

Course Curriculum
For
M. Tech. in Civil Engineering
(With Specialization in
Structural/Geotechnical/
Transportation/Environmental
/Water Resources Engineering)



Department of Civil Engineering
National Institute of Technology Delhi

w.e.f. the Academic Year
2024-2025

Department of Civil Engineering

National Institute of Technology Delhi

1.1 About the Department

Welcome at the Department of Civil Engineering (CE), National Institute of Technology Delhi. It established in 2022, under the aegis of Ministry of Education (MoE), Govt. of India. Currently it is offering one Undergraduate (B. Tech) course and Postgraduate course (M. Tech.). It has excellent laboratories and research facilities. The Department has active collaborations with Institutes & various research institutes. The department welcomes all types of consultancy works.

The Department of CE has a blend of young as well as experienced dynamic faculty members and is committed to providing quality education and research in the field. Faculty members of the department have excellent academic & research credentials and published numerous peer reviewed journal articles/ papers, Books, Book Chapters etc. in diversified field and having adequate experience in advanced research. The Department believes that by developing a culture of seeking for knowledge and dissemination of research findings, intellectually sound, self-motivated and reliant CE engineers and researchers, who will be the bedrock of our nations' march towards qualitative and massive technological development and dynamic industrialization, will be realized. In other words, the department hopes to achieve the national goals and objectives of industrialization and self-reliance. As a result, it hopes to produce graduates with strong academic and practical background so that they can fit into the industry immediately upon graduation.

1.2 Vision

- To create an educational environment to prepare the students to meet the challenges of infrastructure development through state of art technical knowledge and innovative approaches upholding sound ethics.

1.3 Mission

- To create learning, development and testing environment to meet ever challenging needs of the infrastructure development.
- To create entrepreneurial environment and industry interaction for the benefit of society.
- To be a global leader in training human resources in the various domains of Civil Engineering.
- To collaborate with reputed institutions at national and international level for academic and research excellence.

M. Tech. Civil Engineering

2.1 Salient Features/ Philosophy of the M. Tech. Civil Engineering program

M. Tech. Civil Engineering program offered at NIT Delhi is designed to equip the students with a unique blend of skill sets that include:

- Strong theoretical and experimental foundation
- Predominantly experiment oriented approach with access to well-equipped and specialized laboratories, and supervised internship/ Thesis work.
- Hands-on technical training
- Life skills orientation
- Hard and soft skills
- Business perspective, along with emphasis on innovation and entrepreneurship
- Specialized courses in advanced areas such as Structural, Engineering/Environmental, Engineering/Geotechnical, Engineering/Construction etc.

Some of the salient features of the drafted curriculum of M. Tech are as follows:

- Minimum Credits requirements for completion of MTech program is 80.
- The Curriculum is based on the guidelines of National Education Policy (NEP) – 2020.
- The curriculum has embedded the Multi Exit/ Multi Entry in the M. Tech program.
- The curriculum is designed to meet the prevailing and ongoing industrial requirements.
- The curriculum includes Project based Education with adequate exposure for Thesis work.
- The curriculum is flexible and offers adequate Choice of Electives (Program Elective Courses/ Open Elective Courses).
- The curriculum inherits the Value based Education aims the Holistic Development of the students.
- The Curriculum offers Digital Pedagogy & Flipped Learning with adequate motivation for Entrepreneurship/ Startups.

Cardinal Mention:

Students exiting after completing 1st Year will be awarded Post Graduate Diploma in Civil Engineering respectively. A minimum Credit requirement for Post Graduate Diploma is 40 Credits.

2.2 Program Educational Objectives (PEOs)

The PEOs for the M. Tech. Civil Engineering is to prepare engineers and technologist to participate and get placement in academic, research & development, consultancy in the leading organizations/Institutions of the country and abroad. This is well consistent with the institute's mission of preparing manpower with the technical skill, leadership, creativity and innovation for benefit of mankind and continuously striving for excellence.

PEO-1	To impart education in Structural /Environmental /Geotechnical /Construction Management & related fields to have all-round development of students in order to serve the global society.
PEO-2	To develop the critical thinking and problem solving ability amongst the students through application of various aspects/fundamentals of Structural /Environmental /Geotechnical /Construction Management to understand/ analyze/ solve the critical situations in the area amicably.
PEO-3	To develop independent research attitude through projects/dissertations and its administrative & financial management as well as its dissemination to the PG students.
PEO-4	To create awareness amongst the students for collaborative and multidisciplinary activities through usage of modern/emerging tools, technologies and research publications.
PEO-5	To encourage students to be ethically and socially responsible and articulate themselves to be a lifelong learner.

