Gyanmanjari
Innovative University

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

Subject:	Civil Computational Tools- DETCV15219
Type of course	Skill based course
Prerequisite:	Basic Mathematics ,Engineering Mechanics, Building Materials & Construction ,Surveying , Design of Structure , Estimate, Computer Fundamentals

Rationale: This subject helps student uses computational tools to solve civil engineering problems efficiently. It focuses on applying spreadsheets for structural calculations, material estimation, cost analysis, and design. By automating calculations and reducing errors, students can improve accuracy and decision-making. These skills are essential for modern construction practices, making students industry-ready and enhancing their employability.

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	
0	0	4	2	0	0	10	40	50	100

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

Course Content:

Sr. No.	Course content	% Weightage
1	**Introduction to Spreadsheet for Civil Engineering** Basic spreadsheet functions, navigation, cell formatting, and data validation. Understanding formulas like sum, average, min, max, and count. Applying conditional formatting and drop-down lists for data organization.	15
2	**Structural Calculations Using Spreadsheets** Load estimation for beams, slabs, and columns. Shear force and bending moment calculations. Slab load calculations for residential and commercial buildings. Column axial load calculations. Footing design calculations. Reinforcement estimation for beams, slabs, columns, and footings.	25
3	**Quantity Estimation & Costing** Material quantity estimation for brickwork, plastering, and flooring. Cement, sand, and aggregate calculation for different concrete grades., Concrete mix design as per IS 10262:2019. Calculation of cement, aggregate, and water proportions. Strength analysis of concrete cubes. Brick compressive strength calculations using test data. Rate analysis for construction materials and labor cost estimation. Preparation of Bill of Quantities (BOQ) for small buildings.	25
4	**Water Supply & Sewerage System Calculation** Water demand calculation as per standards. Pipeline sizing for water supply networks. Septic tank volume estimation based on population and flow rate. Storm water drainage system design using rainfall data.	15
5	**Surveying & Earthwork Calculation** Leveling calculations using the rise and fall method and height of instrument method. Earthwork volume estimation for cut and fill works. Road material estimation. Contour volume calculations for land development projects.	20

Continuous Assessment:

Sr. No.	Active Learning Activities	Marks
1	**Spreadsheet-Based Load Estimation for Beams** Students will calculate the dead load, live load, and total load on beams using spreadsheet formulas. They will input beam dimensions, material properties, and standard load values (as per IS 875: Part 2) to determine shear forces and bending moments. Using the calculated values, they will check the structural	10

	adequacy of the beam and submit a Excel sheet and including manual calculations, on the GMIU Web Portal.	
2	**Brickwork and Plaster Quantity Estimation** Students will prepare a detailed material quantity estimation for brickwork and plastering using a spreadsheet-based approach. They will input wall dimensions, brick sizes, mortar thickness, and plaster area to calculate the number of bricks required, volume of mortar, and total plastering material. The final estimation will include cement, sand, and brick, which will be verified against manual calculations. Students will submit the completed BOQ sheet on the GMIU Web Portal.	10
3	**Pipeline Sizing and Septic Tank Volume Calculation** Students will calculate the pipeline diameter for a water supply network based on flow rate and velocity constraints. Additionally, they will estimate the septic tank volume required for a specified population and wastewater generation rate, following IS standards. The spreadsheet model will include automated calculations for storm water drainage capacity based on rainfall intensity data. Students will submit their detailed calculation sheets on the GMIU Web Portal.	10
4	**Reinforcement Calculation for Beams and Columns** Students will determine the required reinforcement area for a given beam and column cross-section. Using a spreadsheet-based calculation method, they will consider moment and axial load conditions, steel grade, and concrete strength, referring to IS 456:2000 for design checks. The spreadsheet will include auto-calculated bar spacing, steel percentage, and bending moment diagrams. The final reinforcement calculations will be submitted on the GMIU Web Portal.	10
5	**Earthwork Estimation for Cut and Fill Operations** Students will perform earthwork volume calculations for a given site development project using contour data and leveling survey results. They will apply the Rise and Fall Method and Height of Instrument Method in spreadsheets to determine the cut and fill volumes for excavation and backfilling. Their reports will include material quantity estimation for road subgrade layers, which will be submitted on the GMIU Web Portal.	10
	Total	50

Suggested Specification table with Marks (Theory): NA

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

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	Understand and apply spreadsheet functions for civil engineering calculations.
CO2	Perform structural load estimation and reinforcement calculations.
CO3	Estimate material quantities and prepare a Bill of Quantities (BOQ).
CO4	Compute water supply, sewerage, and drainage system parameters.
CO5	Analyze surveying and earthwork data using spreadsheets.

