post buckling strength.

RBT Levels: L2 L3 L4

Module-5:	8 hrs

Concept of Pre- engineered buildings, Design of compression and tension members of cold formed light gauge sections, Design of flexural members (Laterally restrained / laterally unrestrained).

RBT Levels: L1 L2 L3

IV.COURSE OUTCOMES

CO1	Achieve Knowledge of design and development of problem-solving skills.
CO2	design of gantry column
CO3	Analysis of transmission line towers and light gauge sections
CO4	Understands the concept of pre-engineered buildings.

V.CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1	2	2	2										2			
CO2	2	2	2										2			
CO3	2	2	2										2			
CO4	2	2	2										2			

VI. Assessment Details (CIE & SEE)

General Rules: Refer Annexure Section 1

Continuous Internal Evaluation (CIE): Refer Annexure Section 1

Semester End Examination (SEE): Refer Annexure Section 1

VII.Learning Resources

VII.(a) Reference Books:

1	Design of Steel Structures	N Subramanian	1999	oxford University Press
2	Design of Steel Structures	B.C. Punmia, A.K. Jain	2017	Laxmi Publications
3	Design of Steel Structures " Vol 1 and Vol.2,	Ramchandra and Virendra Gehlot.	1984	Scientific Publishers
4	Limit State Design of Steel Structures	Duggal	1987	TMH
5	IS800-2007, IS875-1987, IS-801-1975. Steel Tables, SP 6(1)	-	-	BIS

VII(b): Web links and Video Lectures (e-Resources):

https://www.youtube.com/watch?v=qJV5zdx7NJs
https://www.youtube.com/watch?v=5nLJHnCUMRI
https://youtu.be/qRiXLB9zM-c?si=qCiXaJmcY1APGbxT

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

Conduction of technical seminars on recent research activities
Group Discussion
Site visit

Semester:	III	**Course Type:**	PEC		
Course Title: STRUCTURAL HEALTH MONITORING					
Course Code:	23CSEP334			**Credits:**	3
Teaching Hours/Week (L:T:P:O)			3:0:0:0	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	3 Hours

I.Course Objectives:

Learn the fundamentals of structural health monitoring.
Study the various vibration-based techniques for structural health monitoring.
Learn the structural health monitoring using fiber-optic and Piezoelectric sensors.
Study the structural health monitoring using electrical resistance and electromagnetic techniques.

II.Teaching-Learning Process (General Instructions):

Chalk and talk, videos, Power Point presentation, animations.

III. COURSE CONTENT

Module-1: 8 Hours

Introduction to Structural Health Monitoring: Definition of structural health monitoring (SHM), Motivation for SHM, SHM as a way of making materials and structures smart, SHM and biomimetics, Process and pre-usage monitoring as a part of SHM, SHM as a part of system management, Passive and active SHM, NDE,SHM and NDECS, Variety and multidisciplinary: the most remarkable characters of SHM, Birth of the SHM Community.

RBT Levels: L2

Module-2: 8 Hours

Basic vibration concepts for SHM, Mathematical description of structural systems with damage, Linking experimental and analytical data, Damage localization and quantification, Solution of the equation system, Neural network approach to SHM, A simulation example, Time-domain damage detection methods for linear systems, Damage identification in non-linear systems, Applications.

RBT Levels: L2

Module-3: 8 Hours

Classification of fiber-optic sensors, The fiber Bragg grating as a strain and temperature sensor, Structures with embedded fiber Bragg gratings, Fiber Bragg gratings as damage sensors for composites, Examples of applications in aeronautics and civil engineering

Levels: L2

Module-4: 8 Hours

The use of embedded sensors as acoustic emission (AE) detectors, State-the-art and main trends in piezoelectric transducer-based acousto-ultrasonic SHM research, Electromechanical impedance.

RBT Levels: L2

Module-5: 8 Hours

Composite damage, Electrical resistance of unloaded composite, Composite strain, and damage monitoring

by electrical resistance, Damage localization. Capacitance probe for cover concrete, Application for external post-tensioned cables.

