

Academic Program: PG

Academic Year 2025-26

Department of Civil Engineering

Computer Aided Design of Structures

III & IV Semester M.Tech Syllabus



**SHRI DHARMASTHALA MANJUNATHESHWARA COLLEGE OF
ENGINEERING & TECHNOLOGY,**

DHARWAD – 580 002

(An Autonomous Institution recognized by AICTE & Affiliated to VTU, Belagavi)

Ph: 0836-2447465 Fax: 0836-2464638

Web: www.sdmcet.ac.in

SDM College of Engineering & Technology, Dharwad
Department of Civil Engineering

It is certified that the scheme and syllabus for I & II semester M.Tech. Computer Aided Design of Structures is recommended by the Board of Studies of Civil Engineering and approved by the Academic Council, SDM College of Engineering & Technology, Dharwad. This scheme and syllabus will be in force from the academic year 2025-26 till further revision.

Principal

Chairman BoS & HoD

College Vision and Mission**VISION:**

To develop competent professionals with human values

MISSION:

- To have contextually relevant curricula.
- To promote effective teaching learning practices supported by modern educational tools and techniques.
- To enhance research culture.
- To involve industrial expertise for connecting classroom content to real life situations.
- To inculcate ethics and impart soft skills leading to overall personality development.

Department Vision and Mission**VISION:**

To be a Centre of excellence, practice state-of-art civil engineering education and developing high quality engineers to serve society.

MISSION:

The stated vision can be achieved through

- Development of robust curriculum to meet the expectations of industry.
- Interactive teaching-learning process with modern educational tools.
- Establishing synergy between teaching and research.
- Networking with industry.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

1. To provide proficiency in the basic principles and advanced courses of technology in Computer Aided Design of Structures so that students are able to formulate, analyze and solve the societal problems for sustainable development related to Structural Engineering.
2. To expose students to the latest innovations and trends with a view to inculcate strong research orientation in Computer Aided Design of Structures as well as in multidisciplinary streams.
3. To create a congenial environment that promotes learning, growth and imparts ability to work with inter-disciplinary groups in professional, industry and research organizations.
4. To produce Structural Engineers who integrate and build on the program's core curricular concepts in the pursuit of professional leadership, teamwork, life-long learning, and successful career advancement.

PROGRAMME OUTCOMES (PO):

1. An ability to independently carry out design / research/ investigation and development work to solve practical problems.
2. An ability to write and present a substantial technical report/document.
3. Students should be able to demonstrate a degree of mastery over design of structures using software tools as per the specialization of the program.

Scheme of Teaching and Examinations – 2025-26
M.Tech., Computer Aided Design of Structures (CADS)

III Semester M. Tech.

Course Code	Course Title	Teaching		Examination				
		L-T-P (Hrs/Week)	Credits	CIE	Theory (SEE)		Practical (SEE)	
				Max. Marks	*Max. Marks	Duration in hours	Max. Marks	Duration in hours
24PCDC301	Analysis of Plates and Shells– Classical and FE Approach	4-0-0	4	50	100	3		
24PCDEXXX	Elective 4	4-0-0	4	50	100	3		
24PCDEXXX	Elective 5	4-0-0	4	50	100	3		
24PCDEXXX	Elective 6	4-0-0	4	50	100	3	-	-
OR								
24PCDL302	Internship in Industry or R&D organization	** Min 4 weeks during vacation after 2 nd sem	4	50	-	-	100	3
24PCDL303	*** Project phase 1	0-0-6	6	50	-	-	50	3
Total		16-0-6/12- 4weeks-6	22	250	400/ 300		50/150	

CIE: Continuous Internal Evaluation

SEE: Semester End Examination

L: Lecture

T: Tutorials

P: Practical

*SEE for theory courses is conducted for 100 marks and reduced to 50 marks.

** The students are expected to undergo training in industry for a period of **four weeks** during the vacation immediately after completion of II Semester examination. A faculty is to be allotted to guide the student. A committee consisting of three faculty members shall evaluate the work carried out and the knowledge the students have acquired. **OR The students can take one elective course if they do not undergo internship.**

***Project phase-I: The students are expected to formulate the problem and carry out the intensive literature survey along with preliminary investigations supporting the project phase-II in IV semester.

