

As Per NEP 2020

University of Mumbai



Syllabus for Minor Vertical 2

Faculty of Engineering

Board of Studies in Civil Engineering

Second Year Programme in Minor (Civil Engineering)

Semester	IV	
Title of Paper (Theory)	Sem.	Total Credits 4
Fundamentals of Civil Engineering	IV	3
Title of Paper (Lab)		Credits
Fundamentals of Civil Engineering Lab	IV	1
From the Academic Year		2025-26

Sem. - IV

Semester IV

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
2094211	Fundamentals of Civil Engineering	3	-	-	3	-	-	3

Course Code	Course Name	Theory					Term work	Pract / Oral	Total
		Internal Assessment			End Sem Exam	Exam Duration (in Hrs)			
		Test 1	Test 2	Total					
2094211	Fundamentals of Civil Engineering	20	20	40	60	2	--	--	100

Rationale:

This course introduces civil engineering principles and practices. It covers the field's importance, disciplines, and career paths, along with the history and stakeholders involved in construction. Students learn about building materials (traditional and modern, including cement), concrete technology (grades, testing, special concretes, mix design), and building drawing (planning, codes, components, BIM). The course also covers surveying basics (linear/angular measurement, leveling) and introduces advanced equipment like auto levels, total stations, GPS, GIS, and remote sensing. This curriculum provides a well-rounded introduction to core civil engineering concepts and technologies.

Course Objectives:

1. To analyze the historical and contemporary significance of civil engineering, articulate the diverse career paths within the field, and evaluate the roles of various stakeholders in construction projects.
2. To identify and classify common construction materials, understand the properties and applications of cement, and evaluate the importance of sustainable building materials.
3. To analyze the properties and behavior of concrete, differentiate between various types of concrete, and understand the principles of concrete mix design and quality control.
4. To interpret and create building drawings, apply building bylaws and regulations, and understand the role of Building Information Modeling (BIM) in building design.
5. To apply fundamental surveying principles, perform linear and angular measurements, and understand the principles of leveling using traditional surveying instruments.
6. To evaluate the applications of modern surveying equipment, including total stations, GPS, GIS, and IoT, in data acquisition and analysis for civil engineering projects.

Course Outcomes:

On completion of the course students will be able to:

1. Analyze the impact of historical civil engineering projects on modern infrastructure and evaluate the diverse career opportunities within the field, considering economic and social factors.
2. Apply their knowledge of material properties to select appropriate building materials for specific construction applications, considering sustainability and cost-effectiveness.
3. Evaluate the quality of concrete through various testing methods and justify the selection of specific concrete mixes and admixtures based on project requirements.
4. Create detailed building drawings, including site plans, floor plans, elevations, and sections, adhering to relevant building codes and using BIM software.
5. Apply surveying techniques using traditional instruments like chains, tapes, compasses, and theodolites to measure and calculate distances, angles, and elevations in field settings.
6. Evaluate and compare the functionalities and applications of advanced surveying equipment, such as total stations, GPS, and GIS, for efficient data collection and analysis in complex surveying projects.

Detailed Syllabus

Module	Course Module / Contents		Hours	CO Mapping
1	Introduction to Civil Engineering		04	CO1
	1.1	Importance of Civil Engineering, Introduction to different disciplines of Civil Engineering; Possible scopes for a career		
	1.2	Early constructions and developments over time; Ancient monuments & Modern marvels. Five-year plan outlays for construction; current budgets for infrastructure works		
	1.3	Discussion on contribution of different disciplines in Civil Engineering related analysis, design, monitoring works through Software designs, Electronic system designs, equipment designs, etc.		
	1.4	Role and responsibilities of various agencies involved in constructions projects. (Client, consultants, Architects, contractors etc.)		
2	Building Materials		08	CO2
	2.1	Introduction to construction materials like Stone, Bricks, Lime, Timber, Sand, Aggregates, Mortar, and bitumen.		
	2.2	Introduction to cement, its chemical composition, Hydration of cement, Properties of Portland cement, OPC: PPC, Slag cement and other types of cement and their suitability, Different tests on Cement		
	2.3	Sustainable building materials.		
3	Concrete Technology		07	CO3
	3.1	Concrete, Grade of concrete. Tests on plastic and hardened cement. Introduction to Non – destructive test.		
	3.2	Introduction to Special concretes – Self-compacting, high-strength, lightweight, and fibre-reinforced concretes.		

