Gyanmanjari Innovative University

Syllabus
Gyanmanjari Institute of Technology
Semester-1 (B. Tech.)

Subject: Materials Technology for Civil Engineering Applications– BET2CV11207

Type of Course: Project-work/Skill based courses/ Training/ Internship in industry or elsewhere

Prerequisite: Basic knowledge of mathematics, geometry, measurements and elementary drawing concepts.

Rationale: Infrastructure development has been the main focus area for developing countries like India. Housing, roads, bridges, public transportation systems and sanitation can be considered as indicators for development of the country. In view of this, it is essential for all engineering graduates to know the basic aspects of civil engineering. This subject deals with planning and construction of building, construction materials, surveying, quality parameters of water and wastewater, water shed management and overview of other infrastructural needs of a city.

Teaching and Examination Scheme:

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

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

Course Content:

Sr. No.	Course Content	Hrs.	% Weightage
1	**Introduction of Civil Engineering** ***Theory Topics:*** Introduction to Civil Engineering, Definition and Significance of Civil Engineering, Historical Development and Evolution of Civil Engineering, Role of Civil Engineering in Nation Building and Infrastructure Development, Branches of Civil Engineering, Scope of Civil Engineering, Role and Responsibilities of a Civil Engineer, Units of Measurement, Unit Conversion Systems and Applications. ***Practical:*** 1. Observe and identify roads, drainage systems, buildings, water	10	20 %

tanks, bridges, and other civil engineering structures in daily life, and classify them according to the relevant branch of civil engineering.

2. Draw a simple layout of a residential or public area showing roads, drainage lines, water supply lines, and buildings, and identify the branch of civil engineering associated with each component.
3. Calculate the approximate quantities of basic construction materials required for a small room using given dimensions.
4. Analyze practical issues such as road damage or water leakage and identify the roles and responsibilities of different civil engineering professionals involved in solving them.
5. Prepare an informative poster highlighting the scope, applications, and future developments of civil engineering, including concepts such as smart cities and green buildings.

Evaluation Method:

Sr. No.	Evaluation Methods	SEE	CCE
1	**Estimation and Unit Conversion for Residential Room Construction** Students will learn the basic principles of measurement, unit conversion, and quantity estimation used in civil engineering. They will convert units of length, area, and volume, and perform calculations related to a simple residential room. Through numerical problem-solving, students will estimate the quantities of materials required for construction activities. This activity will help them understand the practical application of measurements and estimation techniques in real-life building projects.	10	
2	**Active Learning Activity:** **Infra Plan Lab: Design, Map & Interpret Basic Infra structure:** Students will independently survey a small residential or institutional area and prepare a basic infrastructure layout showing roads, buildings, drainage systems, water supply lines, and other civil engineering facilities. They will identify and label each infrastructure component and relate it to the appropriate branch of civil engineering. Based on their observations, students		10

		will analyze the importance and functioning of these facilities in daily life. The collected information will be organized into a well-structured poster presentation and converted into PDF format for submission on the GMIU Portal.				
		Total	**10**	**10**		

Examination Style:

Estimation and Unit Conversion for Residential Room Construction (10 Marks)

Students will be given a numerical problem by the faculty based on a simple residential room construction project. They will use the provided dimensions and data to perform unit conversions, calculate area and volume, and estimate the quantities of construction materials required. The activity will involve applying measurement principles, conversion techniques, and step-by-step calculations in a systematic manner. Students must present their solutions clearly with appropriate units, formulas, and logical procedures. This exercise will help them understand the practical application of estimation and measurement concepts used in civil engineering and building construction.

Infra Plan Lab: Design, Map & Interpret Basic Infrastructure (10 Marks)

Students will be given a planning-based problem by the faculty to design a basic infrastructure layout of a residential, institutional, or public area. The task will involve preparing a simple layout showing civil engineering components such as roads, buildings, drainage networks, water supply lines, and other essential facilities. Students must identify and label each component correctly, classify them according to the relevant branch of civil engineering, and explain their functions. The completed layout should demonstrate logical planning, proper representation, and an understanding of how different civil engineering disciplines contribute to infrastructure development. This activity will help students develop basic planning, mapping, and interpretation skills applicable to real-world engineering projects.