List of Electives

Course Code	Elective Courses
24PCDE325	Design of Precast & Composite Structures
24PCDE326	Advanced Design of Pre-Stressed Concrete Structures
24PCDE327	Design of Substructures
24PCDE328	Composite Materials
24PCDE329	Structural Load Analysis and Design as per Codes

**Scheme of Teaching and Examinations – 2025-26
M.Tech., Computer Aided Design of Structures (CADS)**

IV Semester M. Tech.

Course Code	Course Title	Teaching		Examination				
		L-T-P (Hrs/Week)	Credits	CIE	Theory (SEE)		Practical (SEE)	
				Max. Marks	*Max. Marks	Duration in hours	Max. Marks	Duration in hours
24PCDL401	** Project phase-II	0-0-22	18	100	--	--	100	3
24PCDEOA1	***BOS recommended ONLINE course	-	Audit (PP)	-	-	-	-	-
24PCDEOA2	***BOS recommended ONLINE course	-	Audit (PP)	-	-	-	-	-
Total		0-0-22	18	100	--	--	100	

CIE: Continuous Internal Evaluation

SEE: Semester End Examination

L: Lecture

T: Tutorials

P: Practical

*SEE for theory courses is conducted for 100 marks and reduced to 50 marks.

** Project phase-II: The students are expected to work on a project for the full semester in an industry or an institution

*** Classes and evaluation procedures are as per the policy prescribed for online courses by the institution. The students can take up online courses from I semester to III semester and produce the certificate of the same by the end of IV semester.

**Total Credits offered for the first year: 40
Total Credits offered for the Second year: 40**

24PCDC301	Analysis of Plates and Shell - Classical and FE Approach	(4-0-0) 4
------------------	---	------------------

Contact Hours: 52

Course Learning Objectives (CLOs): The primary objective of this course is to learn classical methods in theory of plates and shell structures. Apply knowledge of mathematics, science and engineering related to plate theory. Analyze the structural elements consisting of curved surfaces. Use finite element methods in plate and shell analysis.

Course Outcomes (COs):				
Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs(1 to 4)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	Formulate , analyze and solve two-dimensional plate elements.	1	3	
CO-2	Formulate , analyze and solve circular plate	1	3	
CO-3	Formulate , analyze and design Membrane theory of cylindrical shells and spherical domes	1	3	
CO-4	Formulate , analyze and design Membrane theory for shells of revolution and Folded plates	1	3	
CO-5	Formulate FEM for plate and shell element	1	3	

POs	1	2	3
Mapping Level	3		2

Prerequisites: 1. Finite element analysis of structural elements.

Contents:

- 1. 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 Strain energy in pure bending- Expression for total energy, Analysis of plates subjected to uniformly

distributed load by energy method.

11 Hours

2. **Circular Plates:** Differential equation for symmetrical bending of laterally loaded circular plates — uniformly loaded circular plates with and without central cutouts, with two different boundary conditions (simply supported and clamped). Centrally loaded clamped circular plate. **10 Hours**
3. **Membrane Theory of Cylindrical Shells and Spherical Domes:** Cylindrical Shells: Elements, IS 2210 specifications, equations of equilibrium, Stresses in a Simply Supported Shell, Stress Resultants under Dead Load and Live Load for circular, cycloid, catenary, parabola and semi ellipse directrix. Spherical Domes: Notations, equations of equilibrium, expressions for stress resultants and ring tension for Dead, Live and Concentrated Load in domes with and without skylight, Proportioning and general detailing rules. Design Examples with and without skylight. **11 Hours**
4. **Membrane Theory for shells of Revolutions:** Geometry of shell of revolutions, Equation of equilibrium for axi-symmetrically loaded shells, Solution of equation of equilibrium, Membrane Analysis and design of Conical shells, Hyperbolic Paraboloid **Folded Plate Roofs:** Design and detailing of folded plates with numerical example **10 Hours**
5. **FE approach:** Finite Element Analysis of Thin Plate: Triangular Plate Bending Element, Rectangular Plate Bending Element, Finite Element Analysis of Thick Plate. Shell elements, four and eight noded shell element and finite elements formulation. **10 Hours**