RBT Levels: L1 L2 L3

IV.COURSE OUTCOMES

CO1	Emphasize the importance of structural health monitoring as part of system management
CO2	Adopt vibration-based techniques for health monitoring of a few structural elements and components
CO3	Use fibre-optic and other types of sensors for estimating damage in a structural element
CO4	Characterise the defect or damage in a structural element using piezo-electric sensors or acoustic emission methods
CO5	Apply general principles of structural health monitoring using Electrical Resistance and Capacitive Methods

V.CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1	2	2											2			
CO2	2	2											2			
CO3	2	2											2			
CO4	2	2											2			

VI. Assessment Details (CIE & SEE)

General Rules: Refer Annexure Section 1

Continuous Internal Evaluation (CIE): Refer Annexure Section 1

Semester End Examination (SEE): Refer Annexure Section 1

VII.Learning Resources

VII.(a)Reference Books:

1	Structural Health Monitoring	Daniel Balageas, Claus-Peter Fritzen, Alfredo Güemes	1, 2006	Wiley ISTE
2	Continuum Mechanics Fundamentals	Health monitoring of structural materials and components- Methods with Applications	1, 2007	John Wiley and Sons
3	Structural Health Monitoring and Intelligent Infrastructure	J. P. Ou, H. Li and Z. D. Duan	1, 2006	Taylor and Francis Group
4	Structural Health Monitoring with Wafer Active sensors, smart materials and structures	Victor Giurglutiu	1, 2007	Gandhi and Thomson
5	Structural Health Monitoring: current status and perspective	Fu Kuo Chang	1, 1997	CRC Press, Inc.

VII(b): Web links and Video Lectures (e-Resources):

https://archive.nptel.ac.in/courses/114/106/114106046/
https://youtu.be/UbmToxTl7gs?si=rVqe3jOjZfyPjCKL
https://youtu.be/UsbhgrtyLZs?si=JJV0FKiN5-gGW6tt

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

Conduction of technical seminars on recent research activities
Group Discussion
Site visit

Semester:	III	**Course Type:**	PEC		
Course Title: SPECIAL CONCRETE					
Course Code:	**23CSEP341**			**Credits:**	03
Teaching Hours/Week (L:T:P:O)			3:0:0:0	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	3 Hours

I.Course Objectives:

3. To obtain an in-depth knowledge of a wide variety of advanced topics in concrete technology and practice.
4. Concrete, being the popular materials for the construction material for civil infrastructure building, is undergoing significant changes in the recent times, in relation to the constituent materials used, production technology, testing methods and performance requirements.

II.Teaching-Learning Process (General Instructions):

Chalk and talk, videos, Power Point presentation, animations.

III.COURSE CONTENT

Module-1:	8 Hours

Fibre reinforced concrete: History, mechanism, different types of fibres, Aspect ratio, Volume of fibres, orientation of fibres, balling effect, properties of fibre reinforced concrete, applications of fibre reinforced concrete. Types of Fibre reinforced concrete.

Ferro cement: Definition, different materials used, casting techniques, properties of Ferro cement, applications.

RBT Levels: L1 L2

Module-2:	8 Hours

Light Weight Concrete: Introduction, classification, properties, strength and durability, mix proportioning and problems

High Density Concrete: Radiation shielding ability of concrete, materials for high density concrete, mix proportioning, properties in fresh and hardened state, placement methods.

RBT Levels: L2 L3

Module-3:	8 Hours

Ready mix concrete: Concept, ready mix concrete plants, difficulties faced and their solution , use of admixtures in ready mix concrete, economics and quality control aspects of ready mix concrete.
High Performance Concrete: Constituents, mix proportioning, properties in fresh and hardened states, applications & limitations

RBT Levels: L2 L3

Module-4:	8 Hours

Polymer concrete: Polymers, resins, polymerization, different types of polymer concrete like polymer impregnated concrete, polymer concrete (Resin concrete) and polymer modified concrete, their properties and applications.
Self-compacting concrete: Development of SCC, basic principles and requirements, workability tests for SCC, mix design of SCC, acceptance criteria for SCC, adoption of SCC in the precast industry, present status of SCC

RBT Levels: L2 L3

Module-5:	8 Hours

Concrete from Industrial wastes:
a. Blast furnace slag cement concrete
b. Fly-ash concrete
c. Silica fume concrete
d. Recycled aggregate Concrete

RBT Levels: L2 L3

IV.COURSE OUTCOMES

CO1	On complete of this course the students will able to understand the construction material, meeting the demanding performance requirements based on men, machines and materials.
CO2	Innovative special concrete with mixes, applications and limitations.
CO3	Testing methods developed to increase the scope of concrete usage as an advanced material.

