Gyanmanjari Innovative University

Syllabus
Gyanmanjari Institute of Technology
Semester-3 (B. Tech)

Subject: Infrastructure Engineering Materials and Construction Practices – BET2CV13306

Type of course: Professional Core

Prerequisite: Knowledge of Materials Technology for Civil Engineering Applications

Rationale: The development of a basic understanding about the construction of different type of Structures and application of the basic principles of Engineering to solve real life problems in construction practices is necessary for civil engineers. Advancement in the technologies for the construction of building structures as per current demand.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks		Total Marks
CI	T	P	C	SEE	CCE	
2	0	4	4	100	50	150

Legends: CI-Classroom Instructions; T-Tutorial; P -Practical; C –Credit; SEE -Semester End Evaluation; CCE-Continuous and Comprehensive Evaluation

Sr. No.	Course Content	Hrs.	% Weightage
1	**Foundation Engineering and Substructure Construction** ***Theory Topics:*** Foundations: Requirement and necessity of foundation, failures of foundation and remedial measures. Subsurface Investigation for foundation. Types of foundations - Shallow Foundation: its types and conditions under which they are used, Deep Foundation: Types of deep foundation-Pile Foundation and its types, pile driving/ boring methods, causes of failures of piles. Well foundation- types of caissons, loads on caisson, design features of caissons, sinking of caisson, caisson diseases. ***Practical:*** 1. Identify and classify different types of foundations (shallow and deep) from drawings, models, site photographs, and understand their suitability and applications. 2. Compare shallow and deep foundations based on load conditions, soil type, and site requirements to determine appropriate selection.	20	20 %

3. Study causes of foundation failures through case studies and identify preventive measures to improve structural safety.
4. Understand subsurface soil investigation methods and identify equipment used for soil exploration through charts, videos, or demonstrations.
5. Study pile foundations, including types such as end-bearing and friction piles, and understand their applications and construction methods.
6. Study pile driving methods and prepare flowcharts showing the sequence of pile installation operations.
7. Study caisson (well) foundations, including types such as open, box, and pneumatic caissons, using diagrams and models.
8. Draw labeled sketches of pile foundations and caissons to understand their structural details and functioning.
9. Study the sinking process of caissons and identify causes, effects, and preventive measures of caisson diseases.
10. Solve case-based problems and prepare comparative analysis for selection between pile foundations and well foundations in different site conditions.

Evaluation Method:

Sr. No.	Evaluation Methods	SEE	CCE
1	**Drawing and Labeling of Foundation Types** Students will prepare neat and properly labeled sketches of different foundation systems assigned by the faculty, such as isolated footing, pile foundation, and caisson foundation. The activity will assess their understanding of foundation types and their structural application in construction. Evaluation shall be based on technical accuracy, correct labeling, clarity of sketches, and overall presentation quality.	20	
2	**Active Learning Assignments: Short Technical Note on Foundation Failure** Students will independently study and prepare a brief note on common types of foundation failures such as settlement, shear failure, differential settlement, and bearing capacity failure. They will identify the major causes of these failures, including poor soil conditions, improper design, construction errors, and		10

		inadequate drainage. Students will also suggest basic preventive measures to avoid such failures in real construction projects. The collected information will be organized with clear explanations and suitable illustrations in a structured format. The final work shall be prepared and submitted in the form of a PowerPoint Presentation (PPT) through the GMIU Web Portal.			
		Total	**20**	**10**	

Examination Style:

Drawing and Labeling of Foundation Types (20 Marks)
In this practical evaluation, students are required to prepare neat and labeled sketches of different foundation systems assigned by the faculty, such as isolated footing, combined footing, pile foundation, or caissons. The drawings should clearly show important structural components, dimensions, and load transfer arrangements. Students must use proper engineering drawing techniques and maintain correct labeling standards. This activity helps students improve their visualization and technical drawing skills related to foundation engineering. It also develops understanding of the construction and applications of different foundation systems. Evaluation is based on drawing accuracy, labeling, neatness, and clarity of presentation.