Reference Books:

1. Timoshenko and Krieger, "Theory of Plates and Shells", McGraw-Hill International Book Company. 1959.
2. P.C. Varghese, "Design of Reinforced Concrete Shells and Folded Plates, PHI.2010.
3. S. S. Bhavikatti, "Theory of Plates and Shells", New Age International Publishers.2012.
4. Robert D Cook et al, "Concepts and Applications of Finite Element Analysis", 3rd Edition, John Wiley and Sons, New York.1981
5. Chandrashekara K, "Theory of Plates", University Press.2001.
6. Ugural A C, "Stress in Plates and shells", McGraw-Hill International Books.1998

Course Learning Objectives (CLOs): To provide the structure and framework for learning outside of the classroom during training experience. The objective of training is to illustrate how a student will DO something and should be specific, strong and clear to provide an understanding of his/her needs and course they are pursuing.

Course Outcomes (COs):				
Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs(1 to 4)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	Experience of applying existing engineering knowledge in similar or new situations	1,3	2	
CO-2	Ability to identify when new engineering knowledge is required, and apply it	1,3	2	
CO-3	Ability to integrate existing and new technical knowledge for industrial application	1,3	2	
CO-4	Ability to demonstrate the impact of the internship on their learning and professional development	1,3	2	
CO-5	Understanding of lifelong learning processes through critical reflection of internship experiences.	1,3	2	

POs	1	2	3
Mapping Level	3	2	3

Evaluation:

- Final internal evaluation of Industrial training** - To be conducted by the internal guide of the college (After the completion of internship). **(50 marks).**
- Viva-Voce on Internship Report-** To be conducted internally is the internship guide (from the college) and external guide under whose supervision the student has carried out the internship **(50 marks).**

Contact Hours: 50

Course Learning Objectives (CLOs): The students are expected to learn carrying out literature surveys to locate the state-of-the-art technology while formulating/defining the project problem in computer aided analysis and design of structures. The students are expected to select a topic from an emerging area relevant to analysis and design of structures and/or other relevant branches and define the problem for the project work. The literature survey, visits, data collection, preliminary design, analysis etc. is to be done in this phase. The same work is to be continued in the next phase in IV sem.

Course Outcomes (COs):				
Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs(1 to 4)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	Carry out the literature survey to locate the state-of-the-art technology in computer aided analysis and design of structures	1,3	2	
CO-2	Define/formulate the problem for the project work	1,3	2	
CO-3	Design , develop, analyze, test, interpret the results, fabricate, simulate, write code etc. relevant to his/her project work	1,3	2	
CO-4	Summarize the work and write a project report and present.	2		

POs	1	2	3
Mapping Level	3	2.25	3

Content:

1. The students are expected to locate the state-of-the-art technology in computer aided analysis and design of structures through proper literature survey and select a topic from an emerging area relevant to structural engineering and/or other relevant branches and define the problem for the project work. The literature survey, visits, data collection, preliminary design, analysis etc. is to be done in this phase.
2. Know the current challenges in analysis and design of structures and try suggesting solutions

Project Phase-I Evaluation

Presentation on formulating/defining the project problem, literature survey, visits, data collection, preliminary design, analysis etc. Will be evaluated for 100 marks by a committee formed by DPGC.

Reference materials/books:

Engineering books.
reputed Journals papers.
Manuals and data sheets.
Software packages.
Previous project reports.
Product information brochures.
Interaction with academia and industrial experts.

24PCDE325	Design of Precast & Composite Structures	(4-0-0) 4
------------------	---	------------------

Contact Hours: 52

Course Learning Objectives (CLOs): In this course, topics on Concepts and components of precast construction, Precast Systems, design of composite floors and beam elements are dealt.