Module	Course Module / Contents		Hours	CO Mapping
	3.3	Introduction to Concrete mix design, types of admixtures and their role in enhancing quality of concrete, Introduction to RMC plant.		
4	Building drawing		05	CO4
	4.1	Principles of residential and commercial building planning Building bylaws and regulations		
	4.2	Classification of buildings, Types of loads acting on buildings, Building components and their functions and nominal dimensions, signs, and symbols used for different materials and elements of buildings		
	4.3	Elements of building drawing, Methods of making line drawing and detailed drawing. Site plan, floor plan, FSI, elevation and section drawing of small residential building. Introduction to BIM software.		
5	Basics of Surveying		09	CO5
	5.1	Role of Civil Engineer in Surveying, Definition, Working Principles, Scale and Mapping, Classification of surveying, Linear measurement, Chain and tapes, field work		
	5.2	Angular Measurement: Bearing and Direction, Types of compasses, Local attraction. Theodolite its uses, measuring horizontal and vertical angles using theodolite.		
	5.3	Levelling: Principle of leveling, Instruments for leveling, Methods of reduction.		
6	Advanced Surveying Equipments		06	CO6
	6.1	Introduction to Auto level, Laser level, EDM and EDT and Total Station.		
	6.2	Application of GPS and GIS and remote sensing in surveying		
	6.3	Application of Database Management system and Internet of Things in surveying.		

Text Books:

1. BIS publication, National Building Code of India 2016, published by the Bureau of Indian Standards (BIS).
2. **Building Materials** S.K. Duggal, published by New Age International (P) Ltd. Publishers.
3. **Concrete Technology** M.S. Shetty, published by S. Chand Publishing.
4. **Building Construction** B.C. Punmia, published by Laxmi Publications
5. Surveying and Levelling N.N. Basak published by McGraw Hill Education

References:

1. Building Construction by P.C. Varghese, published by PHI Learning Pvt. Ltd.
2. Building Materials by S.K. Sharma, published by S.K. Kataria & Sons.
3. Building Construction by B.C. Punmia, Ashok Kumar Jain, and Arun Kumar Jain, published by Laxmi Publications.
4. Building Materials and Construction by S.S. Bhavikatti, published by Vikas Publishing House.
5. Fundamentals of Building Construction: Materials and Methods by Edward Allen and Joseph Iano, published by Wiley.
6. Surveying and Levelling (or A Textbook of Surveying and Levelling) by R. Agor Published by Khanna Publishers

Online References:

Sr. No.	Website Name
1.	The National Programme on Technology Enhanced Learning (NPTEL)

Assessment:**Internal Continuous Assessment: 40%****Internal Assessment Test (IAT) for 20 marks each:**

IA will consist of Two Compulsory Internal Assessment Tests. Approximately 40% to 50% of the syllabus content must be covered in the IAT-I and the remaining 40% to 50% of the syllabus content must be covered in the IAT-II.

End Semester Theory Examination:**➤ Question Paper Format:**

- Question Paper will comprise a total of **six questions each carrying 15 marks Q.1** will be **compulsory** and should **cover the maximum contents of the syllabus**
- Remaining questions will be mixed in nature (part (a) and part (b) of each question must be from different modules. For example, if Q.2 has part (a) from Module 3 then part (b) must be from any other Module randomly selected from all the modules).
- A total of four questions needs to be answered

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
2094212	Fundamentals of Civil Engineering Lab	-	2	-	-	1	-	1

