SARVAJANIK UNIVERSITY
Sarvajanik College of Engineering and Technology
Bachelor of Technology
Civil Engineering

B. Tech. III Semester V

Subject Name : Basic Concrete Design **Subject Code:** BTCL13502

Type of course: PCC

Prerequisite : Engineering Mechanics (BTCL12113), Theory of structures (BTCL13305), Structural Analysis (BTCL13404) , Concrete Technology (BTCL13302)

Rationale : It is the Study of the strength, behaviour, and design of reinforced concrete elements subjected to moments, shear, torsion and axial forces by following the basic principles of structural engineering. This subject is specifically aimed to develop understanding of various design philosophy, Indian codal provisions, design criteria used in design of basic elements of framed structures and its detailing.

Teaching and Examination Scheme:

TEACHING SCHEME				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	150
2	0	2	3	60	25	15	30	20	

CA1: Continuous Assessment (assignments/projects/open book tests/closed book tests **CA2:** Sincerity in attending classes/class tests/ timely submissions of assignments/self-learning attitude/solving advanced problems **TEE:** Term End Examination **TEP:** Term End Practical Exam (Performance and viva on practical skills learned in course) **CA3:** Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in course

Content:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1.	**Introduction:** Properties of materials, Loads & load combinations, Steps of design process, Virtues of structural design, codes & codal provisions, Design Philosophies - Working stress Method, Ultimate Load Method, Limit State Method, and Plastic Method.	3	10%

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2.	**Limit state of collapse & serviceability:** Partial safety factors for material & load, Characteristic strength of materials, Characteristic Loads and its design values, Deflection and Cracking. **Limit State of Flexure & Shear:** Assumptions, Stress-strain relation of concrete & reinforcing steel, Type of section-under reinforced, over reinforced & balance section, Neutral Axis depth, Moment of Resistance for singly reinforced, doubly reinforced and flanged sections. Combined Flexure, Shear and Torsion, Bond & Anchorage, Development length, splicing. Design of Simply supported, Cantilever and Continuous beams.	12	40%
3.	**Limit state design of RCC Elements:** Design of Slab: One way, two way simply supported and continuous slabs. Design of Column: Limit state of compression, Assumptions, Classifications, Design of Short Columns under axial load, uni-axial and biaxial loads. Design of Foundations: Design of isolated footing under axial load and uni-axial bending, Introduction to combined footing.	15	50%

Suggested Specification table with Marks (Theory/Practical):

% Distribution of Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
05	15	20	30	25	5

Legends: R: Remembrance, **U:** Understanding; **A:** Application, **N:** Analyze, **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.

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Reference Text Books:

Sr. No.	Title of book /article	Author(s)	Publisher and details like ISBN	Year of publication	Publication Edition
1.	Reinforced concrete Vol-I;	Dr. H.J. Shah;	Charotar Pub. Anand ISBN: 9789385039188	2016	11th
2.	Reinforced Concrete (Limit State Design)	A.K.Jain	NEM CHAND & BROTHERS ISBN-10 : 9788185240664 ISBN-13 : 978-8185240664	2012	7th
3.	Limit State Theory & Design of Reinforced Concrete (I.S. 456 - 2000)	Vl Shah Sr Karve	Structures Publication, Pune ASIN : B0095EDYG4 ISBN-10 : 8190371711 ISBN-13 : 978-8190371711	-	8th
4.	Limit State Design of reinforced concrete	P. C. Vargheese	Prentice Hall India Learning Private Limited ISBN-10 : 8120320395 ISBN-13 : 978-8120320390	2008	2nd
5.	Handbook of Reinforced Concrete Design	Dr. V.l. Shah and Dr. S.r. Karve	Structures Publications ISBN-10 : 8190371703 ISBN-13 : 978-8190371704	2010	5th
6.	RCC Design	B.C. Punmia, Ashok Kumar Jain, Arun Kumar Jain	Laxmi Publications ISBN-10 : 8131809420 ISBN-13 : 978-8131809426	2015	10th
7.	Limit State Design of Reinforced Concrete	B.C. Punmia, Ashok Kumar Jain, Arun Kumar Jain	Laxmi Publications ASIN : 8131802418 ISBN-10 : 9788131802410 ISBN-13 : 978-8131802410	2016	Revised Edition
8.	Reinforced Concrete Design	Devdas Menon, S. Pillai	McGraw Hill Education ISBN-10 : 007014110X ISBN-13 : 978-0070141100	2017	3rd

