GUJARAT TECHNOLOGICAL UNIVERSITY
Bachelor of Engineering
Subject Code: 3160612
Design of Reinforced Concrete structures
SEMESTER-VI

Type of course: Professional Elective Core

Prerequisite: Structural Analysis, Design of structure

Rationale: Majority of civil engineering structures are made up of Reinforced Cement Concrete. Knowledge of designing and detailing of reinforced concrete structures is very important for civil engineers in order to make structures safe, serviceable and durable during its life span. Limit State design philosophy is prevailing in our country for designing RC structures. Proper designing and detailing of reinforcement will ensure the correct behavior of structures and also leads to smooth construction of RC structures. This course will provide detailed knowledge of design and reinforcement detailing as per Indian standards.
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Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Note: IS:456(2000), IS-1893-1(2016), IS-13920(2016), IS-3370(Part 1 TO 4), SP-16, SP-34, IS-875 are permitted in the examination.

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	**Unit-1: Building Layout and Design** Loads as per I.S., distribution & flow of loads, lateral load due to wind and seismic as per latest IS standards, load combinations, guide lines for preparation of structural layout for building. Analysis, design & detailing of G+3 RC framed building for residential /commercial purpose including ductile detailing.	**12**	30
2	**Unit-2: Design of Retaining wall** Types, behavior and application of retaining wall, stability criteria, design & detailing of cantilever & counter-fort type retaining wall for various ground conditions.	**08**	20
3	**Unit-3: Design of Water Tank** Classification of water tank and method of analysis, permissible stresses, codal provisions, Design of circular and rectangular under-ground water tanks using IS code method, Design of elevated water tank with Intze type of container, frame and shaft type of staging and foundation considering effect of earthquake and wind forces. Design of Foundations: Design of isolated footing under axial load and uni-axial bending, combined footing.	**09**	20

4	**Unit-4: Design of Flat Slab** Direct design method – Distribution of moments in column strips and middle strip-moment and shear transfer from slabs to columns – Shear in Flat slabs-Check for one way and two way shears, Limitations of Direct design method, Introduction to Equivalent frame method.	**06**	15
5	**Unit-5: Earthquake Resistant Design of building** Earthquake resistant design philosophy, capacity design concept, four virtues of Earthquake Resistant design: strength, stiffness, ductility and configuration, Irregularities in structures, Lateral load distribution – Torsionally coupled & uncoupled system, Seismic coefficient Method, Ductile detailing as per IS:13920.	**07**	15

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
05	**10**	**30**	**30**	**20**	**5**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. P. C. Vargheese, Limit State Design of Concrete structure,
2. Shah & Karve; Limit State Theory & Design of Reinforced Concrete; Structure Pub., Pune
3. Dr. H.J. Shah; Reinforced concrete Vol-I; Charotar Pub. Anand
4. Punmia B.C "Advanced RCC Design" Laxmi Publications Pvt. Ltd". 2006.
5. Varghese P. C.., Advanced Reinforced Concrete, Varghese, Prentice Hall of India.
6. Sinha S. N., Reinforced Concrete Design, Tata Mc-Graw Hill, Delhi.
7. N. Krishna Raju, Advanced Reinforced Concrete Design, CBS Publishers.
8. S. Unnikrishna Pillai and Devdas Menon, Reinforced Concrete Design, Tata McGraw Hill.
9. IS: 456 - Code of practice for plain and reinforced concrete
10. IS: 875 (Part I to V) - Code of practice for structural safety of Buildings Loading standards
11. IS: 1893 - Criteria for earthquake resistant design of structures
12. IS: 13920 -Code of Practice for ductile detailing of RC structure subjected to seismic force
13. IS: 3370 (P-1 to 4)
14. SP:16, SP:34.

Course Outcome:

Sr. No.	CO statement	Marks % weightage
CO-1	Apply the principles, procedures and current Indian code requirements to the analysis and design of RC structures	15

CO-2	Prepare layout, determined loads, analyse, design and detail various structural elements for RC framed structure up to G+3.	25
CO-3	Design & detail RC structures like Retaining Wall, Water Tank and Flat slab.	25
CO-4	Apply the concept of earthquake resistant design in the building.	15
CO-5	Prepare design report covering design basis, structural calculations, structural drawings	20

Term Work :

Term work shall consist of satisfactory completion and submission of following list of Practicals/Tutorials.

List of Practicals /Tutorials:

1. Full Design of following structures with detailing in A2 size drawing sheet covering all required details in structural drawing.
   (1) design of G+3 building (design manually & check with software)
   (2) Retaining wall/water tank
2. Software applications of Multi-storied building subjected to wind and earthquake forces
3. Preparation of EXCLE Worksheets for the design of various structural components of building and/or other structures of the syllabus.
4. Prepare at least one drawing in any CAD software (like AutoCAD) for design of structures conducted in the syllabus.

Practical examinations shall consist of oral based on the term-work and above course.

Major Equipment/Software:

1. Any professional software of Structural analysis such as STAAD-pro, SAP, ETABS

List of Open Source Software/learning website:

www.nptel.iitm.ac.in/courses/