INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad - 500 043

CIVIL ENGINEERING

COURSE DESCRIPTIONFORM

Course Title	**Reinforced Concrete Structures Design And Drawing**			
Course Code	**A50121**			
Regulation	**R15 – JNTUH**			
Course Structure	Lectures	Tutorials	Practicals	Credits
	4	-	-	4
Course Coordinator	S.Bhagyalaxmi, PraveenaRao, Assistant Professor, Civil Engineering			
Team of Instructors	S.Bhagyalaxmi, PraveenaRao, Assistant Professor, Civil Engineering			

I. COURSEOVERVIEW:

Civil Engineers are required to learn the fundamentals of design, analysis, and proportioning of reinforced concrete members and structures. Learn design concepts and modes of failure. Methods for analysis and design of these elements under flexure, shear, and axial loads will be examined. Learn how to make design decisions considering realistic constraints such as safety, economy and serviceability. Learn how to use the latest technology in solving structural analysis and design problems. To impart adequate knowledge on how to analyze and design reinforced concrete members and connection. To understand the mechanical properties of structural concrete. To understand the behavior of reinforced concrete elements under normal force, shear, moment and torsion. Concept of ultimate design of reinforced concrete beams, floor systems and columns are to understood. To develop an understanding of and appreciation for basic concepts in the behavior and design of reinforced concrete systems and elements. To help the student develop an intuitive feeling about structuralandmaterialwisebehavioranddesignofreinforcedconcretesystemsandelements..

II. PREREQUISITE(S):

Level	Credits	Periods/ Week	Prerequisites
UG	4	4	Engineering Mechanics, Strength of Materials.

III. MARKSDISTRIBUTION:

Sessional Marks	University End Exam marks	Total marks
Midterm Test There shall be two midterm examinations. Each midterm examination consists of essay paper, objective paper and assignment. The essay paper is for 10 marks of 60 minutes duration and shall contain 4 questions. The student has to answer 2 questions, each carrying 5 marks. The objective paper is for 10 marks of 20 minutes duration. It consists of 10 multiple choice and 10 fill-in-the blank questions, the student has to answer all the questions and each carries half mark. First midterm examination shall be conducted for the first two and half units of syllabus and second midterm examination shall be conducted for the remaining portion.	75	100

Sessional Marks	University End Exam marks	Total marks
Five marks are earmarked for assignments. There shall be two assignments in every theory course. Assignments are usually issued at the time of commencement of the semester. These are of problem solving in nature with course. Critical thinking. Marks shall be awarded considering the average of two midterm tests in each.		

IV. EVALUATIONSCHEME:

S. No	Component	Duration	Marks
1.	I Mid Examination	80 minutes	20
2.	I Assignment	-	5
3.	II Mid Examination	80 minutes	20
4.	II Assignment	-	5
5.	External Examination	3 hours	75

V. COURSEOBJECTIVES:

The objective of the teacher is to impart knowledge and abilities to the students to:

I. Develop an understanding and appreciation for basic concepts in the behavior and design of reinforced concrete systems and elements.

II. Differentiate between working stress design and limit state design.
III. Understand the basic concepts for reinforced concrete sectional design mainly in accordance with ultimate strength.
IV. Assess the structural and material behavior for the design of reinforced concrete systems and elements.

VI. COURSEOUTCOMES:

After completing this course the student must demonstrate the knowledge and ability to:

1. Understand the general mechanical behavior of reinforced concrete in accordance with IS456:2000.
2. Identify and apply the applicable industry design codes relevant to the design of reinforced concrete members.
3. Analyze and design reinforced concrete flexural members with detailing.
4. Design and check for serviceability (crack and deflection) and ultimate limit state conditions.
5. Assess the stresses and design vertical and horizontal shear reinforcements in reinforced concrete members with detailing.
6. Understand and design reinforced concrete compression members or columns.
7. Analyze and design footings and understand the need for development length of reinforcement.
8. Design footings and staircase with detailing of steel reinforcements.