2.3 Program Outcomes (POs)

Program Outcomes (POs) are narrower statements that describe what the students are expected to know and be able to do upon the graduation. They relate the knowledge, skills and behaviour of the students acquire through the program. The POs are specific to the program and facilitate the attainment of PEOs.

At the end of the program, the student shall be able to:

PO-1	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using advanced understanding of mathematics and engineering.
PO-2	Design/development/execution of solutions: Design sustainable solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public safety, and the cultural, societal, legal and environmental considerations.
PO-3	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO-4	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PO-5	Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work effectively, as a member and leader in a multidisciplinary and/or diverse team, to manage projects and in multidisciplinary environments
PO-6	Life-long learning: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

2.4 Program Specific Objectives (PSOs)

PSO -1	Design, develop, construct and manage new civil engineering infrastructure.
PSO -2	Analyze Evaluate, and Execute sustainable solutions to the structural problems faced by the society.
PSO -3	Cognizance of social awareness, environmental necessity, modern management and construction techniques to have a successful career in their respective specializations.

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1. Introduction to the programme:

Considering the growing importance of infrastructure in enhancing the quality of life and supporting economic development, there is a critical need to approach Civil Engineering with a multidisciplinary mindset. This approach aims to effectively address the complex interplay between society, technology, and economics ensuring accurate assessment of infrastructure needs, efficient resource allocation and alignment of technological advancements with socio-economic requirements while maintaining a sustainable balance between economic growth and environmental well-being.

To meet the current needs of society and industry, the Master of Technology in Civil and Infrastructure Engineering program at the Department of Civil Engineering, National Institute of Technology Delhi, is pioneering a comprehensive educational framework that blends traditional Civil Engineering principles with modern Engineering concepts. This program aims to provide extensive knowledge in core fundamentals, design methodologies, analytical techniques and practical implementation strategies for tackling contemporary challenges in civil engineering. The program focuses on practical learning by doing thesis/ projects and

2. Course structure and Syllabus

2.1 Name of the courses:

• **Core Courses**

1. CELM501 Introduction to Green Buildings
2. CELM 502 Environment and Waste Management
3. CELM503 Construction Technology and Management
4. CELM551 Infrastructure Economics
5. CELM552 Numerical Analysis in Infrastructure Engineering

• **Elective Courses (Elective I/ II)**

1. CELM511 Application of Probabilistic Methods in Engineering
2. CELM512 Advanced Engineering Mathematics
3. CELM513 Pre-stressed Concrete
4. CELM514 Soil Exploration
5. CELM515 Transport System Planning and Management
6. CELM516 Active and Passive Control of Structures
7. CELM517 Structural Dynamics
8. CELM518 Theory of Plates and Shells

9. CELM519 Landfill Design, Construction and Operation
10. CELM520 Advanced Soil Mechanics
11. CELM521 Highway Geometric Design
12. CELM522 Water Transportation - Supply and Wastewater Engineering
13. CELM523 Advanced Water Supply and Wastewater Engineering
14. CELM524 Industrial Pollution Control and Prevention
15. CELM525 Sanitation Techniques
16. CELM526 Hydraulic Machines
17. CELM527 GIS in Infrastructure Engineering
18. CELM528 Design of Intelligent Buildings and Cities
19. CELM529 Introduction to Earthquake Engineering
20. CELM530 Advanced Structural Analysis
21. CELM531 Advanced Solid Mechanics
22. CELM532 Analysis and Design of Foundation
23. CELM533 Special Topics in Geotechnical Engineering
24. CELM534 Pavement Design, Maintenance and Management
25. CELM535 Public Transportation Planning and Management