2	**Building Materials – Types, Properties & Applications** ***Theory Topics:*** Building Materials in Civil Engineering Construction, Factors Affecting the Selection of Building Materials, Natural Building Materials, Manufactured Building Materials, Properties of Building Materials, Specific Properties of Materials, Advanced Construction Materials, Recycled and Sustainable Materials, Applications of Building Materials, Importance of Building Materials in Engineering Structures.	20	20 %

Practical:

6. Identify common construction materials such as cement, sand, aggregates, bricks, and steel, and classify them according to their properties and applications in construction.
7. Perform fineness and specific gravity tests of cement to evaluate its quality and suitability for construction work.
8. Determine the standard consistency of cement by finding the amount of water required to produce a paste of standard consistency.
9. Determine the initial and final setting times of cement to study its hardening behavior and usability during construction.
10. Conduct basic tests on building materials such as rocks, aggregates, and bricks to assess their physical properties and quality.
11. Study modern construction materials and their applications, advantages, and significance in sustainable and advanced construction practices.

Evaluation Method:

Sr. No.	Evaluation Methods	SEE	CCE
1	**Cement Testing and Analysis** Students will perform practical tests to evaluate the physical properties of cement using standard laboratory procedures. The activity will include conducting tests such as fineness, standard consistency, and setting time of cement. Students will observe the testing process, record experimental data, and interpret the results according to relevant standards. Based on their findings, they will analyses the suitability of the cement for various construction applications. This activity will help students understand the importance of quality control and material testing in civil engineering practice.	10	
2	**Active Learning Activity:** **Smart Material Lab: Explore & Evaluate Modern Construction Materials:** Students will independently study modern construction materials such as fly ash, Fiber Reinforced Polymer (FRP), self-healing concrete, geotextiles, and other smart materials		10

		used in civil engineering. They will investigate the properties, advantages, limitations, and practical applications of these materials through literature review and online resources. Students will compare these materials with conventional construction materials and evaluate their contribution to sustainable and innovative infrastructure development. The findings will be organized in a systematic report with relevant images, tables, and observations, and submitted in PPT format through the GMIU Portal.				
		Total	**10**	**10**		

Examination Style:

Cement Testing and Analysis (10 Marks)

Students will be assessed through practical testing and analysis of cement properties using standard laboratory procedures. The assessment will include performing or explaining tests such as fineness, standard consistency, and initial and final setting time of cement. Students must follow the correct testing methodology, record observations accurately, and analyse the results obtained. They will interpret the findings to evaluate the suitability of cement for construction purposes and compare them with standard requirements. The evaluation will focus on practical skills, understanding of testing procedures, accuracy of observations, result interpretation, and the application of material testing concepts in real-world civil engineering practices.

Smart Material Lab: Explore & Evaluate Modern Construction Materials (10 Marks)

Students will be assessed on their understanding and evaluation of modern construction materials used in contemporary civil engineering projects, such as fly ash, Fibre Reinforced Polymer (FRP), self-healing concrete, geosynthetics, and other smart materials. The assessment will require students to identify the properties, advantages, limitations, and applications of these materials in construction. Students must analyse their suitability for different engineering scenarios and explain their role in improving sustainability, durability, and performance of structures. The evaluation will focus on technical understanding, analytical skills, practical relevance, and the ability to present findings clearly with appropriate engineering.

3	**Building Planning and Construction** ***Theory Topics:*** Principles of Building Planning, Arrangement and Functionality of	10	20 %

Spaces, Components of a Building, Site Selection and Site Preparation, Building Bye-Laws and Regulations, Sustainable Building Design, Energy-Efficient Building Design, Building Layout and Space Planning, Building Construction Process, Modern Concepts in Building Planning and Construction.

Practical:

12. Classify buildings according to the National Building Code (NBC) and compare their characteristics and uses.
13. Prepare a simple building plan with proper labeling of rooms, doors, and windows, and explain the principles of layout and planning.
14. Analyze a building plan and evaluate its orientation, ventilation, and lighting arrangements for occupant comfort and efficiency.
15. Observe and identify basic building components and describe their functions in a building structure.
16. Draw different types of foundations and explain their applications under various site and loading conditions.
17. Draw common types of doors and windows and describe their uses in residential and commercial buildings.
18. Draw ventilation arrangements and explain the movement of air and its importance in maintaining indoor comfort.
19. Draw different types of staircases and explain their advantages, suitability, and applications in buildings.

