



Gyanmanjari
Innovative University

Syllabus
Gyanmanjari Diploma Engineering College
Semester-1 (Diploma)

Subject: Civil Materials for Infrastructure Development– DET2CV11201
Type of Course: Professional Core Courses
Prerequisite: Basic knowledge of mathematics, geometry and measurements

Rationale: Construction materials are pivotal in any construction project. Diploma civil engineers, also known as technologists, are consistently tasked with selecting materials for diverse construction engineering projects such as residential & commercial buildings, roads, metro railways, bridges, dams, tunnels, and flyovers. The evolution of advanced technology necessitates the adoption of new engineering materials. Choosing the appropriate material that is durable, cost effective, and environmentally friendly presents a significant challenge for civil engineers. New materials enter the market regularly, prompting the development of modern techniques for their economical and safe use in engineering structures. At the diploma level, students are expected to study these aspects to enhance their understanding and develop performance-oriented skills for application in the construction industry.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks		Total Marks
CI	T	P	C	SEE	CCE	
4	0	2	5	100	50	150

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	Overview of Construction Material <u>Theory Topics:</u> Scope of construction materials in Building Construction, Transportation Engineering, Environmental Engineering, Irrigation Engineering (applications only), Selection of materials for different civil engineering structures on the basis of strength, durability, Eco friendly and economy, Broad classification of materials – Natural.	10	20 %



Artificial, special, finishing and recycled.

Practical:

1. Identify and classify commonly used construction materials into natural, artificial, special, finishing, and recycled categories from given samples.
2. Civil Engineering Around Us (Survey Activity) To observe and identify civil engineering works in daily life. Survey campus/home surroundings List structures roads, drainage, buildings, water tanks, etc. Classify them into branches
3. Select suitable materials for a given building component based on strength, durability, and economy.
4. Draw and label typical cross-sections showing materials used in building, road, and irrigation structures.
5. Conduct debate or presentation on conventional vs sustainable materials.
6. Draw sketch of canal section showing materials used in lining.
7. Conduct local market surveys for common civil engineering materials to tabulate cost and quality.
8. Green Building material: Prepare a report suggesting replacement of at least 10 nos. of conventional building materials with green building materials and justify it in terms of cost and environmental impact.

Evaluation Method:

Sr. No.	Evaluation Methods	SEE	CCE
1	Material Identification & its Classification Students are given physical samples or images of materials and asked to identify and classify them into appropriate categories. They must also justify their classification based on basic properties and applications.	20	
2	Active Learning Assignments: Chart/Poster Presentation Students prepare and present a chart/poster on topics like eco-friendly material, green building construction or recycled materials and upload it on GMIU portal.		10
	Total	20	10

Examination Style:

Material Identification + Classification (20 Marks)

In this practical evaluation, students are given physical samples or images of common construction materials like cement, sand, bricks.



	steel, and aggregates. They first identify each material based on visual characteristics such as color, texture, and appearance. After identification, they classify the materials into categories like natural, artificial, special, finishing, or recycled. Students also justify their classification by explaining key properties such as strength, durability, and suitability for use. They relate each material to its application in civil engineering works like buildings, roads, or bridges. Evaluation is based on accuracy of identification, proper classification, and clarity of explanation. Chart/Poster Presentation (10 Marks) In this practical evaluation, students prepare a chart or poster on eco-friendly or recycled construction materials used in civil engineering. They include materials like fly ash bricks, recycled aggregates, or bamboo along with their properties and applications. The chart should highlight benefits such as sustainability, cost savings, and reduced environmental impact. Students present their work, explaining how these materials can be used in real construction projects. This activity helps develop awareness of sustainable practices and improves communication skills. Evaluation is based on content accuracy, clarity, and presentation.		
2	Natural Construction Materials <u>Theory Topics:</u> Requirements of good building stone, general characteristics of stone, Structure of timber, general properties and uses of good timber, different methods of seasoning for preservation of timber, defects in timber, Asphalt, bitumen and tar used in construction, properties and uses, Properties of lime, its types and uses, Properties of sand and uses, Classification of coarse aggregate according to size and its use. <u>Practical:</u> - Study and sketch structure of timber showing different components and types of defects. - Perform sieve analysis of sand to determine grading. - Conduct water absorption tests on aggregates. - Sieve Analysis of Aggregates - Brick Testing - Study and compare properties of different types of lime and their uses. - Conduct field tests for sand such as silt content and bulking of sand. - Identify different types of building stones and evaluate their suitability based on visual characteristics. - Identification of different types of stones and lime. - Identify the various sizes of available coarse aggregates from samples of 10 kg in the laboratory and prepare a report. (80, 40, 20, 10 mm) - Identify different types of Asphalt, Bitumen and Tar used in	20	20 %