Course Outcomes (COs):				
Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs(1 to 4)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	Explain the concepts and techniques of precast construction.	1		
CO-2	Design precast elements suitable for project specific requirements.	1,3		
CO-3	Design precast systems to ensure integrity and safety of structures.	1		
CO-4	Design composite floors and beam elements	3		

POs	1	2	3
Mapping Level	3		2

Contents:

- 1. Concepts and components of precast construction:** Need and types of precast construction, Modular coordination, basic module, planning and design modules,

modular grid systems, National Building Code Specifications, Precast Elements- Hollow Core Slabs, TT, ST, Joists and Planks, Beams and Girders — R, L, I, IT, U shapes, Columns — Single Storey, Multi Storey (continuous), Wall Panels — Solid, Hollow core, Ribbed, Sandwich. **12 Hours**

2. **Design of precast elements:** Design Examples - Wall Panels, Hollow core slabs, Columns with corbels. **10 Hours**

3. **Precast Systems:** Large panels, frames, Slab-column systems with walls, mixed. Connections in precast structures — Classification, Design considerations, Details- wall panel connection, column splices, Foundation connection, Beam, Slab. Handling and assemblage considerations, Structural integrity and avoidance of progressive collapse. **10 Hours**

4. **Composite Floors:** Structural Elements, Profiled Sheeting with concrete topping, Design method, Bending and Shear Resistance of Composite Slabs, Serviceability Criteria, Analysis for Internal forces and Moments, Design Steps **10 Hours**

5. **Composite Beams:** Elastic behavior — No and Full interaction, Shear connectors, Load bearing Mechanism, Ultimate Load behavior of Composite beams, Stresses and deflection in service and vibration, Basic Design Considerations, Design Example of Simply Supported and Continuous Composite beams. **10 Hours**

Reference Books:

1. Hass A.M. — Precast Concrete — Design and applications Applied Science, 1983.
2. David Sheppard — “Plant cast, Precast and Prestressed concrete — McGraw Hill; 1989
3. NBC (2005)- (Part I to Part VII) BIS Publications, New Delhi,
4. R.P.Johnson: Composite Structure of Steel and Concrete (Volume 1), Blackwell Scientific Publication (Second Edition), U.K., 1994.
5. Hass A.M. — Precast Concrete — Design and applications Applied Science, 1983.

24PCDE326	Advanced Design of Prestressed Concrete Structures	(4-0-0) 4
------------------	---	------------------

Contact Hours: 52

Course Learning Objectives (CLOs): Concept of shear and torsion in PSC. To study different types of composite beam and its behavior in flexural and shear. To discuss the precast bridge girders, segmental constructions and external prestressing.

Course Outcomes (COs):			
Description of the Course Outcome: At the end of the course the student will be able to:	Mapping to POs(1 to 4)		
	Substantial	Moderate	Slight

		Level (3)	Level (2)	Level (1)
CO-1	Design and Analyze Anchorage Zone stress in post-tensioned members	1		3
CO-2	Design and Analyze Shear and torsional resistance	1		3
CO-3	Design and Analyze Composite Beams	1		3
CO-4	Illustrate and evaluate Tension members and compression members Slab and grid floors	1		3
CO-5	Design and Analyze Precast elements, Railway sleepers	1		3

POs	1	2	3
Mapping Level	3		1

Contents:

1. Anchorage Zone stress in post-tensioned members-Introduction to PSC, stress distribution in end block, investigations on anchorage zone stress, Magnel and Guyon's methods, comparative analysis, anchorage zone reinforcement. **10 Hours**
2. **Shear and torsional resistance-** Shear and principal stresses, ultimate shear resistance, design of shear reinforcement, torsion, design of reinforcement for torsion. **11 Hours**
3. **Composite Beams-**Introduction, types of composite beams, analysis for stress, differential shrinkage, serviceability limit state, design for flexural and shear strength. **10 Hours**
4. **Tension members and compression members-**Introduction, ties, Columns, Short columns, long columns, biaxially loaded columns, prestressed concrete piles.
Slab and grid floors- Types of floor slabs, design of one way, two way and flat slabs. Distribution of prestressed tendons, analysis and design of grid floors. **11 Hours**
5. **Precast Elements:** Introduction, prestressed concrete poles, manufacturing techniques, shapes and cross-sectional properties, design loads, design principles.
Railway sleepers: classification and manufacturing techniques, design loads, analysis, and design principles. Precast bridge girders and segmental constructions, external prestressing. **10 Hours**

Reference Books:

1. Lin.T.Y and H.Burns, "Design of prestressed concrete structures"-John Wiley and sons,1982.
2. N.Krishnaraju, "Prestressed concrete"- Tata McGraw-Hill,3rd edition,1995.
3. P.Dayaratnam, "Prestressed concrete structures"-Oxford and IBH, 5th edition, 1991.
4. G.S.Pandit and S.P.Gupta, "Prestressed concrete structures"-CBS Publishers, 1993.
5. Guyon, "Prestressed concrete structures", Contractors Record books,1963.

