

III& IV Semester M.Tech.

Computer Aided Design of Structures



SHRI DHARMASTHALA MANJUNATHESHWARA COLLEGE OF ENGINEERING &
TECHNOLOGY, DHARWAD – 580 002

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

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SDM College of Engineering & Technology, Dharwad

It is certified that the scheme and syllabus for III& IV 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 2026-27 till further revision.

Principal**Chairman BoS &HoD**

SDM College of Engineering & Technology, Dharwad**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.

SDM College of Engineering & Technology, Dharwad

Civil Engineering Department

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):

PO1: An ability to independently carry out design /research/investigation and development work to solve practical problems.

PO2: An ability to write and present a substantial technical report/document.

PO3: 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		16-0-6/12-4 weeks-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 the 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	

III & IV Sem. M.Tech. (CADs) 2026-27

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 AC, "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:

- 1. Final internal evaluation of Industrial training** - To be conducted by the internal guide of the college (After the completion of internship). **(50 marks).**
- 2. 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).**

24PCDL303

Projectphase-I

(0-0-6)6

ContactHours:

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.

CourseOutcomes(COs):				
DescriptionoftheCourseOutcome: At the end of the course the student will be able to:		MappingtoPOs(1to4)		
		Substantial Level(3)	Moderate Level(2)	Slight Level(1)
CO-1	Carryouttheliteraturesurveyto locate the state-of-the-art technology in computer aided analysisanddesignofstructures	1,3	2	
CO-2	Define/formulatetheproblemfor the project work	1,3	2	
CO-3	Design, develop, analyze, test, interpret the results, fabricate, simulate,writecodeetc.relevant to his/her project work	1,3	2	
CO-4	Summarizetheworkandwritea project report and present.	2		

POs	1	2	3
MappingLevel	3	2.25	3

Content:

1. Thestudentsareexpectedtolocatethestate-of-the-arttechnologyincomputeraided

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

ProjectPhase-IEvaluation

Presentationonformulating/definingtheprojectproblem,literaturesurvey,visits,data collection, preliminary design, analysis etc. Will be evaluated for 100 marks by a committee formed by DPGC.

Referencematerials/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, Loadbearing 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—“Plantcast, 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.