V.CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1	2	1		2								1	1			
CO2	2	1		2								2	1			
CO3	2	1		2								2	1			

VI. Assessment Details (CIE & SEE)

General Rules: Refer Annexure Section 1

Continuous Internal Evaluation (CIE): Refer Annexure Section 1

Semester End Examination (SEE): Refer Annexure Section 1

VII: Learning Resources

VII(a): Reference Books:

1	High performance concrete	Aitcin P.C.	1 and 1998	E and FN, Spon London
2	CONCRETE, "Microstructure, Properties and Materials"	Kumar Mehta.P, Paul J.N.Monterio		TataMcGraw Hill

3	Rixom.R. and Mailvaganam.N	Chemical admixtures in concrete	1999	E and FN, Spon London
4	Rudnai.G	Light Weight concrete	1963	Akademiaikiado, Budapest

VII(b): Web links and Video Lectures (e-Resources):

https://onlinecourses.nptel.ac.in/noc23_ce61/preview

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

Seminar, Assignments, Quiz

Semester:	III	**Course Type:**	PEC		
Course Title: Prefabricated Structures					
Course Code:	23CSEP342			**Credits:**	3
Teaching Hours/Week (L:T:P:O)			3:0:0:0	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	3 Hours

I. Course Objectives:

Learn the fundamentals of structural health monitoring.
Study the various vibration-based techniques for structural health monitoring.
Learn the structural health monitoring using fiber-optic and Piezoelectric sensors.
Study the structural health monitoring using electrical resistance and electromagnetic techniques.

II.Teaching-Learning Process (General Instructions):

Chalk and talk, videos, Power Point presentation, animations.

III.COURSE CONTENT

Module-1:	8 Hours

General Principles of Pre-Fabrication Comparison with monolithic construction, Types of prefabrication, site and plant prefabrication, Economy of prefabrication, Modular coordination, Standardization, Planning for Components of prefabricated structures, Disuniting of structures, Handling and erection stresses, Elimination of erection stresses (Beams, columns) Symmetrical frames.

RBT Levels: L2 L3

Module-2:	8 Hours

Prefabricated Elements Roof and floor panels, ribbed floor panels, wall panels, footings, Joints for different structural Connections, Effective sealing of joints for water proofing, Provisions for non-structural fastenings, Expansion joints in pre-cast construction. Construction of precast structural components (Purlins, Principal rafters, roof trusses, lattice girders, gable frames, Single span single storeyed frames, Single storeyed buildings – slabs, beams and columns.)

RBT Levels: L2 L3 L4

Module-3:	8 Hours

Production and Hoisting Technology Choice of production setup, Manufacturing methods, Stationary and mobile production, Planning of production setup, Storage of precast elements, Dimensional tolerances, Acceleration of concrete hardening. Equipment for hoisting and erection, Techniques for erection of different types of members like Beams, Slabs, Wall panels and Columns, Vacuum lifting pads.

RBT Levels: L2 L3 L4

Module-4:	8 Hours

Precast sandwich Panels, Pre-stressed concrete solid flat slabs, Hollow core slab/panels, Pre-stressed concrete Double "T", Bridge, Precast segmental Box Girders, Specifications and design considerations.

RBT Levels: L2 L3 L4

Module-5:	8 Hours

Pre-Engineered Buildings Introduction, Advantages, Pre Engineered Buildings Vs. Conventional Steel Buildings, Design Consideration of Pre Engineered Buildings (PEB) – Applications.

RBT Levels: L1 L2 L3

IV.COURSE OUTCOMES

CO1	Achieve Knowledge of General Principles of Pre-Fabrication.
CO2	Evaluate concept in construction of precast elements
CO3	Understand production and hoisting technology.
CO4	Understands the concept of pre-engineered buildings.