	construction and prepare reports about the specifications. 20. Identify the grain distribution pattern in a given sample of teak wood in the laboratory and draw the various patterns. (along and perpendicular to the grains) 21. Collect the market rates for following construction materials from various dealers/suppliers of the local market for different brands. Bricks, Stone/aggregate (20 mm, 40 mm and 80 mm). Teak wood, Flooring tiles, Ordinary Portland Cement, Oil paint, Cement Paint, Plaster of Paris. Plastic paints, Recent types of paint Evaluation Method: <table border="1"> <thead> <tr> <th>Sr. No.</th><th>Evaluation Methods</th><th>SEE</th><th>CCE</th></tr> </thead> <tbody> <tr> <td>1</td><td>Case-Based Material Selection Students are given a practical scenario and asked to select suitable construction materials. They justify their choices based on strength, durability, and environmental conditions.</td><td>20</td><td></td></tr> <tr> <td>2</td><td>Active Learning Activity: Sand analysis: Students perform a simple test like silt content of sand or visual inspection of aggregates. They record observations and state a brief conclusion in the form of report and upload on GMIU portal.</td><td></td><td>10</td></tr> <tr> <td colspan="2">Total</td><td>20</td><td>10</td></tr> </tbody> </table> Examination Style: Case-Based Material Selection (20 Marks) In this practical evaluation, students are given a real-life scenario such as constructing a house in a coastal area or a road in a heavy rainfall region. They are required to select appropriate construction materials considering factors like strength, durability, and environmental exposure. Students analyze the conditions and choose materials that can withstand moisture, load, and climatic effects. They then justify their selection with proper reasoning based on material properties and performance. This activity enhances decision-making skills and practical understanding of material selection. It also helps students apply theoretical knowledge to real-world civil engineering situations. Short Practical Test (10 Marks) In this practical evaluation, students perform a simple test such as determining the silt content of sand or conducting a visual inspection of coarse aggregates. For the silt content test, students mix sand with water in a measuring cylinder and observe the settlement of particles to estimate the percentage of silt present. In visual inspection, they	Sr. No.	Evaluation Methods	SEE	CCE	1	Case-Based Material Selection Students are given a practical scenario and asked to select suitable construction materials. They justify their choices based on strength, durability, and environmental conditions.	20		2	Active Learning Activity: Sand analysis: Students perform a simple test like silt content of sand or visual inspection of aggregates. They record observations and state a brief conclusion in the form of report and upload on GMIU portal.		10	Total		20	10		
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	examine aggregates for shape, size, surface texture, and presence of impurities. Students carefully record their observations in a structured format. Based on the results, they draw a brief conclusion regarding the suitability of the material for construction. This activity helps students develop basic testing skills and understand the importance of material quality in civil engineering.		
3	Artificial Construction Materials <u>Theory Topics:</u> Constituents of brick earth, Conventional, Traditional bricks, Modular and Standard bricks, Special bricks –fly ash bricks, Characteristics of good brick, Classification of burnt clay bricks and their suitability, Manufacturing process of burnt clay brick, fly ash bricks, Aerated concrete blocks, Flooring tiles – Types and its uses, Manufacturing process of Cement - dry and wet (only flow chart), types of cement and its uses, Pre-cast concrete blocks- hollow, solid, pavement blocks, and their uses, Plywood, particle board, Veneers, laminated board and their uses, Types of glass: soda lime glass, lead glass and borosilicate glass and their uses, Ferrous and non-ferrous metals and their uses. <u>Practical:</u> 22. Prepare flowchart showing the manufacturing process of burnt clay bricks. 23. Identify different types of special bricks from samples or images. 24. Prepare flowchart of manufacturing process of fly ash bricks. 25. Prepare flowchart of cement manufacturing by dry process and wet process. 26. Identify different types of cement and match them with suitable applications. 27. Compare hollow and solid concrete blocks based on strength and use. 28. Identify different types of glass used in construction through samples or charts. 29. Draw labeled sketches of hollow blocks, pavement blocks, and flooring tile arrangements. 30. Study common uses of metals like steel, aluminum, and copper in construction. 31. Identify types of glass (soda lime, lead, borosilicate) and state their uses. 32. Identify different types of boards (plywood, particle board, laminated board, veneer). 33. Measure dimensions of 10 bricks and find average dimension and weight. Perform field tests dropping, striking and scratching by nail and correlate the results obtained. 34. Identify different types of concrete blocks used in building construction and prepare reports about the specifications. 35. Identify different types of flooring tiles such as vitrified tiles.	20	20 %