Short Technical Note on Foundation Failure (10 Marks)
In this practical evaluation, students are required to write a brief technical note on common foundation failures such as settlement, tilting, cracking, or excessive loading and explain their possible causes. They also describe suitable preventive and remedial measures for avoiding such failures in construction works. After preparing the content, students create a PowerPoint presentation including diagrams, images, and technical explanations related to foundation failures. The presentation should be organized in a clear and systematic manner using proper engineering terminology. Students are required to upload the completed presentation on the GMIU portal within the given submission schedule. Evaluation is based on technical accuracy, quality of presentation, clarity of explanation, and proper submission of the work.

2	**Masonry Construction and Wall Finishing Works** ***Theory Topics:*** Stone Masonry Construction, Technical Terms in Stone Masonry, Types of Joints in Stone Masonry, Classification of Stone Masonry, Brick Masonry Construction, Technical Terms in Brick Masonry, Types of Bonds in Brickwork, Composite Masonry, Hollow Block Masonry, Partition	20	20 %

Walls, Cavity Walls, Lintels and Their Types, Arches and Their Construction, Wall Finishes, Plastering Techniques, Pointing in Masonry, Painting Works in Building Construction.

Practical:

11. Identify and classify building stones, bricks, and hollow blocks based on their properties, quality, and suitability in construction.
12. Study and perform basic material tests such as water absorption test on stones and compressive strength test on bricks to evaluate their performance.
13. Draw and analyze different types of stone masonry joints and compare rubble masonry with ashlar masonry.
14. Draw brick masonry bonds such as English bond and Flemish bond and understand their application in wall construction.
15. Perform hands-on brick laying practice for English and Flemish bond in one-brick thick walls.
16. Study cavity wall and hollow block masonry systems and analyze their thermal, structural, and load-bearing behavior.
17. Draw and study structural elements such as lintels and arches with proper detailing and classification.
18. Study plastering work, including common defects, their causes, and suitable remedial measures.
19. Compare different finishing materials such as paints (emulsion, enamel, distemper) and study pointing techniques in masonry.
20. Perform a comprehensive study of masonry construction techniques including material selection, bonding systems, and construction practices for improved durability and performance.

Evaluation Method:

Sr. No.	Evaluation Methods	SEE	CCE
1	**Stone identification, classification and water absorption test** Students will receive various unknown stone samples. They identify, classify, and conduct a water absorption test.	20	
2	**Active Learning Activity: Bond diagram drawing:** Students will be assigned any two types of brick bonds (such as stretcher bond, header bond, English bond, or Flemish bond) by the examiner. They will draw the plan view of each assigned bond,		10

			showing a minimum of four alternating courses for a one-brick thick wall. Students must clearly indicate proper brick arrangement and ensure correct bonding pattern continuity. All technical terms and components must be neatly labelled in the drawing. The activity will develop students' understanding of masonry bonding principles and construction detailing. The final work shall be submitted in the form of a drawing on the GMIU Portal.			
			Total	**20**	**10**	

Examination Style:

Stone identification, classification and water absorption test (20 Marks)

Students are provided with 6 to 8 unknown stone samples and must first identify each by observing physical properties such as colour, texture, grain size, and hardness. Based on these observations, they classify each stone into its geological category — igneous, sedimentary, or metamorphic — with written justification. They then conduct a water absorption test, weighing each sample before and after 24 hours of immersion to calculate percentage absorption. Results are compared against IS acceptance criteria to judge durability, and students recommend the appropriate construction use for each sample — such as flooring, foundation, or face work. Findings are submitted as a structured lab record with tabulated data and conclusions.