VII. HOW PROGRAM OUTCOMES AREASSESSED:

Program Outcomes		Level	Proficiency assessed by
PO1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	S	Assignments, Exams

PO2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	S	Assignments, Exams
PO3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	S	Assignments
PO4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	S	Assignments
PO5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.	-	-
PO6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.	S	Exams
PO7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainabledevelopment.	S	Exams, Assignments
PO8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.	S	Quizzes, Discussions
PO9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	S	Lectures, Discussions
PO10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to Comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	S	Lectures, Discussions
PO11	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	S	Possible Projects
PO12	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	S	Discussions

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VIII. HOW PROGRAM SPECIFIC OUTCOMES AREASSESSED:

Program Specific Outcomes		Level	Proficiency assessed by
PSO1	**ENGINEERING KNOWLEDGE:** Graduates shall demonstrate sound knowledge in analysis, design, laboratory investigations and construction aspects of civil engineering infrastructure, along with good foundation in	H	Lectures, Assignments, Exams
PSO2	**BROADNESS AND DIVERSITY:** Graduates will have a broad understanding of economical, environmental, societal, health and safety factors involved in infrastructural development, and shall demonstrate ability to function within multidisciplinary teams with competence in modern tool usage.	S	Lectures, Assignments, Exams
PSO3	**SELF-LEARNING AND SERVICE:** Graduates will be motivated for continuous self-learning in engineering practice and/ or pursue research in advanced areas of civil engineering in order to offer engineering services to the society, ethically and responsibly.	S	Guest Lectures, Possible Group Projects,Industrial Internship

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IX. SYLLABUS:

Unit - I

Concepts of RC Design – Limit state method – Material Stress–Strain curves – Safety factors – Characteristic values – Stress block parameters – IS-456:2000 – Working StressMethod.

BEAMS: Limit state analysis and design of singly reinforced, doubly reinforced, T, and L beam sections.

Unit – II

SHEAR TORSION AND BOND**:** Limit state analysis and design of section for shear and torsion – concept of bond, anchorage and development length, I.S. code provisions. Design examples in simply supported and continuous beams, detailing Limit state design for serviceability for deflection, cracking and codal provision.

Unit - III

Design of Two-way Slabs, one-way slabs, Continuous slabs using I.S. coefficients, Cantilever slab/ Canopy slab.

Unit - IV

SHORT AND LONG COLUMN – Axial loads, uni-axial and bi-axial bending I.S. Code provisions.

Unit – V

DESIGN OF FOOTINGS– Isolated (square, rectangle) and Combined Footings. Design of Stair Case.

Textbooks:

1. Limit state design of reinforced concrete by P. C. Varghese, Prentice Hall of India, NewDelhi.
2. Reinforced Concrete design by N. Krishna Raju and R. N. Pranesh, New Age International Publishers, New Delhi.
3. Reinforced concrete design by S. UnnikrishnaPillai and DevdasMenon, Tata Mc. Graw Hill, NewDelhi.
4. Limit state design of reinforced concrete by Dr. B.C.Punmia, Laxmi Publication , NewDelhi

Reference Books:

1. FundamentalsofreinforcedconcretedesignbyM.L.Gambhir, PrinticeHallofIndiaPvt.Ltd,NewDelhi.
2. Reinforced concrete structural elements – behaviour, Analysis and design by P. Purushotham, Tata McGraw Hill, 1994.
3. Plasticity in Reinforced Concrete by Chen – Cengage Learning Pvt.Ltd.