- **Elective Courses (Elective III/ IV/V)**

1. CELM553 Applied Finite Element Method for Industries
2. CELM554 Structural Health Monitoring
3. CELM555 Sustainable Urban Planning and Design
4. CELM556 Municipal Rules and By-laws
5. CELM557 Disaster Mitigation
6. CELM558 Reliability Engineering
7. CELM559 Environmental Impact Assessment
8. CELM560 Concrete Technology
9. CELM561 Advanced Structural Design
10. CELM562 Stability Analysis of Structures
11. CELM563 Inspection, Maintenance and Retrofitting of Foundation
12. CELM564 Earthquake Resistant Design of Foundations
13. CELM565 Ground Improvement and Reinforced Earth
14. CELM566 Traffic Engineering and Highway Safety
15. CELM567 Air Transportation
16. CELM568 Auxiliary Water Supply System
17. CELM569 Planning and Design of Sewerage and Sewage Treatment Facilities
18. CELM570 Hazard Management in Water Distribution System
19. CELM571 Physio chemical Processes for Water and Wastewater Treatment
20. CELM572 Water Harvesting, Conservation and Intelligent Control
21. CELM573 Infrastructure Informatics

22. CELM574 Planning and Design of Water Supply and Treatment Facilities
23. CELM575 Solid and Hazardous Waste Management
24. CELM576 Air Pollution Control Techniques
25. CELM577 CFD for Multiphase Gravity flow

- **Open Elective Courses (Open Elective I/ II)**

1. MELM 553 Design of Experiment and Research Methodology
2. MELM 537 Advanced Optimization Technique
3. MELM 587 Product Design Development
4. MELM 583 Computational Fluid Dynamics
5. MELM 503 Computational Methods in Engineering
6. CSLM 554 Statistical Methods for Research
7. CSLM 623 Fuzzy Logic and Application
8. CSLM 618 Optimization Technique
9. CSA 524 Soft Computing
10. CSA 512 Optimization Technique
11. CSA 522 Machine Learning
12. CSA 523 Neural Network
13. CSA 550 Smart Sensors and Sensor Networking
14. CSBM 611 Machine Learning
15. EELM 555 Renewable and Distributed Energy System
16. EELM 557 Energy Auditing and Management
17. EELM 515 Soft Computing and Application
18. EELM 517 AI Techniques and Application
19. EELM 530 Machine learning and Deep Learning

- **Lab Courses**

20. CEPM549 Infrastructure Engineering Lab-I
21. CEPM599 Infrastructure Engineering Lab-II

2.2 Course Curriculum:

1ST SEMESTER

Sl. no.	Course Number	Course Title	L	T	P	C
1	CELM 501	Introduction to Green Buildings	3	0	0	3
2	CELM 502	Environment and Waste Management	3	0	0	3
3	CELM 503	Construction Technology and Management	3	0	0	3
4	CELM 5×××	Elective-I	3	0	0	3
5	CELM 5×××	Elective-II/ Open Elective-I	3	0	0	3
6	CEPM 549	Advanced Civil Engineering Lab-I	0	0	6	3
7	CEPM 500	Independent Study and Seminar-I	0	0	4	2
	Sub Total		15	0	10	20

2ND SEMESTER

Sl. no.	Course Number	Course Title	L	T	P	C
1	CELM 551	Finite Element Method	3	0	0	3
2	CELM 552	Numerical Analysis in Infrastructure Engineering	3	0	0	3
3	CELM 5××	Elective-III	3	0	0	3
4	CELM 5××	Elective-IV	3	0	0	3
5	XXXM XXX	Elective-V/ Open Elective-II	3	0	0	3
6	CEPM 599	Advanced Civil Engineering Lab -II	0	0	6	3
7	CEPM 600	Independent Study and Seminar-II	0	0	4	2
	Sub Total		15	0	10	20

3RD SEMESTER

Sl. no.	Course Number	Course Title	L	T	P	C
1	CEPM 601	Seminar-I	0	0	2	1
2	CELM 602	MOOCs Course-I/ Independent Study Course-I	3	0	0	3
2	CELM 649	Thesis/Industrial Project Phase-I				16
	Sub Total					20

4TH SEMESTER

Sl. no.	Course Number	Course Title	L	T	P	C
1	CELM651	MOOCs Course-II/ Independent Study Course-II	3	0	0	3
2	CEPM 671	Seminar-II	0	0	2	1
3	CELM 699	Thesis/Industrial Project Phase-II				16
	Sub Total					20

TOTAL CREDITS: 20+20+20+20=80

The List of program Electives offered by the Department is tentative and will be reviewed on yearly basis and depending upon the requirements of the Industry/ Availability of faculties.

**The Open Electives will be selected by the students from the Electives offered by Other Department for their M Tech programs.