24PCDE327

Design of Substructures

(4-0-0) 4

Contact Hours: 52

Course Learning Objectives (CLOs): To know design parameters of substructures and their RCC design. Design of piles and special foundations

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student		Mapping to POs(1 to 4)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	Explain and Illustrate Design parameters for substructures	1		3
CO-2	Design of different types of foundations	1		3
CO-3	Design and Illustrate Pile foundations	1		3
CO-4	Explain and Illustrate Special foundations	1		3
CO-5	Explain and Illustrate Elements of soil dynamics and design of machine foundations	1		3

POs	1	2	3
Mapping Level	3		1

Contents:

- 1. Design parameters for substructures:** Factors influencing selection of depth of foundation, subgrade reaction, Winkler hypothesis and beams on elastic foundation, soil line method, foundations on expansive soils, geotechnical failure of foundations during earthquake-earthquake resistant design of shallow foundations, liquefaction and remedial measures. **12 Hours**
- 2. RCC Design:** Spread footings, Combined footings and Rafts; Unsymmetrical Footing **10 Hours**
- 3. Pile foundations:** Classification of pile foundation and general consideration of design, ultimate load capacity of piles, pile settlement, analysis of single pile and pile group, laterally loaded piles and ultimate lateral resistance, uplift resistance of piles and under reamed pile, pile load tests, design examples **10 Hours**
- 4. Special Foundations:** Foundation for transmission line towers-necessary information, forces on tower foundation, general design criteria, choice and type of foundations, design procedure and design problems. Earth retaining structure. **10 Hours**
- 5. Elements of soil dynamics and design of machine foundations:** IS 2974: Part I to IV machine foundation system, block foundation, frame foundation, design criteria, tuning foundation, DOF of rigid block foundation, linear elastic spring, elastic half space analog, parameter influencing dynamic soil parameter, soil mass participation, vibration isolation system. **10 Hours**

Reference Books:

1. Swamy Saran, "Analysis and Design of Substructures", 5th edition, Oxford and IBH Publishing co., Pvt, Ltd, New Delhi, 1996.
2. Swami Saran, "Soil Dynamics and Machine Foundations", Galgotia publications pvt Ltd, New Delhi. 1999.
3. Dr.B.C.Punmia, "Soil Mechanics and Foundation Engineering".Laxmi Publications, 113, Golden House, Darya Ganj, New Delhi - 110002, India
4. Varghese P.C., "Foundation engineering", Prentice Hall of India, New Delhi.
5. Das B.M., "Principles of foundation Engineering", Thomson Brooks/ Cole Publishing Company, Singapore. 2013.

24PCDE328**Composite Materials****(4-0-0) 4****Contact Hours: 52**

Course Learning Objectives (CLOs): A great deal of fundamental and developmental research has been made to bring composite materials in various applications such as automobile, space, medical, automotive, building construction, etc. The advent of composite materials has introduced a new dimension in application of energetic, smart and reactive materials. The objective of this course is to know the processing and application of composite materials.

Course Outcomes (COs):				
Description of the Course Outcome: At the end of the course the student		Mapping to POs(1 to 4)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	Identify and understand the basic properties and manufacturing process along with their application for different types of composites.	3	1	
CO-2	Analyze and identify the Properties of Composite materials	3	1	
CO-3	Failure theories of composites and Analyze Cross-ply and Angle-ply Laminates	3	1	
CO-4	Understand the Micro-Mechanics of the Composite	3	1	
CO-5	Analyze Interlaminar Stresses-Delamination of the Lamina	3	1	

POs	1	2	3
Mapping Level	2		3

Contents:

- 1. Introduction:** Definition and importance of composite materials, Constituents of composites, Classification of composites, Applications of composites, micromechanics of lamina: Volume and mass fraction of Constituents, Load distribution between matrix and fiber, Minimum and critical fiber volume fraction, Engineering properties, Halpin-Tsai model. **12 Hours**
- 2. Anisotropic elasticity:** 3D elasticity, stiffness and compliance component of anisotropic, triclinic, monoclinic, orthotropic and isotropic materials. Material symmetry in composites. Transformation of material properties, Elastic constants and interrelationships. Coupling of materials. **10 Hours**
- 3. Mechanical Behavior and Failure Analysis:** Ply-level stress and strain of lamina, Failure theories for lamina, Hygrothermal Behaviour of Lamina. **10 Hours**
- 4. Micromechanics and Laminate Theory:** Classical Laminate Theory (CLT), Stress-strain relations in a laminate, Cross-ply and angle-ply laminates, Symmetric, antisymmetric, and general laminates, Laminate stacking sequence. **10 Hours**

- 5. Interlaminar Stresses- Delamination:** Classical lamination theory, interlaminar stresses in laminate, Prediction of Delamination. **10 Hours**

Reference Books:

1. Robert M Jones, "Mechanics of Composite Materials", McGraw Hill Publishing Co.1999.
2. Bhagwan D Aggarwal, and Lawrence J Brutman, "Analysis and Performance of Fiber Composites", John Willy and Sons.2006.
3. Madhujit Mukhopadhyay, "Mechanics of Composite Materials and Structures", Universities Press. 2004.

24PCDE329	Structural Load Analysis and Design as per Codes	(4-0-0) 4
------------------	---	------------------

Contact Hours: 52

Course Learning Objectives (CLOs): Aims to equip students with a comprehensive understanding of the importance of applying appropriate code provisions in structural design to ensure safety and compliance.

Course Outcomes (COs):				
Description of the Course Outcome: At the end of the course the student		Mapping to POs(1 to 4)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	Understand the importance of appropriate code provisions	3	1	
CO-2	Familiarize with procedures for calculating action effects for different types of structures frequently encountered in practice	3	1	
CO-3	Assess the basic need, concepts and procedures of different types of analysis	3	1	
CO-4	Characterize the response of different types of structural systems for Tall buildings	3	1	

POs	1	2	3
Mapping Level	2		3

Contents:

- 1. IS 875 PART 1, 2, 4, 5 Sources**, Nature and Magnitude, Probabilistic assessment, Characteristic and Design values. IS 875 PART 1 and 2 code provisions. Load combination rules for design. Load path for gravity loads- Tributary Area and Stiffness based approaches. Estimation of DL and LL on structural elements such as Slab, Beams, Columns, in different types of structural systems, Joint Loads on Trusses, Distributed load on Purlins- Numerical examples. Accidental loads – Impact and collisions, Numerical examples **11 Hours**
- 2. Wind Load - IS 875 PART 3:** Buildings Nature and Magnitude, Factors influencing wind loads, Internal and External pressure distribution, Design Wind Speeds and Pressure, Numerical Examples to calculate external and internal pressure for different types of buildings and regions – Pitched Roof, Sign board, Structural glazing, Multistory Frames - Load path for Lateral loads **11 Hours**
- 3. Seismic Loads: IS 1893:** Buildings Nature and Magnitude, Centre of mass and rigidity, Calculation of Design Seismic Force by Static Analysis Method, Dynamic Analysis Method, Location of Centre of Mass, Location of Centre of Stiffness, and Lateral Force Distribution as per code provisions. - Load path for Lateral loads – Floor diaphragm action. **10 Hours**
- 4. Vehicles Loads as per IRC 6 - 2010 on Road Bridges** – Class 70 R, Class AA, Class A, Class B, Tracked Vehicle, Wheeled Vehicle, Load Combinations, Impact, Wind, Water Currents, Longitudinal Forces: acceleration, braking and frictional resistance, Centrifugal forces, temperature, Seismic forces, Snow Load, Collision Loads. Load Combinations – Simple Numerical examples, **10 Hours**
- 5. 5.Types of Analysis and Structural forms of Tall Buildings:** Linear, Nonlinear behavior, Material nonlinearity, Geometric nonlinearity, Rigid and Elastic Supports, First Order Elastic Analysis, Second Order Elastic Analysis, First order Inelastic Analysis, Second order Inelastic Analysis – Concepts and Brief descriptions. Structural forms in Tall buildings – Rigid frame, Braced Frames, Shear Walls, Core walls, Tubular, Belt truss, Outrigger **10 Hours**

