

Branch Name:	Civil engineering
Program Code:	ET401
Course Name:	Design Of Reinforced Concrete Structures
Course Code:	2ET4010501
Pre-requisite Course:	---

COURSE OBJECTIVE:

The content should be taught and implemented with the aim to develop skills so that students are able to acquire following competencies:

1. Analyze RCC building structure/element for various application.
2. Provide a design and detailed drawing of analyzed structure/element using Limit State Method as per code of practice IS 456 -2000.

TEACHING AND EVALUATION SCHEME:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)			
Lecture	Tutorial	Practical	Credit	Theory		Practical	
				University Assessment	Continuous Assessment	University Assessment	Continuous assessment
03	01	02	05	60	40	40	60

DETAILS OF COURSE CONTENTS:

S.NO.	TOPIC	Total Hrs.	WEIGHTAGE
1	INTRODUCTION TO IS 456-2016 1.1 Reinforced Cement concrete, necessity of steel in concrete, normal location of Tension steel in beams, slabs & in footing. 1.2 Limit State, Limit State of Collapse, Flexure, Shear, Compression, Torsion, Limit State of, Serviceability, Deflection, Cracking. 1.3 Characteristic Strength of Concrete and Steel, Partial Safety Factor for Concrete and Steel. 1.4 Characteristic or Working Load, Partial Safety Factor for Load, Limit State or Factored Load.	4	6%
2	SINGLY RC BEAM 2.1 Assumptions for Limit State of Collapse due to Flexure. 2.2 Stress and Strain Diagram of SRRS. Equation related to maximum depth of N.A- X_{umax} , 2a Analyze & Design of Singly Reinforced Rectangular Section (SRRS) under Flexure. 2b Analyze SRRS for flexure using SP-16. 10 06 Actual Depth of N.A- X_u , Limiting Moment of Resistance- M_{ulim} , Actual Moment of Resistance- M_u , maximum % limiting steel – P_{tlim} as per IS 456-2016 & Design Aid SP 16. 2.3 Balance Section, Under Reinforced Section, Over	4	10%

	Reinforced Section 2.4 Minimum and Maximum steel in beam and in slab and clear cover as per IS 456-2016 (Clause 26.4, 26.5, Table 16). 2.5 Design problem to find size of SRRS Beam and steel area for limit state Bending Moment. 2.6 Related Numerical.		
3	DOUBLY RC-BEAM 3.1 Stress and Strain Diagram of DRS and Condition for Doubly Reinforced Section. 3.2 Equation stated in SP-16 for D.R.S. 3.3 Related Numerical.	4	12%
4	FLANGED BEAM 4.1 Conditions for the beam to act as Tee Beam. 4.2 Width of Flange as per IS 456-2000. 4.3 Equation regarding Tee Beam from IS 456-2000 4.4 Numerical to find Moment of Resistance of Tee Beam. 4.5 Numerical to find main steel area in tension of Tee Beam. 4.6 Numerical to find Limiting Moment of Resistance of Tee Beam using equation of IS 456-2000.	4	12%
5	DEVELOPMENT LENGTH & P SHEAR REINFORCEMENT 5.1 Diagonal Tension Crack in Beam due to Shear. 5.2 Equation related to Limit State of Collapse due to Shear as per IS 456-2016. 5.3 IS 456-2016 clauses (26.5.1.5 & 1.6) related to Minimum and Maximum Spacing of Stirrups, minimum shear reinforcement. Anchoring reinforcing bars in Tension and in Compression (Clause 26.2.2) Clauses related to Lap Length of Is 456-2016. 5.4 Numerical to check the slab for shear.	7	14%
6	AXIALLY LOADED COLUMN 6.1 Column, slenderness Limit for Short & Long Column, Minimum Eccentricity in column, condition for axially loaded column, equation for axially loaded short column of IS 456-2016 (Clause 25 & 39.3). 6.2 Clauses (26.5.3.1, 26.5.3.2(C, 1-2)) of IS 456-2016 related to % compression steel, numbers of compression bars and its spacing, lateral ties – diameter and pitch.	7	14%
7	ISOLATED FOOTING 7.1 Numerical to design & to detail Isolated Pad and Slope Foundation for assigned limit state compression load of column and SBC of soil for Bending Moment, One Way Shear, Punching or Double Shear, Load Transfer from Column to Footings (Clause 34).	5	12%
8	DESIGN OF SLAB	13	20%