Evaluation Method:

Sr. No.	Evaluation Methods	SEE	CCE
1	**Building Planning and Construction:** Students will be evaluated based on their practical and conceptual understanding of building planning and construction. The assessment will include drawing of building layouts, identification of building components, and application of planning principles such as orientation, ventilation, and space utilization. Students will be judged on accuracy of drawings, correctness of concepts, ability to apply knowledge in real-life scenarios, and clarity of presentation. The evaluation will emphasize skill-based learning, logical planning, and neat and well-structured representation of work.	10	
2	**Active Learning Activity:** **Plan Design Lab: Design, Draw & Present Building Layout:**		10

		Students will independently prepare a basic building plan for a residential or small public structure, showing rooms, doors, windows, circulation paths, and other essential components. They will apply fundamental planning principles such as orientation, ventilation, lighting, privacy, and functional space arrangement while developing the layout. Students will accurately label all building elements and provide a brief explanation of the planning considerations adopted in their design. The completed drawing and supporting description will be compiled into a well-organized poster presentation report and submitted on the GMIU Portal.				
		Total	**10**	**10**		

Examination Style:

Building Planning and Construction (20 Marks)
Students will be assessed on their understanding of building planning and construction through practical and conceptual tasks. They will design and draw a basic building layout, identify key building components, and explain the stages of construction from foundation to finishing. The assessment will also evaluate their knowledge of planning principles such as orientation, ventilation, and space utilization. Marks will be awarded based on drawing accuracy, conceptual understanding, practical application, and clarity of presentation.

Plan Design Lab: Design, Draw & Present Building Layout: (10 Marks)
Students will be assessed through practical and conceptual evaluation of their ability to design and draw a basic building layout. They will prepare a neat and properly labeled plan showing rooms, doors, windows, and circulation spaces while applying principles of orientation, ventilation, lighting, and space utilization. Students must demonstrate an understanding of building planning concepts and their application in real-life residential or public buildings. The assessment will focus on drawing accuracy, proper labeling, planning efficiency, and clarity of presentation.

4	**Modern and Sustainable Materials** ***<u>Theory Topics:</u>*** Modern Construction Materials, Sustainable Building Materials, Performance Characteristics of Construction Materials, Environmental Impact of Building Materials, Utilization of Industrial Waste in Construction, Strength Characteristics of Modern Materials.	10	20%

Smart Materials in Civil Engineering, Material Efficiency and Resource Optimization, Green Construction Practices, Carbon Footprint Reduction in Construction, Resource Conservation Techniques, Sustainable Engineering Practices.

Practical:

20. Study the properties, applications, and advantages of fly ash and Fiber Reinforced Polymer (FRP) materials used in concrete construction.
21. Explore recycled, energy-efficient, and smart materials and understand their role in sustainable construction practices.
22. Compare traditional, modern, and natural construction materials based on their properties, performance, cost, and environmental impact.
23. Study self-healing materials, solar-integrated materials, thermal insulation materials, and sound insulation materials, and evaluate their applications in modern buildings.
24. Perform a waste material reuse activity to identify ways of converting construction or household waste into useful products for sustainable development.

Examination Style:

Sr. No.	Evaluation Methods	SEE	CCE
1	**Modern and Sustainable Materials:** Students will be evaluated based on their understanding and application of modern and sustainable construction materials. The assessment will include identification of materials such as fly ash, FRP, recycled materials, and smart materials, along with analysis of their properties, advantages, and real-life applications. Students will also be assessed on their ability to compare traditional and modern materials, interpret case studies related to green construction, and present their findings clearly. The evaluation will focus on conceptual understanding, practical relevance, analytical skills, and clarity of presentation, encouraging innovative and sustainable thinking in civil engineering practices.	10	
2	**Concurrency & Synchronization Mini Task:** Students will independently study and compare traditional and modern		10