X. COURSEPLAN:

At the end of the course, the students are able to achieve the following course learning outcomes:

Lecture No.	Topics to be covered	Course Learning Outcomes	References
1-3	**UNIT - I** Concepts of RC Design, IS-456:2000 – Working stress method	**Explain** the concepts of reinforced concrete design. Discuss IS 456: 2000 code. Explain the concept of working stress method.	T4: 2.1 to 2.2
4-6	Limit state method Material Stress–Strain curves – Safety factors	**Explain** Relation between stress and strain for mild steel. **Understand** working stressand factor ofsafety.	T4: 2.3 to 2.6
7-8	Material Stress–Strain curves – Safety factors	**Explain** Relation between stress and strain.	T4: 2.7 to 2.9
9-10	Characteristic values – Stress block parameters	Explain the characteristics values and stress block parameters.	T4: 3.1 to 3.6
11-13	Limit state analysis and design of singly reinforced beam sections.	Explain the concept of limit state analysis for singly reinforced beam sections. Solved problems.	T4: 3.8 to 3.10
14-17	Limit state analysis and design of doubly reinforced beam sections.	Explain the concept of limit state analysis for doubly reinforced beam sections. Solved problems.	T4: 4.1 to 4.6

18-20	Limit state analysis and design of T and L beam sections.	Explain the concept of limit state analysis for T and L beam sections. Solved problems.	T4: 6.1 to 6.3
21-24	**UNIT - II** Limit state analysis and design of section for shear and torsion.	Explain the concept of limit state analysis and design of section for shear and torsion.	T4: 7.1 to 7.6
25-28	concept of bond, anchorage and development length, I.S. code provisions	Explain the concept of bond, anchorage and development length with I.S. code provisions. Solved problems.	T4: 8.1 to 8.9
29-31	Design examples in simply supported and continuous beams,	Solved problems for design of simply supported and continuous beams	T1:9.6-11
32-34	Detailing and Limit state design for serviceability for deflection, cracking and codal provision.	Solved problems for detailing and Limit state design for serviceability for deflection, cracking and codal provision.	T4: 10.1 to10.7
34-36	**UNIT - III** Design of One-way Slabs	Design of one way slabs with examples.	T4: 11.4 to 11.7
37-40	Design of Two-way Slabs	Design of two way slabs with examples.	T4: 12.1 to 12.3
41-43	Design of Continuous slabs using I.S. coefficients,	Design of Continuous slabs using I.S. coefficients with examples.	T4: 12.4 to 12.6
44-46	Design of Cantilever slab/ Canopy slab.	Design of Cantilever slab/ Canopy slab withexamples.	T4: 12.4 to 12.6
46-49	**UNIT -IV** Short And Long Columns - Axial loads,	Differentiate short and long columns and design them for axial loads. Solved problems	T4: 16.1 to 16.9
50-54	Short And Long Columns – uni-axial bending I.S. Code provisions.	Design short and long columns for uni-axial loads. Solved problems	T1: 17.1 to 17.6
55-59	Short And Long Columns - bi-axial bending	Design short and long columns for bi-axial loads. Solved problems	T4: 18.1 to 18.6
60-63	**UNIT -V** Design Of Footings – Isolated (square, rectangle)	Design Of square and rectangle footings with solved problems.	T4: 7.1-3
63-67	Design Of Footings – Combined Footings. Design of StairCase.	Design Of combined footings with solved problems.	T4: 7.4-7
68-72	Design of Stair Case.	Design of Stair Case with solved problems.	T4: 12.1-3

XI. MAPPING COURSE OBJECTIVES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFICOUTCOMES:

Course Objectives	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
I	S	H								H	S	S	H	H	S
II		H			H					S	S	S	H	H	
III			S	H							S	S		H	S
IV		H	S							H	S	S	H	H	S

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XII. MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFICOUTCOMES:

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	S	H	S								S		H	H	S
2		H	H								S	S	H	H	S
3	H	H	H		S									H	S
4	H	H	H		S						S		H	H	S
5		H	S		H						S		H		
6	H	S	S		H						S		H	H	S
7	H	S	S		H						S		H	H	S
8								S		S		H	H	H	S

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