V.CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1	2	2	2										2			
CO2	2	2	2										2			
CO3	2	2	2										2			
CO4	2	2	2										2			

VI. Assessment Details (CIE & SEE)

General Rules: Refer Annexure Section 1

Continuous Internal Evaluation (CIE): Refer Annexure Section 1

Semester End Examination (SEE): Refer Annexure Section 1

VII. Learning Resources

VII.(a): Reference Books:

1	Prefabricated Concrete for Industrial and Public Structures	L. Mokk	2007	Publishing House of the Hungarian Academy of Sciences
2	Manual of Precast Concrete Construction Vol. I, II, III & IV	T. Koncz	1971	Berlin
3	Building with Large Prefabricates	B. Lewicki	1998	Elsevier Publishing Company
4	Structural Design Manual	-	2009	Society for the Studies in the use of Precast Concrete
5	Precast concrete design and Applications	Hass, A.M.	1983	Applied Science Publishers

VII(b): Web links and Video Lectures (e-Resources):

https://www.youtube.com/watch?v=VHOC0ZaZErE
https://www.youtube.com/watch?v=FdbHC4sfqBo

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

Conduction of technical seminars on recent research activities
Group Discussion
Site visit

Semester:	III	**Course Type:**	PEC		
Course Title: Fracture Mechanics					
Course Code:	23CSEP343			**Credits:**	3
Teaching Hours/Week (L:T:P:O)			3-0-0-0	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	3 Hours

I.Course Objectives:

- To compute the stress intensity factor, strain energy release rate and the stress and strain fields around a crack tip for linear and nonlinear materials.
- Know experimental methods to determine the fracture toughness.
- Use the design principles of materials and structures using fracture mechanics approach.

II.Teaching-Learning Process:

Chalk and talk, videos, Power Point presentation, animations.

III.COURSE CONTENT

Module-1: Stress concentration in elastic materials — 8 Hours

Theory of stress concentration in elastic materials, stress concentration factors around circular and elliptic holes. Influence of ratio of radii on stress concentration factor in elliptic hole.

RBT Levels: L3

Module-2: Linear Elastic Fracture mechanics — 8 Hours

Modelling a crack as a flat elliptic hole by Inglis and the limitations of the model, Griffith theory of brittle fracture
Theories of linear elastic fracture mechanics, stress intensity factors, Irwin's definition. Fracture toughness KIc, KIIc, KIIIc & corresponding values of GC.

RBT Levels: L3

Module-3: Elasto-plastic fracture mechanics — 8 Hours

Crack-tip plasticity in metals. Irwin's modification for elasto-plastic material.
J integral, CMOD, CTOD. Mixed mode problems and evaluation of critical fracture parameters.

RBT Levels: L3

Module-4: Fracture of Concrete — 8 Hours

Limitations of theories of linear elastic fracture mechanics in concrete, Review of concrete behaviour in tension and compression.
Kaplan's experiments, concept of fracture energy, definition of a quasi-brittle material, concept of softening.

RBT Levels: L3

Module-5: Advanced concepts in fracture behavior of concrete — 8 Hours

Definition of fracture energy by RILEM, Influence of size on fracture behavior, Bazant's size effect law. Size dependent & independent fracture energies.
Application of fracture mechanics in design of concrete structures.

RBT Levels: L3

IV.COURSE OUTCOMES

CO1	Discuss the stress concentration effects in elastic materials
CO2	Adopt Linear Elastic Fracture mechanics for crack modeling.
CO3	Make use of Elasto-plastic fracture mechanics
CO4	Discuss about fracture behaviour of concrete
CO5	Outline the Advanced concepts in fracture behavior of concrete.