	8.1 Slab –Spanning in Shorter Span, Steel for Bending Moment, Distribution Steel, Depth of Slab as per Deflection, Effective span as per IS 456-2016 (Clause 22.2), Dead Load, Live Load on Slab, Shear and Cracking in Slab. 8.2 Numerical to design and detail Simply Supported One Way Slab for Bending Moment, Shear, Deflection, Cracking for the assigned Floor Finish & Live Load. 8.3 Numerical to design and detail One Way Continuous Slab for Bending Moment, Shear, Deflection, Cracking for the assigned Floor Finish & Live Load using IS 456 -2016 B.M and S.F coefficients(Table 12 & 13). 8.4 Numerical to design and detail Two Way Simply Supported Slab with and without Torsion Steel for Bending Moment, Shear, Deflection, Cracking for the assigned Floor Finish & Live Load using IS 456 -2000.		
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LIST OF PRACTICAL:

SR. No.	Experiment / Exercises
1	Draw One Way Simply Supported Slab in Plan and in Longitudinal cross section along shorter span with reinforcement and its bent up details in A2 Size Drawing Sheet.
2	Draw One Way Continuous slab in Plan and in Longitudinal cross section having Four equal spans with reinforcement and its curtailment and its bent up details in A2 Size Drawing Sheet.
3	Draw Two Way Simply Supported Slab with Torsion Steel in Plan having longitudinal cross sections along shorter and longer span with reinforcement, bent up bars details in A2 Size Drawing Sheet.
4	Draw Longitudinal Cross Section Elevation and a Section along Length of -Singly Reinforced Beam with shear reinforcement -Doubly Reinforced Beam with shear reinforcement Above two in A2 Size Drawing Sheet
5	Draw Plan and Cross Section Elevation of RCC Column having Isolated Slope Foundation with reinforcement details.
6	Sketch Book shall be prepared with following sketches... 1. Longitudinal and cross section elevation along Length of Singly Reinforced Simply Supported Beam 2. Longitudinal and cross section elevation along Length of Cantilever Beam 3. Longitudinal and cross section elevation along Length of Simply Supported Tee Beam 4. Plan & c/s elevation along shorter span of One Way Simply Supported Slab 5. Plan & c/s elevation along shorter span & Longer span of Two Way Simply Supported Slab without torsion steel. 6. Plan of Circular Slab with reinforcement 7. Column and Beam ductile connection 8. Column to Column Connection when size of Upper column is reduced 9. Circular Water Tank with flexible joint 10. Cantilever Retaining Wall. 11. Reinforcement details of Shear Wall 12. Reinforcement details of R C C Dome

LIST OF REFERENCES:

Sr. no.	Title	Author	Publication
1	Reinforced Concrete	Dr. H J shah	Charotar Publication
2	Limit State Design of Reinforce Concrete	Dr. Punamiya, A K Jain, Arun K Jain	Laxmi Publications
3	R C C design and drawing	Neelam Sharma	S K Kataria and Sons
4	Illustrated Reinforced Concrete Design	Dr. V L Shah & S R Karve	Structures Publication
5	Limit State Design of Reinforced Concrete	Vaghrese P C	PHI Learning Pvt. Ltd.
6	R C C Design & Drawing	M I Ohri	Tech India Publication Series
7	***IS-456 – 2000	-----	Bureau of Indian Standard
8	***Design Aid – SP - 16	-----	Bureau of Indian

*** Students are permitted to appear in theory & practical examination with these IS codes.

LIST OF OPEN SOURCE SOFTWARE/LEARNING WEBSITE:

- 1) <https://nptel.ac.in>
- 2) www.civilengineersforum.com
- 3) <https://www.sefindia.org>

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Basics of design reinforced concrete structures.	1 Remembering 2 Understanding
CLO2	Analysis & Design of Singly Reinforced Rectangular Section (SRRS) under Flexure.	4 Analyze 3 Applying
CLO3	Design Stirrups for Reinforced Concrete Rectangular Beam.	4 Analyze 3 Applying
CLO4	Apply Deflection & Cracking requirements of IS 456-2000.	1 Remembering 4 Analyze 3 Applying
CLO5	Design & Detail Cantilever Slab, One Way Simply Supported Slab, One Way Continuous Slab & Two Way Simply Supported Slab.	2 Understanding 4 Analyze 3 Applying
CLO6	Analyze & Design Doubly Reinforced Rectangular Section. Analyze Tee Beam for Flexure.	4 Analyze 3 Applying

Course Learning Outcomes	Program Outcomes (Po's)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CLO1	H											
CLO2	H										H	
CLO3	M	H					I	H				H
CLO4	M				L	H			H	H		
CLO5	H	I		H			H					H
CLO6	M			I								L

H: High, M: Medium, L: Low