		construction materials based on parameters such as strength, durability, cost, availability, and sustainability. They will analyze the advantages, limitations, and suitability of different materials for various construction applications and real-life scenarios. Students will evaluate how material selection influences the safety, economy, and environmental impact of construction projects.				
		Total	**10**	**10**		
	Modern and Sustainable Materials: Examination Style (10 Marks) Students will be assessed through conceptual and analytical evaluation demonstrating their understanding of modern and sustainable construction materials. The examination will require students to explain materials such as fly ash, FRP, recycled materials, and smart materials, analyze their properties and advantages, and evaluate their applications in real-life construction scenarios. Students will also compare these materials with traditional ones and justify their use in sustainable construction. The assessment will focus on conceptual clarity, practical relevance, analytical skills, and clear presentation. **Compare Lab: Traditional vs Modern Materials Analysis (10 Marks)** Students will be assessed through analytical and conceptual evaluation demonstrating their ability to compare traditional and modern construction materials. The examination will require students to analyze materials based on properties such as strength, durability, cost, and environmental impact, and justify their suitability for different construction scenarios. Students will also interpret case-based situations and recommend appropriate materials. The assessment will focus on comparative analysis, practical relevance, decision-making ability, and clarity of presentation.					
5	**Building Finishing and Miscellaneous Materials** ***Theory Topics:*** Building finishing materials, plastering, painting, flooring, polishing, timber, glass, plastics, paints, Miscellaneous materials, water supply, drainage, electrical systems, durability, cost, maintenance, and environmental conditions, sustainability, energy efficiency, performance in construction. ***Practical:*** 25. Study plastering and flooring materials, and understand their properties, applications, and suitability for different building works.				10	20 %

26. Study glass materials, plastic materials, paints, and coatings, and examine their uses in construction and building finishes.
27. Study various types of pipes, fittings, and timber, and understand their characteristics and applications in building construction.
28. Study electrical wires and cables used in buildings, and identify their types, specifications, and applications.
29. Examine different surface finishing techniques and understand their role in improving the appearance and durability of building components.
30. Study waterproofing materials and false ceiling materials, and evaluate their functions, advantages, and applications in modern buildings.

Evaluation Method:

Sr. No.	Evaluation Methods	SEE	CCE
1	**Interior and Exterior Finishing Materials:** Students will be evaluated based on their understanding and application of building finishing and miscellaneous materials used in construction. The assessment will include identification of materials such as paints, tiles, timber, glass, pipes, and cables, along with analysis of their properties, uses, and suitability for different construction conditions. Students will also be assessed on their ability to compare materials, interpret case studies related to interior and exterior finishing, and suggest appropriate materials for real-life scenarios. The evaluation will focus on conceptual understanding, practical relevance, material selection skills, and clarity of presentation.	10	
2	**Service Lab: Study & Analyze Utility Materials:** Students will work in groups to study building service materials such as pipes, fittings, valves, wires, cables, switches, and other components used in water supply and electrical systems. They will identify the functions, specifications, and applications of these materials in residential and commercial buildings. Students will analyze the importance of proper material selection for efficient,		10

		safe, and sustainable building services and document their observations with suitable illustrations and examples. This activity will strengthen their understanding of building services and their role in modern infrastructure.				
		Total	**10**	**10**		

Examination Style:

Interior and Exterior Finishing Materials (10 Marks)

Students will be assessed through conceptual and application-based evaluation demonstrating their understanding of interior and exterior finishing materials used in building construction. The examination will require students to identify materials such as paints, tiles, plaster, flooring, and cladding, explain their properties and uses, and analyze their suitability for different conditions. Students will also evaluate real-life scenarios and select appropriate materials for interior and exterior finishes based on durability, aesthetics, and environmental factors. The assessment will focus on conceptual clarity, practical application, material selection skills, and clear presentation of answers.

Service Lab: Study & Analyze Utility Materials (10 Marks)

Students will be assessed through practical and application-based evaluation demonstrating their understanding of utility materials used in building services. The examination will require students to identify materials such as pipes, fittings, valves, wires, and cables, explain their functions and properties, and analyse their applications in water supply, drainage, and electrical systems. Students will also evaluate given building scenarios and select suitable utility materials based on performance, safety, and cost considerations. The assessment will focus on material identification, practical application, system understanding, and clear presentation of solutions.

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 %	-	-	-	-	-	-

Course Outcome:

After learning the course, the students should be able to:	
CO1	Understand basic concepts, branches, and scope of civil engineering.
CO2	Identify building materials and explain their properties and applications.
CO3	Apply building planning principles and understand construction processes.
CO4	Analyse modern and sustainable materials for construction.
CO5	Select suitable finishing and service materials for building applications.

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.

Reference Books:

[1] Building Materials by S.K. Duggal, New Age International
[2] Building Construction by B.C. Punmia, Ashok Kumar Jain, Laxmi Publications
[3] Construction Technology by Subir K. Sarkar, Oxford University Press
[4] Civil Engineering Materials by M.L. Gambhir, McGraw Hill
[5] Engineering Materials by Surendra Singh, Vikas Publishing House