Course Code	Course Name	Examination Scheme						
		Theory Marks				Term Work	Practical/ Oral	Total
		Internal assessment			End Sem. Exam			
		Test 1	Test 2	Total				
2094212	Fundamentals of Civil Engineering Lab	--	--	--	--	25	25	50

Lab Objectives:

1. Perform and analyze the initial and final setting time and soundness tests on cement, evaluating the suitability of cement for specific construction applications based on test results.
2. Prepare a conventional concrete mix and determine its workability using appropriate tests, applying their understanding of mix design principles.
3. Conduct a compression test on concrete cubes, calculate the compressive strength, and interpret the results to assess the quality of hardened concrete.
4. Develop a detailed plan for a G+1 residential building, applying building codes and regulations to ensure functional and compliant design.
5. Create accurate cross-sectional, elevation, and site plan drawings for a G+1 residential building, demonstrating proficiency in technical drawing and spatial visualization.
6. Apply fundamental surveying techniques, including chaining, ranging, offsetting, traverse surveying, and leveling, to determine distances, bearings, and relative elevations in field settings.

Lab Outcomes: Student will be able to

1. Analyse data from cement setting time and soundness tests to assess cement performance for diverse construction needs.
2. Apply the proper procedures for concrete mix preparation and measure the workability of fresh concrete using standard testing methods.
3. Evaluate the structural integrity of concrete by calculating and explaining the compressive strength derived from cube tests.
4. Design a residential building plan that complies with relevant building regulations and meets functional requirements.
5. Create detailed architectural drawings, including cross-sections, elevations, and site plans, to illustrate the design of a residential building.

- Utilize surveying tools and methods to collect and process field data for determining distances, bearings, and elevations.

Text Books:

- Concrete Technology Theory and Practice: M.S. Shetty, S. Chand Publication.
- Building Construction: S.C. Rangwala, Charotar Publications, and Gujarat, India.
- Building Drawing with an Integrated Approach to Built Environment by M. G. Shah, C.M. Kale, S.Y. Patki (Tata McGraw-Hill Education)
- Surveying and Levelling N.N. Basak published by McGraw Hill Education

References:

- Building Construction by P.C. Varghese, published by PHI Learning Pvt. Ltd.
- Building Materials by S.K. Sharma, published by S.K. Kataria & Sons.
- Building Construction by B.C. Punmia, Ashok Kumar Jain, and Arun Kumar Jain, published by Laxmi Publications.
- Building Materials and Construction by S.S. Bhavikatti, published by Vikas Publishing House.
- Fundamentals of Building Construction: Materials and Methods by Edward Allen and Joseph Iano, published by Wiley.
- Surveying and Levelling (or A Textbook of Surveying and Levelling) by R. Agor Published by Khanna Publishers

Online Resources:

Sr. No.	Website Name
1.	Development Control Regulations for Mumbai Metropolitan Region for 2016 – 2036 (https://mmrda.maharashtra.gov.in)
2.	Development Plan and Control Regulation KDMC. (https://mmrda.maharashtra.gov.in)
3.	NPTEL Lecture series on Building Materials and Concrete Technology. (https://swayam.gov.in)

List of Experiments.

Sr. No.	List of Experiments (Any Ten)	Hrs
01	Initial and Final setting time and soundness test on cement.	02
02	Preparation of conventional concrete mix and workability test on plastic concrete.	04
03	Compression test on concrete cubes.	02
04	Developed plan of G+1 residential building.	04
05	Cross section, elevation and site plan of G+1 residential building.	06
06	Chaining, ranging and offsetting.	02
07	Determination of bearings of a closed traverse.	02
08	Determination of R.Ls using level.	02

Assessment:

Term Work: Term Work shall consist of practicals based on the above list. Also, Term work Journal must include at least 3 assignments.

Term Work Marks: 25 Marks (Total marks) = 15 Marks (Experiment) + 5 Marks (Assignments) + 5 Marks (Attendance)

Practical& Oral Exam: An Oral exam will be held based on the above syllabus.