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9.	Design of Reinforced Concrete Structures	N. Subramanian	Oxford ISBN-10 : 0198086946 ISBN-13 : 978-0198086949	2013	Illustrated Edition
10.	Structural Design & Drawing	N. Krishna Raju	Universities Press ASIN : 8173716706 ISBN-10 : 9788173716706 ISBN-13 : 978-8173716706	2009	3rd
11.	Design Of Reinforced Concrete Structures	Ramamrutham S	DHANPAT RAI PUBLISHING COMPANY (P) LTD-NEW DELHI ISBN-10 : 9352161327 ISBN-13 : 978-9352161324	2016	1st

IS: 456 – 2000 Code of practice for plain and reinforced concrete
IS: 875 (Part I to V) - Code of practice for structural safety of Buildings Loading standards
IS: 13920 -Code of Practice for ductile detailing of RC structure
SP: 16 Design Aid for Reinforced Concrete

Course Outcome:

Sr. No.	CO Statement **After learning this subject, students will be able to**	Marks % weightage
CO-1	Explain material properties, loads & its combinations, analysis and design process. *(R, U, A, N, E ….cognitive level)*	5
CO-2	Explain different design philosophy evolved from time to time and its applicability in designing structural elements. *(R, U, A, N, E ….cognitive level)*	5
CO-3	Evaluate the capacity of elements subjected to loads considering the IS Codal provisions. *(R, U, A, N, E ….cognitive level)*	20
CO-4	Design the flexural and shear elements using principles of Limit State Method and considering IS Codal provisions. *(R, U, A, N, E, C ….cognitive level)*	35
CO-5	Design the compression and bending elements using principles of Limit State Method and considering IS Codal provisions. *(R, U, A, N, E, C ….cognitive level)*	35

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Mapping with POs:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO-1	3	1	1	-	-	-	-	-	3	2	1	3	-	-	2
CO-2	3	1	1	-	-	-	2	-	3	2	1	3	-	-	2
CO-3	3	3	2	-	3	1	1	2	3	3	2	3	1	3	2
CO-4	3	3	3	-	3	1	1	2	3	3	2	3	2	3	3
CO-5	3	3	3	-	3	1	1	2	3	3	2	3	2	3	3
Rationale *	**15**	**11**	**10**	**-**	**9**	**3**	**5**	**6**	**15**	**13**	**8**	**15**	**5**	**9**	**12**

Rationale*: The study of fundamental aspects of analysis and design will help to design various RCC elements of structures and justify the well defined POs and PSOs.

LIST OF PRACTICALS:

1. The students will have to solve at least three examples and related theory from each topic as an assignment/tutorial.
2. Prepare sketches of structural detailing of RC components in sketch book/A3 size sheet.
3. Experiments may be designed and carried out related to the topics of the course such as
   a. Design, casting and testing of under reinforced, over reinforced and limiting sections of beam element.
   b. Design, casting and testing of short columns.
   c. Model making of various RCC elements

Major Equipment/Software:

1. Universal testing machine
2. Compression Testing Machine
3. Concrete Mixture
4. STTAD-Pro, SAP, ETABS, MIDAS, ANSYS

List of Open Source/learning website:

- https://nptel.ac.in/courses/105/105/105105104/
  - Design of Beams, Slabs, Columns, Foundations.
- www.nptel.iitm.ac.in/courses/
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