Reference Books:

- IS 875 Parts (1 to 5), IS 1893, IRC 6, Srinath. L.S., Advanced Mechanics of Solids, Tata M Publishing Co Ltd., New Delhi cGraw-Hill
- An explanatory Handbook on IS 875 (PART 3); Wind Load on Building and Structures, Document No: IITK-GSDMA Wind 07 V1.0 - IITK-GSDMA Project on Building Codes
- Explanatory Examples on Indian Seismic Code IS 1893 (Part I): Document No. :: IITK-GSDMA-EQ21-V2.0 - IITK-GSDMA Project on Building Codes
- Matrix Analysis of Structures, Aslam Kassimali, Cengage Learning, 2012

IV Semester

24PCDL401

Project phase - II

(0-0-22)18

Contact Hours: 200

Course Learning Objectives (CLOs): The students are expected to find solutions individually in computer aided analysis and design of structures. They are expected to carry out the intensive literature survey to locate the state-of-the-art technology in structural engineering. They must learn to formulate/define/locate real time problems for the project work. They will also learn to design, develop, analyze, test, interpret the results, fabricate, simulate, write code, and convert reports into papers for publication in journals to add value to the existing literature. They are also expected to acquire the skills of summarizing the work and writing a project report and present the same.

Course Outcomes (COs):				
Description of the Course Outcome: At the end of the course the student		Mapping to POs(1 to 4)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	Carry out the literature survey to locate the state-of-the-art technology in structural engineering.	1,3,2		
CO-2	Define /formulate/locate real time problem for the project work	1,3		
CO-3	Design , develop, analyze, test, interpret the results, fabricate, simulate, write code, prepare paper etc.	1,3		
CO-4	Summarize the work and write a project report and present the same	2		

POs	1	2	3
Mapping Level	3	3	3

Prerequisites: Knowledge of both theory and practical courses learnt in all the

previous semesters and relevant value-added information

Contents:

1. The students are expected to locate the state-of-the-art technology in his domain of structural engineering and select a topic from an emerging area relevant to computer aided analysis and design and define the problem for the project work. The literature survey, visits, data collection, preliminary design, analysis etc. is to be done in this phase.
2. Structure related analysis and design challenges and providing feasible solutions.

Reference Books:

1. Engineering books.
2. International reputed Journals.
3. Manuals and data sheets.
4. Software packages.
5. Previous project reports.
6. Product information brochures.
7. Interaction with academia and industrial experts.
8. Internet etc.

Project Phase-II Evaluation

1. Presentation on detailed design, implementation, validation, demonstration and report will be evaluated by an internal guide for 100 marks
2. Final viva voce will be conducted by two examiners (Internal and an external member nominated by DPGC) for 100 marks.

24PCDEOA1 24PCDEOA2	BOS recommended ONLINE course	Audit
--------------------------------------	--------------------------------------	--------------

Course Learning Objectives (CLOs): The students are expected to find solutions individually in computer aided analysis and design of structures through online lecture by various reputed universities/institutions.

Sl. No	ONLINE course	Course Offered by
1	Reliability-Based Structural Design	Swayam-NPTEL
2	Plates and Shells	Swayam-NPTEL
3	Advanced Reinforced Concrete Design	Swayam-NPTEL
4	Dynamics Of Structures	Swayam-NPTEL
5	Finite Element Method And Computational Structural Dynamics	Swayam-NPTEL
6	Advanced Design Of Steel Structures	Swayam-NPTEL
7	Pytorch	Spoken Tutorial IIT Mumbai
8	Scilab	Spoken Tutorial IIT Mumbai
9	Python/Tensor flow	Spoken Tutorial IIT Mumbai
10	ETABS & SAFE: Advanced Course for RCC and Steel Structures	Udemy
11	<u>STAAD PRO & RCDC Complete Building Design & Detailing Course</u>	Udemy