V.CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1	3	3											3			
CO2	3	3											3			
CO3	3	3											3			
CO4	3	3											3			
CO5	3	3											3			

VI. Assessment Details (CIE & SEE)

General Rules: Refer Annexure Section 1

Continuous Internal Evaluation (CIE): Refer Annexure Section 1

Semester End Examination (SEE): Refer Annexure Section 1

VII. Learning Resources

VII: Reference Books:

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
01	Theory of Elasticity	Timoshenko & Goodier	3, 1970	McGrawHill
02	Continuum Mechanics Fundamentals	Valliappan S.	1982	Oxford IBH, ND. New Delhi
03	Elementary Engineering Fracture Mechanics	Broek, D.	4, 1987	Martinus Nijhoff
04	Fracture Mechanics-Fundamentals and Applications	T. L. Anderson	2, 1995	CRC press
5	Advanced Mechanics of Solids	Srinath L.S.	10, 1994	Tata McGraw Hill

VII(c): Web links and Video Lectures (e-Resources):

https://archive.nptel.ac.in/courses/112/106/112106065/
https://youtu.be/SD6qITe3-Xo?si=7wTvTAb0U8jiNFkh
https://youtu.be/Pvg0f6hHmQU?si=1qCUYTTDWfhCsQfk

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

Seminar, Assignments, Quiz

Semester:	III	**Course Type:**	PEC		
Course Title: Repair and Rehabilitation of structures					
Course Code:	23CSEP344			**Credits:**	3
Teaching Hours/Week (L:T:P:O)			3:0:0:0	**Total Hours:**	40
CIE Marks:	**50**	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	3 Hours

I. Course Objectives:

Learn the fundamentals of structural health monitoring.
Study the various vibration-based techniques for structural health monitoring.
Learn the structural health monitoring using fiber-optic and Piezoelectric sensors.
Study the structural health monitoring using electrical resistance and electromagnetic techniques.

II.Teaching-Learning Process (General Instructions):

Chalk and talk, videos, Power Point presentation, animations.

III. COURSE CONTENT

Module-1: 8 Hours

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

RBT Levels: L2 L3

Module-2: 8 Hours

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.

RBT Levels: L2 L3

Module-3: 8 Hours

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, Fibre 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

RBT Levels: L2 L3

Module-4:	8 Hours

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.

RBT Levels: L2 L3

Module-5:	8 Hours

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

RBT Levels: L1 L2 L3

IV.COURSE OUTCOMES

CO1	Achieve Knowledge of Maintenance**,** Repair and Rehabilitation.
CO2	Understand the cause of deterioration of concrete structures.
CO3	Distinguish Repair Materials and Techniques for Repair.
CO4	Understands the concept of Repair, Rehabilitation and Retrofitting Techniques.
CO5	Distinguish Health Monitoring and Demolition Techniques.

V.CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1	2	2											2			
CO2	2	2											2			
CO3	2	2	1										2			
CO4	2	2	1										2			

VI. Assessment Details (CIE & SEE)

General Rules: Refer Annexure Section 1

Continuous Internal Evaluation (CIE): Refer Annexure Section 1

Semester End Examination (SEE): Refer Annexure Section 1

VII. Learning Resources

VII.(a): Reference Books:

1	Deterioration, Maintenance and Repair of Structures	Sidney, M. Johnson	1980	Publishing House of the Hungarian Academy of Sciences
2	Concrete Structures – Materials, Maintenance and Repair	Denison Campbell, Allen & Harold Roper	2009	Longman Scientific and Technical
3	Repair of Concrete Structures	R.T.Allen and S.C. Edwards	1998	Blakie and Sons
4	Learning for failure from Deficiencies in Design, Construction and Service	Raiker R.N	1987	R&D Center (SDCPL)
5	Rehabilitation Of Concrete Structures	Dr. B. Vidivelli	2007	Standard Publishers Distributors

VII(b): Web links and Video Lectures (e-Resources):

https://www.youtube.com/watch?v=taa4Fq-fERQ&list=PLq46p_ppqQemCi6i4SvZ1kCpFREHQkF

https://www.youtube.com/watch?v=x9noZ4xEXyg&list=PLNRGMg8U7bLdPXyqgUHSzjL58kH3urQN1

https://www.youtube.com/watch?v=G7S_XocB9G8

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:
Conduction of technical seminars on recent research activities Group Discussion Site visit

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CIE & SEE Evaluation strategy for Autonomous Scheme MTech 2023

Date: 28/03/2024

Note: Calcuation of components of CIE for final marks is modified as per regulations