ceramic tiles, glazed tiles, mosaic tiles, anti- skid tiles, cheered tiles, paving blocks and prepare report about the specifications.			
Evaluation Method:			
Sr. No.	Evaluation Methods	SEE	CCE
1	Material Classification Activity: Students classify given materials such as bricks, blocks, tiles, glass, and metals into appropriate categories. They justify the classification based on properties and applications.	20	
2	Active Learning Activity: Drawing-Based Evaluation: Students will prepare labeled sketches of various blocks, tiles, or brick etc. as given by the faculty and upload PDF on GMIU portal.		10
	Total	20	10
Examination Style:			
Material Classification Activity (20 Marks)			
In this practical evaluation, students are provided with samples or images of construction materials such as bricks, concrete blocks, flooring tiles, glass, and metals. They identify each material and classify them into suitable categories based on their type and properties. Students explain the basis of classification using characteristics such as strength, durability, weight, transparency, or manufacturing method. They also describe common applications of these materials in building and infrastructure projects. This activity helps students understand the relationship between material properties and their practical uses. Evaluation is based on correct classification, technical explanation, and clarity of presentation.			
Drawing-Based Evaluation (10 Marks)			
In this practical evaluation, students are required to prepare neat and labeled sketches of construction materials such as bricks, concrete blocks, flooring tiles, or similar components assigned by the faculty. The sketches should clearly show dimensions, shapes, and important features of the material. Students must use proper technical labeling and maintain drawing standards. This activity helps improve visualization and technical drawing skills required in civil engineering practice. It also develops understanding of the structure and applications of different construction materials. Evaluation is based on accuracy, labeling, neatness, and overall presentation of the drawing.			