Bond diagram drawing: (10 Marks)

Students are assigned two brick bond types from stretcher, header, English, or Flemish bond, and must draw the plan view of each showing a minimum of four alternating courses for a one-brick thick wall. Each drawing must be neatly executed to scale, clearly showing the correct arrangement of headers, stretchers, and queen closers at the appropriate course positions. All standard technical terms — including header, stretcher, bed joint, cross joint, queen closer, frog, and course line — must be labelled accurately on both drawings. A proper title block containing the student's name, roll number, date, and scale must be included on the drawing sheet. Once complete, students are required to upload a clear photograph or scanned copy of their drawing on the GMIU portal.

3	**Concrete Construction and Formwork Systems** ***Theory Topics:*** Plain Cement Concrete Construction, Reinforced Cement Concrete	20	20 %

(RCC) Construction, Precast Concrete Construction, Cast-in-Situ Concrete Construction, Introduction to Concrete 3D Printing, Formwork Systems in Construction, Formwork for RCC Walls, Formwork for Slabs, Formwork for Beams, Formwork for Columns, Centering for Large Span Arches, Slip Formwork Systems, Horizontal Slip Formwork, Vertical Slip Formwork, Applications of Modern Formwork Techniques in Civil Engineering.

Practical:

21. Identify different types of plain and reinforced cement concrete (RCC) construction from models, images, or site observations.
22. Study precast concrete components used in building construction and understand their applications.
23. Compare precast and cast-in-situ construction methods in terms of quality, cost, and execution.
24. Prepare a chart showing advantages and limitations of precast concrete construction techniques.
25. Draw labeled sketches of formwork used for RCC elements such as walls, beams, columns, and slabs.
26. Study the requirements and characteristics of good formwork in RCC construction.
27. Compare timber, steel, and aluminum formwork based on performance, cost, and usability.
28. Identify defects caused by improper formwork and suggest preventive measures for construction quality improvement.
29. Study slip formwork systems used in vertical and continuous construction works.
30. Prepare a comparative analysis of different formwork materials and systems used in RCC construction.
31. Identify structural defects caused by faulty formwork practices and suggest corrective and preventive measures.
32. Prepare a mini report on innovative concrete construction techniques and modern developments in formwork systems.

Evaluation Method:

Sr. No.	Evaluation Methods	SEE	CCE
1	**Case-Based Construction Method Selection:** Students are given practical construction situations and asked to select suitable construction methods such as precast, cast-in-situ, or slip formwork. They justify their choices based on speed, economy, and site conditions.	20	
2	**Active Learning Activity: Flowchart Preparation for**		10

	Construction Sequence: Students will independently prepare clear flowcharts illustrating the sequential stages of RCC concreting or the process of formwork erection and removal. They will identify and arrange each stage in the correct order, ensuring logical continuity and proper technical representation of construction activities. The flowcharts must be neatly designed with appropriate labels, symbols, and brief descriptions of each step. This activity will help students understand construction sequencing and site execution practices in RCC works. The final work shall be submitted in the form of a PDF through the GMIU Portal.		
	Total	20	10

Examination Style:

Case-Based Construction Method Selection: (20 Marks)
In this practical evaluation, students are given real-life construction situations such as high-rise buildings, mass housing projects, bridges, or large storage structures. They are required to select suitable construction methods such as precast construction, cast-in-situ construction, or slip formwork based on the given conditions. Students analyze factors like construction speed, economy, labor availability, quality control, and site conditions before making their decisions. They also justify their selected method by explaining its advantages and suitability for the project. This activity helps students develop practical decision-making and analytical skills related to modern construction techniques. Evaluation is based on appropriateness of method selection, technical justification, and clarity of explanation.