Sl. No.	Course Type /Credits	Continuous Internal Evaluation (CIE)																			Semester End Examination (SEE)										Total Marks (CIE+ SEE)	Min. passing standard
		Total CIE marks	Min. Eligty.	I. Theory Component							II. Practical Component								Total CIE marks	Dur. In hrs.	Theory			Practical									
				Marks	Min. Eligty.	A. Unit test			B. Formative Assessments		Tot. Theory marks (I)	Marks	Min. Eligty.	C. Weekly Evaluation		D. Internal Test			Tot. marks (II)			Max. cond. marks	Max. considered marks	min. pass %	Max. cond. marks	Max. considered marks	min. pass %	Total SEE marks						
						Nos.	Marks/ Each	Tot. Marks	Nos.	Marks/ Each				Each week	Tot. marks	Nos.	Marks/ Each	Total marks															
1	BSC/PCC/PEC (3/4 Credit courses)	50	50%	50	50%	2	50	50 (avg. of 2)	1	50	50 {(A+B) scaled down to 50}	--	--	--	--	--	--	--	--	50 (I)	03	100	50	40%	--	--	--	50	100	50%
2	IPCC (4 Credit courses)	50	50%	50	50%	2	50	50 (avg. of 2)	--	--	50 (A)	50	50%	50	50 (Avg. of all)	1	50	50	50 (Avg. of C & D)	50 (Sum of I & II scaled down to 50)	03	100	50	40%	--	--	--	50	100	50%
3	PCCL (2 Credit courses)	50	50%	--	--	--	--	--	--	--	--	50	50%	50	50 (Avg. of all)	1	50	50	50 (Avg. of C & D)	50 (II)	03	--	--	--	100	50	50%	50	100	50%

Formative (Successive) Assessments: Assignments/quiz/ seminars/field survey and report presentation/course project/etc. based on the faculty & dept. planning

Practical Conduction: The conduction of each experiment/program per week should evaluate for 50 Marks and average of all shall be taken.

In case of Integrated course, minimum eligibility shall be attained as prescribed in both the theory and practical components.

Self Learning Courses (SLC) Courses, Internship, Mini project & Major Project: Rubrics & Methodology shall be defined seperately

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CIE and SEE guidelines based on course Type for M.Tech Autonomous Scheme 2023

Note:

- **The CIE conduction coordination will be done by the office of Controller of Examination (COE).**
- **The SEE will be conducted by the office of Controller of Examination (COE).**

Continuous Internal Evaluation (CIE)	Semester End Examination (SEE)	Final Passing requirement
1. BSC/PCC/ PEC– Theory Course (03/04 Credit courses)		
The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%.		
The minimum passing mark for the CIE is 50% of the maximum marks (25 marks out of 50). **Continuous Internal Evaluation:** CIE will be conducted by the department and it will have only 01 component: **I. Theory component.** Theory Component will consist of A. Internal Assessment Test B. Formative assessments **A. Internal Assessment Test:**	The minimum passing mark for SEE is 40% of the maximum marks (20 out of 50 marks). **Semester-End Examination:** Duration of 03 hours and total marks of 100. • The question paper will have ten questions. Each question is set for 20 marks. • There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-	The student is declared as a pass in the course if he/she secures a minimum of 50% (50 marks out of 100) in the sum total of the CIE and SEE taken together.

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• There are 02 tests each of 50 marks conducted during 7th week & 14th week, respectively. • The question paper will have four questions (max of 3 sub questions) from the notified syllabus. Each question is set for 25 marks. • The student have to answer 2 full questions (one from 1st & 2nd questions and another from 3rd & 4th question). • Internal Assessment Test question paper shall be designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course. **B. Formative assessments:** • 01 formative assessment for 50 marks shall be conducted by the course coordinator based on the dept. planning during random times. • One formative assessment shall be completed before 12th week. • The syllabus content for the formative assessment shall be defined by the course coordinator. • The formative assessments include Assignments/ Quiz/ seminars/case study/field survey/ report presentation/ course project/etc. • The assignment QP or Quiz QP shall indicate marks of each question and the relevant COs & RBT levels. • The rubrics required for the other formal assessments shall be defined by the departments along with mapping of relevant COs & POs. **The final CIE marks will be 50:** Sum of {(Average of 2 Internal Assessment test of 50) + one formative assessment of 50}. It will be scaled down to 50 marks. **The documents of all the assessments shall be maintained meticulously.**	questions), should have a mix of topics under that module. • The students have to answer 5 full questions, selecting one full question from each module. • Marks scored shall be proportionally reduced to 50 marks.	