4	Special Construction Materials <u>Theory Topics:</u> Types of material and suitability in construction works of following materials: Water proofing, Termite proofing; Thermal and sound insulating materials, Fibers – Types –Jute, Glass, Plastic Asbestos Fibers. <u>Practical:</u> 36. Study applications of waterproofing materials in roofs, basements, and water tanks. 37. Prepare a chart showing methods and materials used for termite proofing. 38. Compare different thermal insulating materials based on applications. 39. Identify different fiber materials such as jute, glass, plastic, and asbestos fibers. 40. Draw labeled sketches showing application areas of waterproofing and insulation materials. 41. Prepare material selection table for waterproofing, termite proofing, and insulation works. 42. Identification of anti-termite chemicals and methods used before and after construction. 43. Study of asbestos fiber products and their applications in construction. 44. Sound Insulation Material Study 45. Comparative study of thermal insulation and sound insulation applications in buildings. 46. Identify different types of Water proofing, Termite proofing; Thermal & sound insulating materials and prepare reports about the specifications. 47. Identify different types of fibrous material used in construction and prepare report about the specifications <u>Examination Style:</u> <table border="1" data-bbox="319 1560 1152 1979"> <thead> <tr> <th>Sr. No.</th><th>Evaluation Methods</th><th>SEE</th><th>CCE</th></tr> </thead> <tbody> <tr> <td>1</td><td>Case-Based Material Selection: Students are given practical problems such as roof leakage, soundproof room, or thermal insulation requirements. They select suitable materials and justify their choices based on application and performance.</td><td>20</td><td></td></tr> <tr> <td>2</td><td>Short Technical Note Writing: Undertake a market survey for the cost and technical specification of different</td><td></td><td>10</td></tr> </tbody> </table>	Sr. No.	Evaluation Methods	SEE	CCE	1	Case-Based Material Selection: Students are given practical problems such as roof leakage, soundproof room, or thermal insulation requirements. They select suitable materials and justify their choices based on application and performance.	20		2	Short Technical Note Writing: Undertake a market survey for the cost and technical specification of different		10	20	20%
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	brands of following construction Materials and prepare a comparison chart. 1.Cement 2. Tiles 3. Glass 4. Paints.		
	Total	20	10
	Case-Based Material Selection (20 Marks) In this practical evaluation, students are given real-life construction problems such as roof leakage, excessive heat inside a building, or the need for soundproofing in a room. They are required to analyze the situation and select suitable materials for waterproofing, thermal insulation, or sound insulation. Students justify their material selection based on properties such as water resistance, heat resistance, sound absorption, durability, and cost effectiveness. They also explain how the selected material improves the performance and service life of the structure. This activity helps students develop problem-solving and decision-making skills related to practical construction work. Evaluation is based on the suitability of the selected materials and the clarity of technical justification. Short Technical Note Writing (10 Marks) In this practical evaluation, students are asked to write a short technical note on topics such as termite proofing, waterproofing, or fiber materials used in construction. The note should include basic definitions, important properties, methods, and practical applications of the selected topic. Students are expected to present the information in a clear and organized manner using proper technical terms. This activity helps improve technical writing skills and conceptual understanding of construction materials. It also encourages students to study practical applications beyond classroom learning. Evaluation is based on clarity of explanation, technical accuracy, and presentation of the content.		
5	Processed Construction Materials <u>Theory Topics:</u> Constituents and uses of POP (Plaster of Paris), POP finishing boards, sizes and uses, Paints- whitewash, cement paint, Distempers, Oil Paints and Varnishes with their uses. (Situations where used), Industrial waste materials- Fly ash, Blast furnace slag, Granite and marble polishing waste and their uses, Argo waste materials - Rice husk, Bagasse, coir fibers and their uses, Special processed construction materials; Geosynthetic, Ferro Crete, Artificial timber, artificial sand and their uses. <u>Practical:</u> 48. Identify constituents of Plaster of Paris (POP) and explain their functions. 49. Identify different types and sizes of POP finishing boards from samples or charts.	20	20 %