Flowchart Preparation for Construction Sequence:(10 Marks)
In this practical evaluation, students are required to prepare flowcharts showing the sequence of activities involved in RCC concreting or formwork erection and removal. The flowchart should include important stages such as material preparation, reinforcement placement, formwork fixing, concrete pouring, compaction, curing, and removal of formwork. Students must arrange the steps in the correct construction order using proper technical terminology. This activity helps students understand the systematic procedure followed in concrete construction works. It also improves their planning and process visualization skills used in site execution. Evaluation is based on sequence accuracy,

<table>
<tr><td></td><td>technical correctness, neatness, and clarity of presentation.</td><td></td><td></td></tr>
<tr><td>4</td><td>Building Components and Finishing Systems

<u>Theory Topics:</u>

Building Components: Doors and Windows: technical terms, size, types, suitability, fixtures and fastenings, Ventilators Stairs and Staircases: Definition, technical terms, requirements of good stair, classification, stair design/planning, Lifts, elevators, escalators. Floorings: Introduction, essential requirements of a floor, factors affecting selection of flooring material, Roofs and Roof Coverings: Introduction, requirements of good roof, technical terms, classification, types of roof coverings, advantages and disadvantages of different types of roofing.

<u>Practical:</u>

33. Identify different types of doors, windows, and their fittings (hinges, locks, handles, bolts, stoppers) from models, images, or samples and understand their applications in buildings.
34. Study technical terms related to doors, windows, ventilators, and staircases through labeled sketches and drawings.
35. Measure and compare standard sizes of doors and windows used in residential and commercial buildings.
36. Identify different types of windows and ventilators and explain their suitability based on ventilation, lighting, and functional requirements.
37. Draw labeled sketches of ventilators, steps, and staircase components to understand their construction details.
38. Study various types of staircases and understand their components, technical terms, and applications in buildings.
39. Study the working principles and applications of lifts, elevators, and escalators in modern building systems.
40. Identify different types of flooring materials and compare them based on cost, durability, and maintenance requirements.
41. Identify different roof types and prepare labeled sketches of pitched roof, flat roof, and shell roof systems.
42. Study different roof coverings and evaluate their advantages and disadvantages in building construction.

Evaluation Method:

<table><tr><th>Sr. No.</th><th>Evaluation Methods</th><th>SEE</th><th>CCE</th></tr></table></td><td>20</td><td>20%</td></tr>
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1	**Drawing and Labeling of Building Components: st**udents prepare neat and labeled sketches of doors, windows, staircases, roofs, or ventilators. Assessment focuses on technical accuracy and presentation quality.	20	
2	**Flowchart Preparation for Flooring or Roofing Work:** Students prepare flowcharts showing sequence of flooring installation or roof construction activities.		10
	Total	**20**	**10**

Examination Style:

Drawing and Labeling of Building Components (20 Marks)

In this practical evaluation, students are required to prepare neat and labeled sketches of building components such as doors, windows, staircases, roofs, or ventilators assigned by the faculty. The drawings should clearly show important parts, dimensions, and technical details using proper engineering drawing standards. Students must use correct labeling and maintain clarity in presentation. This activity helps students improve their visualization and drafting skills related to building construction. It also develops understanding of the structure, function, and applications of different building components. Evaluation is based on technical accuracy, labeling, neatness, and overall presentation quality.

Flowchart Preparation for Flooring or Roofing Work (10 Marks)

In this practical evaluation, students are required to prepare flowcharts showing the sequence of activities involved in flooring installation or roof construction works. The flowchart should include important stages such as surface preparation, material placement, finishing, curing, and inspection in proper construction order. Students must use clear technical terminology and systematic presentation while preparing the flowchart. This activity helps students understand the step-by-step execution process followed in building construction. It also improves planning and process visualization skills required for site work. The completed work must be prepared digitally and uploaded on the GMIU Portal within the given submission schedule, and evaluation will be based on sequence accuracy, technical correctness, neatness, and timely submission.