List of Practical:

Sr. No.	Descriptions	Unit No.	Hrs.
1.	Basic Spreadsheet Functions – Navigation, data entry, formatting, and cell referencing.	1	2
2.	Formula Application – SUM, AVERAGE, MIN, MAX, and COUNT functions.	1	2
3.	Conditional Formatting & Data Validation – Creating drop-down lists for data organization.	1	2
4.	Basic Charting & Graphing – Representing civil engineering data visually.	1	2
5.	Data Sorting & Filtering – Managing large datasets efficiently.	1	2
6.	Load Estimation for Beams & Slabs – Live load and dead load calculations.	2	2
7.	Shear Force & Bending Moment Calculations – For simply supported and cantilever beams.	2	2
8.	Slab Load Calculation – For residential and commercial buildings.	2	2
9.	Axial Load Calculation for Columns – Load distribution and safety factor considerations.	2	2
10.	Footing Design Calculation – Bearing capacity and size estimation.	2	2

11.	Reinforcement Estimation – Quantity calculation for beams, slabs, and footings.	2	2
12.	Brickwork Estimation – Material quantity calculation for walls.	3	2
13.	Plastering & Flooring Estimation – Surface area and material requirements.	3	2
14.	Concrete Mix Quantity Calculation – Cement, sand, and aggregate for different grades.	3	2
15.	Rate Analysis of Construction Materials – Cost estimation per unit.	3	2
16	Labor Cost Estimation – Work rate-based labor costing.	3	2
17	BOQ Preparation – Simple building project bill of quantities.	3	2
18	Water Demand Calculation – Using population and standard water usage values.	4	2
19	Pipeline Sizing for Water Supply Networks – Based on velocity and flow rate.	4	2
20	Septic Tank Volume Estimation – Considering population and wastewater flow.	4	2
21	Storm water Drainage Design – Rainfall data-based runoff estimation.	4	2
22	Water Balance Calculation – Estimating water usage vs. supply availability.	4	2
23	Leveling Calculations Using Rise & Fall Method – Height difference determination.	5	2
24	Leveling Calculations Using Height of Instrument Method – Elevation determination.	5	2
25	Earthwork Volume Estimation – Cut and fill calculations.	5	2
26	Road Material Estimation -- Subgrade, base, and surface layer material calculation.	5	2
27	Contour Volume Calculation – Area and volume estimation for land development.	5	2
28	Concrete Mix Design (M20 & M40) – IS 10262:2019 method.	6	2
29	Cement, Aggregate & Water Proportioning – For desired concrete strength.	6	2
30	Strength Analysis of Concrete Cubes – Using experimental data.	6	2
Total			**60**

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 the 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] Spreadsheet Applications in Civil Engineering – P. Niraja Rani, Lakshmi Publication

[2] Estimating and Costing in Civil Engineering – B.N. Dutta, UBS Publishers

[3] Design of Reinforced Concrete Structures – N. Subramanian, Oxford University Press

[4] Surveying Vol. 1 & 2 – B.C. Punmia, Laxmi Publications

[5] Concrete Technology – M.S. Shetty & A.K. Jain, S. Chand Publications

[6] Water Supply Engineering – S.K. Garg, Khanna Publishers

[7] Limit State Design of Reinforced Concrete – A.K. Jain, Nem Chand & Bros

[8] IS 456:2000 – Indian Standard Code for Plain and Reinforced Concrete

[9] IS 10262:2019 – Indian Standard Code for Concrete Mix Design

[10] IS 3370:2009 – Indian Standard Code for Water Retaining Structures