	50. Compare properties and applications of different paints used in construction. 51. Study situations where whitewash, distemper, oil paint, or varnish are suitably used. 52. Prepare charts showing types of paints and their practical uses. 53. Study applications of fly ash in bricks, cement, and concrete works. 54. Study applications of agro waste materials in boards, panels, and insulation works. 55. Compare natural sand and artificial sand based on properties and uses. 56. Identify industrial waste materials such as fly ash, blast furnace slag, and marble waste from samples or images. 57. Identify agro waste materials such as rice husk, bagasse, and coir fibers. 58. Study of Artificial timber, artificial sand and their uses. 59. Prepare mortar using cement and Fly ash or Granite/marble polishing waste in the proportion 1:6 or 1:3. 60. Download the IS 456 and IS 800 and attach the printout for following materials. Steel section (I-section and ISA), Mortar of proportion 1:6 and 1:4, Cement concrete mix of 1:2:4, 1:3:6 and 1:4:8 Evaluation Method: <table border="1"> <thead> <tr> <th>Sr. No.</th><th>Evaluation Methods</th><th>SEE</th><th>CCE</th></tr> </thead> <tbody> <tr> <td>1</td><td>Mini Case Presentation Students prepare and present a short case study on use of sustainable or special construction materials in real projects. They explain material selection, advantages, and practical outcomes.</td><td>20</td><td></td></tr> <tr> <td>2</td><td>Comparative Analysis Task: Students compare conventional materials with waste-based or special processed materials, they prepare and explain PPT of advantages, limitations, and practical applications.</td><td></td><td>10</td></tr> <tr> <td colspan="2">Total</td><td>20</td><td>10</td></tr> </tbody> </table> Examination Style: Mini Case Presentation (20 Marks) In this practical evaluation, students prepare a short case study on the use of sustainable or special construction materials in real construction projects. They collect information about materials such as fly ash bricks, geosynthetics, artificial sand, or agro waste	Sr. No.	Evaluation Methods	SEE	CCE	1	Mini Case Presentation Students prepare and present a short case study on use of sustainable or special construction materials in real projects. They explain material selection, advantages, and practical outcomes.	20		2	Comparative Analysis Task: Students compare conventional materials with waste-based or special processed materials, they prepare and explain PPT of advantages, limitations, and practical applications.		10	Total		20	10		
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	materials and study their applications. Students explain why these materials were selected based on factors like durability, economy, environmental benefits, and performance. They also describe the practical outcomes achieved through the use of these materials in the project. This activity helps students understand modern construction practices and encourages awareness of sustainable development. Evaluation is based on technical content, clarity of explanation, presentation skills, and relevance of the case study. Comparative Analysis Task (10 Marks) In this practical evaluation, students compare conventional construction materials with waste-based or special processed materials used in modern construction. They study differences in properties such as strength, durability, weight, cost, and environmental impact. Students explain the advantages of sustainable materials, including reduced waste generation and eco-friendly construction practices. They also discuss limitations such as availability, processing requirements, or performance constraints. Practical applications of both conventional and modern materials in buildings, roads, and infrastructure works are explained. This activity helps students develop analytical skills and understanding of innovative construction materials.		
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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%	40%	10%	10%	10%

Course Outcome:

After learning the course, the students should be able to:	
CO1	Develop fundamental knowledge of construction materials and their properties.
CO2	Explain the characteristics and applications of natural construction materials.
CO3	Analyze the properties and uses of artificial construction materials.
CO4	Evaluate the characteristics and applications of special construction materials.
CO5	Apply knowledge of finishing and processed construction materials in construction practices.

Instructional Method:

The course delivery method will depend upon the requirement of content and the needs of students. The teacher, in addition to conventional teaching methods by black board, may also use any tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.

The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.

Practical examination will be conducted at the end of semester for evaluation of performance of students in the laboratory.

Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory

Reference Books:

- [1] Construction Materials Ghose. D. N Tata McGraw Hill, New Delhi, 2014 ISBN: 9780074516478
- [2] Building Materials Varghese, P.C. PHI learning. New Delhi. 2014 ISBN: 8120328485
- [3] Engineering Materials Rang Walla, S.C. Charator publisher, Ahemdabad, 2015, ISBN: 9789385039171
- [4] Civil Engineering Materials Somayaji, Shan Pearson education, New Delhi, 2015 ISBN: 9788131766316
- [5] Engineering Materials Rajput, R.K S. Chand and Co., New Delhi, 2015 ISBN 8121919606
- [6] Engineering Materials Sharma PHI Learning, New Delhi, 2015 ISBN: 812032448X
- [7] Building Materials Duggal, S. K. New International, New Delhi, 2014 ISBN: 8122414354