5	**Special Construction Works and Protective Treatments** ***Theory Topics:*** Special Works: Timbering in trenches, Control of Ground water in excavation, types of scaffoldings, shoring, underpinning, Coffer Dams, Diaphragm Walls, Demolition of structures and site safety. Special Treatments: Fire resistant, water resistant, thermal insulation, acoustical construction and anti-termite treatment. ***Practical:*** 43. Prepare labeled sketches of timbering arrangements for excavations. 44. Study methods used for control of groundwater during excavation works. 45. repair flowchart showing groundwater control procedure in excavation. 46. Draw labeled sketches of single, double, cantilever, and suspended scaffolding. 47. Study shoring systems used for temporary support in structures. 48. Study underpinning methods used for strengthening existing foundations. 49. Draw labeled sketches of earthfall, sheet pile, and cellular cofferdams. 50. Study methods and equipment used for demolition of structures. 51. Prepare a chart showing site safety measures during excavation and demolition. 52. Identify anti-termite treatment methods used in building construction. 53. Solve case-based problems related to excavation safety and special treatments. 54. Prepare a presentation on special construction works and treatment methods. **Evaluation Method:**	10	20 %

Sr. No.	Evaluation Methods	SEE	CCE
1	**Special Treatment Material Selection Task** Students select suitable fire-resistant, waterproofing, thermal insulation, acoustical, or anti-termite treatments for given building conditions and justify their choices.	20	
2	**Technical Note Writing on Site Safety:** Students write a short note explaining safety precautions during demolition and		10

	excavation works.		
	Total	**20**	**10**

Examination Style:

Special Treatment Material Selection Task (20 Marks)
In this practical evaluation, students are given different building conditions such as fire-prone areas, damp environments, excessive heat exposure, noise-sensitive spaces, or termite-affected locations. They are required to select suitable treatments such as fire-resistant coatings, waterproofing systems, thermal insulation materials, acoustical treatments, or anti-termite methods based on the given situation. Students justify their selection by explaining important properties like durability, resistance, safety, effectiveness, and suitability for the structure. They also describe how the selected treatment improves the performance, protection, and service life of the building. This activity helps students develop practical decision-making and problem-solving skills related to special construction treatments. Evaluation is based on appropriateness of treatment selection, technical justification, and clarity of explanation.

Technical Note Writing on Site Safety:(10 Marks)
In this practical evaluation, students are required to write a short technical note explaining important safety precautions followed during demolition and excavation works. The report should include safety measures related to worker protection, use of personal protective equipment, barricading, structural stability, dust control, machinery handling, and emergency procedures. Students must explain the importance of safe working practices to prevent accidents and ensure site safety during construction activities. The report should be prepared in a proper technical format with clear headings, diagrams, or images wherever required. This activity helps students understand practical safety standards followed in civil engineering projects. The completed report must be uploaded on the GMIU Portal within the given submission schedule, and evaluation will be based on technical content, clarity of explanation, presentation quality, and timely submission.

Course Content:

Suggested Specification table with Marks (Theory): 100

Distribution of Theory Marks (Revised Bloom's Taxonomy)						
Level	Remembrance (R)	Understanding (U)	Application (A)	Analyze (N)	Evaluate (E)	Create (C)
Weightage %	10%	20%	30%	20%	10%	10%

Course Outcome:

After learning the course, the students should be able to:	
CO1	Develop understanding about structural stability and importance of types of foundation.
CO2	Recognize the associated entities involved in building construction process.
CO3	Identify the factors to be considered in selection of construction of different building components
CO4	Understand the practices and techniques for Temporary/Special construction Works.
CO5	Learning to further research in sustainable civil construction technology and green building

Instructional Method:

The course delivery method will depend upon the requirement of content and need of students.

A minimum of 20–30% of the course content shall be suggested to deliver through Flipped Learning, where students study digital learning resources before the classroom session. Classroom time shall be utilized for discussion, problem-solving, practical applications, and higher-order learning activities.

Students shall be encouraged to use AI-powered learning platforms, simulation software, virtual laboratories, digital libraries, research databases, online certification courses, NPTEL, SWAYAM, MOOCs, and other technology-enabled learning resources to strengthen conceptual understanding and practical competence.

Continuous assessment shall be conducted through Active Learning Assignments (ALAs), quizzes, skill demonstrations, presentations, practical exercises, projects, case studies, innovation activities, peer assessment, reflective learning, and industry-oriented tasks instead of relying primarily on conventional written assignments.