



**Gyanmanjari**  
Innovative University

Course Syllabus  
Gyanmanjari Institute of Technology  
Semester-5 (B. Tech.)

**Subject:** Design of Structures – BETCV15314

**Type of Course:** Professional Core

**Prerequisite:** Knowledge of Structural Mechanics

**Rationale:** This subject is applications of structural engineering principles to design basic structural elements using of reinforced concrete and steel as materials. The subject is specifically aim to develop understanding of various design philosophy, Indian codal provisions, design basis used in design of basic elements of framed structures and its detailing requirement

**Teaching and Examination Scheme:**

Teaching Scheme			Credits	Examination Marks					Total Marks
CI	T	P	C	Theory Marks		Practical Marks		CA	
				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: Subject related Indian Standard Codes (1) IS:456-2000 (2) IS:800-2007 (3) SP-16 Design Aid to IS-456 (5) SP-6 Handbook for Steel Structures will be allowed during Examinations.*



**Course Content:**

Sr. No	Course Content	Hrs.	% Weightage
1	<b>Introduction</b> Objectives, Properties of Reinforced Concrete and Structural Steel, Loads & load combinations, Methods of Analysis, Codes & specifications, Design Philosophies - Working stress Method, Ultimate Load Method, Limit State Method, Plastic Method	08	10
2	<b>Philosophy of Limit state design for RC structures</b> Limit state of collapse & serviceability, partial safety factors for material & loading. Limit State of Flexure: Stress-strain characteristics 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. Limit state of Axial, Shear and Torsion, combined flexure & torsion, Bond & Anchorage, Development length, splicing	10	20
3	<b>Limit state design of RC structural Element</b> Design of Beams: Simply supported, cantilever and continuous beams Design of Slab: One way, two way simply supported and continuous slabs Design of Column: Classifications, Assumptions, Design of Short Columns under axial load Design of Foundations: Design of isolated footing under axial load and uniaxial bending, combined footing.	16	25
4	<b>Philosophy of Limit state design for Steel</b> Limit state of collapse & serviceability, partial safety factor for material and loading, Type & behavior of sections – Plastic, compact, semi compact, slender. Connections: Bolted connections – bearing type, behavior of bolted joints, Design strength of ordinary & HSFG bolts. Welded connections Fillet and Butt weld, design of simple connections such as lap and butt joints, truss joint connections.	10	20
5	<b>Limit state design of Steel components</b> Axial force design: Tension member: types of tension member, behavior, modes of failure, Design of tension member, splices, lug angle. Compression member: Behaviour, classification of sections, possible modes of failure, elastic buckling of slender member, design of compression member having single & built-up section, lacing & battening, Footing : slab based, gusseted base foundation	16	25





**Continuous Assessment:**

Sr. No.	Active Learning Activities	Marks
1	<b>List out Software's with Detail using in RCC Structure</b> Enlist Various Software used For the Design of RCC Structures and Make a report in details of any one software and upload it on GMIU Web Portal.	10
2	<b>Field visit on Construction Site</b> Visit the Construction Site and check the level of slab, Plumb Of column and depth of Column as per plan and make A presentation on It and Upload it on GMIU Web Portal.	10
3	<b>Excel program on Structural Component</b> Faculty Will Assign Different Criteria of Beam. Then Prepare an excel Program for analysis Doubly Reinforced RC Beam. And Upload it on GMIU Web Portal.	10
<b>Total</b>		<b>30</b>

**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%	20%	50%	15%	5%	5%

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	Describe different properties of RC and Structural steel, loads & its combinations, method of analysis used in design of structural elements
CO2	Explain different design philosophy evolved time to time and its applicability in designing structural elements.
CO3	Apply Indian standard codal provisions of Limit state methods for RC and Steel structural components.
CO4	Apply design principles of Limit state methods in RC and steel structural components.
CO5	Appraise capacity of RC and Steel structural elements in different design methods and designing section with appropriate method



### List of Practical

Sr. No.	Descriptions	Unit No.	Hrs
01	Interpret IS Code provisions for Limit state R.C.C. Design from IS:456-2000.	01	02
02	Analyse Singly Reinforced Beams for Moment of Resistance from given data	02	04
03	Design of singly reinforced beams for flexure and shear and apply necessary checks from given data.	02	02
04	Design of One way simply supported slabs and apply necessary checks from given data	02	02
05	Draw sketches (not to scale) showing reinforcement details of singly and doubly reinforced beams	04	02
06	Draw sketches (not to scale) showing reinforcement details of one way simply supported slab in longitudinal and cross-sectional view.	04	04
07	Draw sketches (not to scale) showing reinforcement details of two way simply supported slab in longitudinal and cross-sectional view.	04	04
08	Draw sketches (not to scale) for types of roof trusses, components of roof truss and important four joints like ridge joint, eave joint, bottom middle joint and intermediate joint.	05	06
09	Prepare a detailed report of site visit for reinforcement detailing of structural elements like beams & columns. Prepare a detailed report of site visit for study of rolled steel	05	02
10	Prepare a detailed report of site visit for reinforcement detailing of structural elements like staircase & footing. Prepare a detailed report of site visit for study of rolled steel	05	02
<b>TOTAL</b>			<b>30</b>





### **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 laboratory.

### **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] N. Subramanian; Steel Structures, Oxford Publication
- [4] Arya & Ajamani.; Design of Steel Structures; Nemchand & Bros., Roorkee

