Gyanmanjari Innovative University

Course Syllabus
Gyanmanjari Institute of Technology
Semester-7 (B. Tech.)

Subject: Design of Reinforced Concrete Structure– BETCV17335
Type of Course: Professional Core
Prerequisite: Knowledge of Structural Mechanics, Design of Structure

Rationale: Most civil engineering structures are constructed using Reinforced Cement Concrete (RCC). Therefore, a thorough understanding of analysis, design, and detailing of RCC structures is essential for civil engineers to ensure safety, serviceability, durability, and structural performance throughout the intended life span of a structure. The Limit State Design philosophy is widely adopted in India for the design of reinforced concrete structures. Proper structural planning, accurate analysis, and systematic detailing of reinforcement are crucial to achieving reliable structural behaviour and facilitating efficient construction practices. This course aims to provide comprehensive knowledge of RCC design principles, codal provisions, and reinforcement detailing in accordance with the latest Indian Standards, thereby preparing students for professional practice and real-world structural engineering applications.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks					Total Marks
				Theory Marks		Practical Marks		CA	
CI	T	P	C	ESE	MSE	V	P	ALA	
4	0	2	5	60	30	10	20	30	150

Legends: CI-Classroom Instructions; T – Tutorial; P - Practical; C – Credit; ESE - End Semester Examination; MSE- Mid Semester Examination; V – Viva; CA - Continuous Assessment; ALA- Active Learning Activities.

Note: IS:456(2000), IS-1893-1(2016), IS-13920(2016), IS-3370-2021(Part 1 TO 4), SP-16, SP34, IS-875 (Part 3) – 2015 are permitted in the examination.

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Course Content:

Sr. No.	Course Content	Hrs.	% Weightage
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	15	25%
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	10	15%
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 latest 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.	15	25%
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.	10	15%
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.	10	20%

Continuous Assessment:

Sr. No.	Active Learning Activities	Marks
1	**Structural Modelling Laboratory Activity** Faculty will assign a G+3 RCC building plan, and the activity will be conducted in groups of students. Students will develop a 3D analytical model using STAAD Pro., define materials, sections, supports and load cases, and perform structural analysis. Deflection, bending moment and shear force results will be interpreted. The laboratory report with modelling screenshots and analysis outputs must be uploaded to the GMIU Web Portal.	10
2	**Innovation in RCC Materials Study** Faculty will assign topics such as High-Performance Concrete (HPC), Fiber Reinforced Concrete (FRC) and Self-Compacting Concrete (SCC). This activity will be conducted in groups of students. Students will prepare a structured PowerPoint presentation covering properties, performance, applications and limitations. Each member must participate in the presentation. The presentation file must be uploaded to the GMIU Web Portal.	10
3	**Seismic Base Shear Analysis Using Excel** Faculty will provide building data including seismic zone, importance factor, response reduction factor, soil type and building height. This will be an individual activity. Students will prepare an Excel sheet implementing the seismic coefficient method as per IS 1893 to calculate base shear and distribute lateral loads floor-wise. A brief technical summary must be prepared. The Excel file and report must be uploaded to the GMIU Web Portal.	10
TOTAL		**30**

Suggested Specification table with Marks (Theory): 60

Distribution of Theory Marks (Revised Bloom's Taxonomy)						
Level	Remembrance (R)	Understanding (U)	Application (A)	Analyze (N)	Evaluate (E)	Create (C)
Weightage %	5%	10%	25%	25%	20%	15%

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.

Course Outcome:

After learning the course, the students should be able to:	
CO1	Apply the principles, procedures and current Indian code requirements to the analysis and design of RC structures
CO2	Prepare layout, determined loads, analyses, design and detail various structural elements for RC framed structure up to G+3.
CO3	Design & Detail RC structures like Retaining Wall, Water Tank and Flat slab.
CO4	Apply the concept of earthquake resistant design in the building.
CO5	Prepare design report covering design basis, structural calculations, structural drawings

List of Practical

Sr. No.	Descriptions	Unit No.	Hrs.
01	Full design of the following structures with detailing on A2 size drawing sheets, covering all required details in the structural drawings, designed manually for a G+3 building.	01	04
02	Full design of the following structures with detailing on A2 size drawing sheets, covering all required details in the structural drawings, designed using software for a G+3 building.	01	04
03	Full design of the retaining wall with detailing on an A2 size drawing sheet, covering all required details in the structural drawing.	02	02
04	Full design of the water tank with detailing on an A2 size drawing sheet, covering all required details in the structural drawing.	03	02
05	Full design of the Flat Slab with detailing on an A2 size drawing sheet, covering all required details in the structural drawing. .	04	02
06	Software applications of multi-storied building subjected to wind forces and earthquake forces	05	04
07	Preparation of Excel worksheets for the design of various structural components of buildings.	ALL	02
08	Preparation of Excel worksheets for the design of various structural components of other structures as per the syllabus.	ALL	02
09	Prepare at least one drawing in any CAD software for design of structures conducted in the syllabus.	ALL	04
10	Drawing of design Structural detail drawing in sketchbook	ALL	04
TOTAL			**30**

Instructional Method:

The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.
From the content 10% topics are suggested for flipped mode instruction.
Students will use supplementary resources such as online videos, NPTEL/SWAYAM videos, e-courses, Virtual Laboratory.
The internal evaluation will be done on the basis of Active Learning Assignment.
Practical/Viva examination will be conducted at the end of semester for evaluation of performance of students in the laboratory.

Reference Books:

[1] Limit State Design of Concrete Structures, P. C. Varghese, Prentice Hall of India, New Delhi.
[2] Limit State Theory and Design of Reinforced Concrete, Shah & Karve, Structures Publications, Pune.
[3] Reinforced Concrete Vol. I, Dr. H. J. Shah, Charotar Publishing House, Anand.
[4] Advanced RCC Design, B. C. Punmia, Laxmi Publications Pvt. Ltd., New Delhi, 2006.