INSTITUTE	**FACULTY OF TECHNOLOGY**
PROGRAM	**BACHELOR OF TECHNOLOGY (CIVIL ENGINEERING)**
SEMESTER	**6**
COURSE TITLE	**ELEMENTARY DESIGN OF STRUCTURES**
COURSE CODE	**01CI1602**
COURSE CREDITS	**5**

Objective:

1 To Develop a fundamental understanding of the behavior of different structural systems under various loading conditions

2 To Gain proficiency in applying relevant design codes and standards for structural design, ensuring compliance with industry guidelines

3 To Learn to select appropriate materials for different structural elements, considering factors such as strength, durability, and economic feasibility

4 To be able to perceive the analysis and design of RCC and Steel structural members

Course Outcomes: After completion of this course, student will be able to:

1 Describe the principles and methodologies of structural design of reinforced concrete and steel structures.

2 Apply the Indian Standard Code provisions to create safe and efficient structural designs.

3 Analyze the behavior of structural elements under various load conditions to ensure stability and safety.

4 Design reinforced concrete and steel structures according to Indian Standard Codes.

5 Evaluate the performance of structural designs against criteria for serviceability and ultimate strength.

Pre-requisite of course: Mechanics of Solids, Structural Analysis – 1& 2

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
4	1	0	50	30	20	25	25

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Contents : Unit	Topics	Contact Hours
1	**Introduction** Introduction to Structural Design Process, Role of Structural Engineer, Architecture, and builder, Properties of Reinforced Concrete and Structural Steel, Loads and load combinations., Types of steel structures, Structural steel sections and properties, Methods of Analysis, Codes & and specifications, Stages in structural planning and design, Design Philosophies: Working stress Method, Ultimate Load Method, Limit State Method.	3
2	**Philosophy of Limit State Design** Assumptions of limit state method, Stress-Strain behavior of steel and concrete, Stress block diagrams, Limit state of collapse and serviceability, Partial safety factors for material and loading, Characteristic load and strength	4
3	**Design of Beams** Limit State of Collapse: Types of sections, Over-Reinforced Section, Balanced Section and Under-Reinforced Section, Depth of Neutral Axis, Analysis and design of Singly Reinforced Beams, Doubly Reinforced Beam, and Flanged beams, Limit State of Serviceability: Limiting deflection, short-term deflection, long-term deflection, Calculation of deflection of singly reinforced beam only, Cracking in reinforced concrete members, Side face reinforcement, slender limits of beams for stability, Design for Shear: Bond & Anchorage, Development length, Splicing, Shear Reinforcement., Design of Beam: Design of Simply Supported, Cantilever, and Continuous Beams.	9
4	**Design of Slab and Staircase** Design of Slab: Classification of Slabs, Design of One-way slab, Two-way Slabs and Continuous Slab. , Design of Staircase: Classification of Staircase, Design of Staircase with waist slab.	8
5	**Design of Column and Footing** Design of Column: Classifications, Assumptions, Design of Short and Axially loaded Column, Design of Foundations: Types of footing, Design Consideration, Design of square and rectangular isolated footing under axial load, Check for one-way and two-way shear.	6
6	**Connections** Types of Connections, Advantages and Disadvantages of Bolted and Welded Connections., Bolted Connection: Types of Bolts, Failure and Behavior of Bolted connections, design of bolted connection for plates, Angles and truss joint connections., Welded connections: Types of Welds, Design of connection with Fillet and Butt weld.	6
7	**Axial Force Design for Steel Member** Design of Tension Members: types of tension members, behavior, modes of failure. Design of tension member, splices, lug angle, Design of Compression Members: Possible Failure modes, Section Classification, local and global buckling, effective length, design and detailing compression members with connections; Design and Detailing of built-up section and lacing and battening system	12

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Contents : Unit	Topics	Contact Hours
8	**Flexural Design for Steel Member** Type of sections, classification, Lateral stability, Design strength of laterally restrained and unrestrained beams, shear strength, deflection, web buckling & crippling, Design of simply supported beam, Slab based, gusseted base foundation	6
Total Hours		**54**

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	**Tutorial-1** Analysis and Design of Singly RC Beam	1
2	**Tutorial-2** Analysis and Design of Doubly RC Beam	1
3	**Tutorial-3** Design of Flanged Beam	1
4	**Tutorial-4** Bond, Development Length and Shear Reinforcement	1
5	**Tutorial-5** Design of Slab	1
6	**Tutorial-6** Design of Column	1
7	**Tutorial-7** Design of Isolated Column Footing	1
8	**Tutorial-8** Design of Bolted Connection	1
9	**Tutorial-9** Design of Welded Connection	1
10	**Tutorial-10** Analysis and Design of Tension Members	1
11	**Tutorial-11** Analysis and Design of Compression Members: Strut	1
12	**Tutorial-12** Analysis and Design of Compression Members: Columns	1
13	**Tutorial-13** Design of Lacing and Battening	1
14	**Tutorial-14** Analysis and Design of Flexural Members	1
Total Hours		**14**

Textbook :

1 Limit State design of reinforced concrete, P C Varghese, PHI, New Delhi, 2008

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Textbook :

2 Reinforced concrete (Elementary structural design) Vol-I, Dr. H. J. Shah, Charotar publishing house, Anand, 2012

3 Advanced Design of Concrete Structures, Krishana Raju N., Tata Mc-Graw Hill, Delhi, 2012

References:

1 Unified Theory of Concrete Structures,, Unified Theory of Concrete Structures,, s, Hsu T. T. C. and Mo Y. L, John Wiley & Sons, 2010

2 Design of Concrete structures, Design of Concrete structures, Subramanian, Oxford university Press, 2010

Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery

Remember / Knowledge	Understand	Apply	Analyze	Evaluate	Higher order Thinking / Creative
10.00	15.00	20.00	25.00	15.00	15.00

Instructional Method:

1 At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.

2 Lectures will be taken in class room with the use of multi-media presentations, white board – mix of both

3 Attendance is compulsory in lectures and laboratory which carries a 5% component of the overall evaluation

4 About 10 to 15% of the topics/ sub-topics which is relatively simple is to be given to the students for self-learning and collaborative learning method. The assessment of Cos for the particular topics will be through classroom presentations.

5 Guide Students to undertake in micro-project.

6 Minimum two internal exams will be conducted and average of two will be considered as a part of continuous evaluation

7 Assignments based on course content will be given to the students at the end of each unit/topic and will be evaluated at regular interval. It carries a weightage of 5%.

8 Surprise tests/Quizzes will be conducted which carries 5% component of the overall evaluation.

Supplementary Resources:

1 https://archive.nptel.ac.in/courses/105/105/105105105/

2 https://archive.nptel.ac.in/courses/105/105/105105162/