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2. IPCC – Integrated with Theory & Practical (04 credit courses)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%.

The minimum passing mark for the CIE is 50% of the maximum marks (25 marks out of 50). Minimum eligibility of 50% marks shall be attained separately in both the theory component and practical component. **Continuous Internal Evaluation:** CIE will be conducted by the department and it will have 02 components: I. Theory Component. II. Practical Component. I. Theory Component will consist of A. Internal Assessment Test B. Formative assessments (Not required for Integrated courses) **A. Internal Assessment Test:** • There are 02 tests each of 50 marks conducted during 7th week & 14th week, respectively. • The question paper will have four questions (max of 3 sub questions) from the notified syllabus. Each question is set for 25 marks. • It is suggested to include questions on laboratory content in the Internal Assessment test Question papers. • The student have to answer 2 full questions (one from 1st & 2nd questions and another from 3rd & 4th question). • Internal Assessment Test question paper shall be designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course. **B. Formative assessments:** • Not required for Integrated courses. **II. Practical Component:**	The minimum passing mark for SEE is 40% of the maximum marks (20 out of 50 marks). **Semester-End Examination:** Only theory SEE for duration of 03 hours and total marks of 100. • The question paper will have ten questions. Each question is set for 20 marks. • There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module. • The laboratory content must be included in framing the theory question papers. • The students have to answer 5 full questions, selecting one full question from each module. • Marks scored shall be proportionally reduced to 50 marks. **No Practical SEE for Integrated Course.**	The student is declared as a pass in the course if he/she secures a minimum of 50% (50 marks out of 100) in the sum total of the CIE and SEE taken together.

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C. Conduction of each experiment/program should be evaluated for 50 marks and average of all the experiments/programs shall be taken. (rubrics will be published by the lab conduction committee) **D.** One laboratory Internal Assessment test will be conducted during the 14th week for 50 marks. (rubrics will be published by the lab conduction committee) **The final CIE marks will be 50:** Sum of {**I** [Avg. of 02 Internal assessment tests] + **II** [Avg. of (C & D)]}. It will be scaled down to 50 marks. **The documents of all the assessments shall be maintained meticulously.**		

3. PCCL: Laboratory course (01 credit course)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%.

The minimum passing mark for the CIE is 50% of the maximum marks (25 marks out of 50). **Continuous Internal Evaluation:** CIE will be conducted by the department and it will have only 01 component: I. Theory Component. (Not required for Laboratory course) II. Practical Component. **II. Practical Component:** **C.** Conduction of each experiment/program should be evaluated for 50 marks and average of all the experiments/program shall be taken (rubrics will be published by the lab conduction committee). **D.** One laboratory Internal Assessment test will be conducted for 50 marks (rubrics will be published by the lab conduction committee). **The final CIE marks will be 50** = Avg. of (C & D)	The minimum passing mark for SEE is 50% of the maximum marks (25 out of 50 marks). **Semester-End Examination:** Only laboratory SEE will be conducted jointly by the internal examiner and external examiner appointed by COE as per the scheduled timetable for duration of 03 hours. • The examination shall be conducted for 100 marks and shall be reduced to 50 marks proportionately. • All laboratory experiments/programs are to be included for practical examination. • Breakup of marks (Rubrics) and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners (OR) based on the course	The student is declared as a pass in the course if he/she secures a minimum of 50% (50 marks out of 100) in the sum total of the CIE and SEE taken together.

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The documents of all the assessments shall be maintained meticulously.	requirement evaluation rubrics shall be decided jointly by examiners. • Students can pick one question (experiment/program) from the questions lot prepared by the internal /external examiners jointly. • Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners. • General rubrics suggested for SEE: writeup-20%, Conduction procedure and results -60%, Viva-voce 20% of maximum marks. • Change of experiment is allowed only once and shall be assessed only for 85% of the maximum marks.	

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Accredited by NAAC with A+

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Certified by ISO 9001 – 2015

ATAL Ranking:
Band Performer

Band of 151 to 300 in
Innovation Category