



Gyanmanjari
Innovative University

Course Syllabus
Gyanmanjari Diploma Engineering College
Semester-5 (Diploma)

Subject: Design of Structures – DETCV15213

Type of course Professional Core

Prerequisite: Knowledge of Structural Mechanics

Rationale: After learning Mechanics of rigid bodies and Mechanics of deformable bodies, this subject "Design of Structures" introduced in 5th semester, as it deals with the design and analysis of R.C.C. and Steel structures, is the backbone of Civil Engineering Course. The design of prime members like Slabs, Beams, Columns and Footing in R.C.C. and in Steel structures some Introductory topics like design of connections and calculations of various loads on Roof Truss are intended to incorporate in this subject of design of structures. Analyze and Design important structural members of R.C.C. and primary knowledge of bolted and welded connections for Steel structures and various loads for steel structures

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) IS: 875 (Part- I,II,III) (4) 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	Fundamentals of R.C.C. Design & Singly Reinforced Beam Reinforced Cement Concrete, necessity of steel in concrete, normal location of steel in beams, slabs, column & footing. Limit State, Limit State of Collapse Flexure, Shear, Compression, Torsion, Limit State of Serviceability-deflection & Cracking Nominal Cover, Effective depth, Effective span. Types of beam: Singly reinforced beam, Doubly reinforced beam, T beam, L-beam. Difference among various beams Stress-strain diagram for singly RC section. Under reinforced, over reinforced and balanced section. Analysis of Singly RC beam: Determination of lever arm, total tension, total compression, percentage area of reinforcement and Moment of resistance. Numerical based on this	14	25%
2	Shear and Development Length Shear: Definition of shear, IS codes specifications, single legged and two legged shear reinforcement. Vertical stirrups, Incline stirrups, benefit of bent up of main tension reinforcement. Spacing of stirrups. Numerical based on this. Effect of shear in slabs. IS code provision. Development Length: Definition of development length, IS provision for determination of development length for tension and compression zone. Numerical based on this.	12	20%
3	Slabs Axially loaded short column and pad footing Column: Types of column, Long Column, Short column, Axially loaded column, uniaxial loaded column and biaxial loaded column. Above beams Point of Contra-flexure & its importance Limit state of collapse: Compression, assumptions, effective length, slenderness ratio, minimum eccentricity. IS provision for reinforcement in column, lateral reinforcement as tie only for column Load analysis of axially loaded short columns. Design of axially loaded short columns. Check for minimum eccentricity. Footing: Types of isolated footing, pad and sloped footing. IS specification for reinforcement in pad footing only Design of isolated pad footing. Numerical based on this with reinforcement details.	14	25%
4	Fundamental of Steel Design Bolted and Welded connections Steel versus RCC as a building material. Advantages and disadvantages of steel. Types of steel sections normally in use.	12	15%



	Characteristic strength and design strength, Bolted connection: Types of bolts, Black Bolts, Turned Bolts, HSFG Bolts, Grade of Bolts Lap and Butt Joint, Minimum and Maximum Pitch, Tack Bolting, Edge Distance, Gauge Distance, Bolt Hole. Analysis and design of bolted connection of plate and Angle sections. Numerical based on this.		
5	Load Calculation for Roof Truss Types of Truss for various spans, Pitch of Truss, Rise, Spacing of Truss, Members of Truss: Purlin, Principal Rafter, Main Tie, Sag Tie. Joints: eave joint, ridge joint, intermediate joint and middle bottom joint. Roofing material GI and AC Sheets. Types of load and load combinations for roof truss as per IS 875 codal provisions. Live Load per panel point on purlin and Truss. Wind Load per panel point on roof truss Numerical on dead load, live and wind load for roof truss.	08	15%

Continuous Assessment:

Sr. No.	Active Learning Activities	Marks
1	Steel Structure Site visit and Make a Presentation Individually Collect by student's different photographs of steel structural members by visiting railway station, or industrial sheds where connections can be shown actually implemented at site. and Make a Presentation and Upload it to the GMIU Web Portal.	10
2	Market Survey of Steel Bar Compare the price of different grades of steel bars by actual market survey (In Students Group) and prepare the report. Upload it to the GMIU Web Portal.	10
3	Prepare spreadsheet On Column Faculty Assign to Individual Student. Prepare spreadsheet or computer program to calculate load carrying capacity of axially loaded short RC column. Upload it to on 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 %	20%	20%	50%	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	Analyze and Design singly reinforced rectangular beam for flexure and shear.
CO2	Evaluate the effects of shear on beams and slabs.
CO3	Design axially loaded short column and pad footing.
CO4	Understand bolted and welded connections.
CO5	Determine Dead Load, Live Load and Wind Load on Roof Truss

List of Practical: -

Sr. No.	Descriptions	Unit No.	Hrs
01	Analyse Singly Reinforced Beams for Moment of Resistance from given data (3-Problems).	1	04
02	Draw sketches (not to scale) showing reinforcement details of singly and doubly reinforced beams and one way simply supported slab in longitudinal and cross sectional view	2	04
03	Analyse and design axially loaded short square column from given data	2	04
04	Analyse and design pad footing of column from given data.	2	02
05	Draw sketches (not to scale) showing reinforcement details of axially loaded short rectangular and Circular columns in plan and sectional view in longitudinal and cross sectional view	3	02
06	Draw sketches (not to scale) showing reinforcement details of isolated pad and slope footing in plan and sectional view in longitudinal and cross sectional view	3	02
07	Calculate dead load, live load and wind load for the given data of steel roof truss and prepare a force table.	4	04



08	Design of Two way simply supported slabs and apply necessary checks from given data. (Corners not held down condition only)	4	04
09	Design a welded connection for the given data of steel section as per IS: 800-2007.	5	02
10	Design a bolted connection for the given data of steel section as per IS: 800-2007.	5	02
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 laboratory.

Reference Books:

- [1] Design of Reinforced Concrete Structures N Krishna Raju CBS Publishers
- [2] Design of Reinforced Concrete Structures N Subramanian Oxford Publisher
- [3] Reinforced Concrete Vol. I Dr. H. J. Shah Charotar Publication
- [4] Design of Steel Structures by Limit State Method as per IS:800-2007
- [5] Limit State design of Steel Structures S. K. Duggal

