



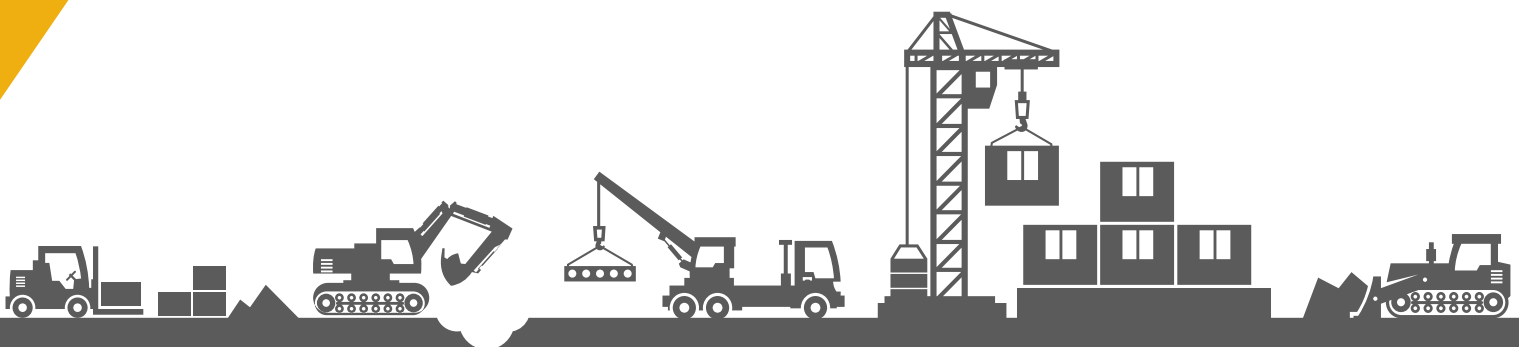
IIT Madras CODE offers Certificate  
Program on

# Construction Technology and Management

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# Table of Contents

About the Course	03
Eligibility criteria and Course fees	04
01. Engineering Economics	05
02. Concrete Technology	06
03. Road and Pavement Technology	07
04. Construction Planning and Control	08
05. Construction Processes & Productivity	09
06. Quality	10
07. Durability and Repair	11
08. Safety	12
09. Construction Contracts	13
10. Resource Constrained Schedule Optimization	14

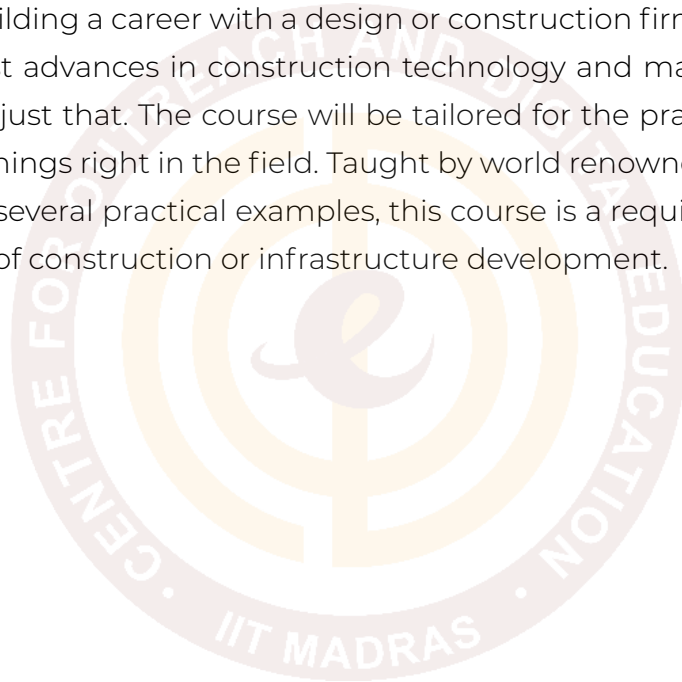


# ABOUT THE COURSE

This course is expected to expose the senior undergraduate students, graduate students, and professionals working in structural design and construction firms to cutting edge construction technology and management practices. India will invest significantly in developing infrastructure and buildings in the years to come and it is important that we build on time, on budget, using new technologies and to the highest standards of quality (construction process, workmanship, finishing, mechanical/durability performance, etc.) possible. This course will address exactly these aspects and provide specific tools and guidelines that will enhance the skills of aspiring or practicing graduate civil/structural engineers, construction technologists and managers.

## Why should anyone take this course

If you are interested in building a career with a design or construction firm, it is imperative that you understand the latest advances in construction technology and management practices. This course will offer you just that. The course will be tailored for the practicing engineer and will focus on how to get things right in the field. Taught by world renowned professors from IIT Madras and replete with several practical examples, this course is a requirement if you wish to make a mark in the field of construction or infrastructure development.



## Eligibility Criteria

No specific eligibility but an architecture, civil, mechanical, electrical or management background is preferred

**Course Fees:** Rs. 1,50,000 + 18% GST

## About IITM CODE

Established in 1986, the Centre for Continuing Education (CCE), now renamed as Center for Outreach and Digital Education (CODE), coordinates the outreach and online programs of IIT Madras. The centre's activities include coordinating the Web-enabled MTech programs; coordinating NPTEL and GIAN courses; coordinating IIT Madras' BS Degree programs; short-term skilling programs targeted towards Industry, Quality Improvement programs, meant for faculty in engineering institutions, support for conferences, book writing, etc. For more details, please refer : <https://code.iitm.ac.in/>

To Register

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# Engineering Economics

## Module 01

**Prof. Ashwin Mahalingam**  
Department of Civil Engineering  
IIT Madras



### About the module

Engineering economics allows students to understand how economic and financial decisions are made between project alternatives. Which project do we choose to construct? Which equipment do we choose to rent? What is the return on an infrastructure investment that we plan to make? These and similar questions will be answered in this module. Candidates will be exposed to concepts relating to the time value of money, inflation, comparison of alternatives, internal rate of return, cost-benefit analysis, replacement analysis, break-even analysis and similar topics

### Learning outcomes of this module

Candidates will learn how to judiciously select one among many project alternatives from an economic and financial perspective. The candidate will achieve a good degree of proficiency in financial and economic analysis of engineering projects and situations.

### Applications of this module

This module can be useful at a personal level as a candidate decides what investments to make. At a professional level, this is a critical skill that any design or construction firm requires to select a project to take on and to decide what kind of return/profit they are likely to make out of this project. Financiers and investors also regularly use the tools taught in this module to make investment decisions in the infrastructure and other sectors.



# Concrete Technology

## Module 02

**Prof. Ravindra Gettu**  
**Prof. Manu Santhanam**  
Department of Civil Engineering  
IIT Madras



### About the module

Concrete is the most widely used construction material, and is progressively changing in components, composition, properties and response. It is, therefore, necessary to understand the scientific fundamentals and the recent developments in the technology, as well as the performance in different scenarios. This module will cover the basics needed to apply concrete appropriately in the field and the various aspects of the behaviour in the fresh and hardened states. Supplementary cementitious materials, special concretes and sustainable practices would also be introduced.

### Learning outcomes of this module

This module would provide a refresher about the basics of the science and technology of concrete, knowledge about newer components such as superplasticizers and supplementary cementitious materials, understanding of the performance in the fresh and hardened state and the ability to choose the best concrete for a project. Further, this would also help in troubleshooting problems that are related to concrete usage in a construction site.

### Applications of this module

This module would be of relevance to all aspects of construction with concrete, including the production of concrete, fabrication of precast elements and in-situ construction.



# Road and Pavement Technology

## Module 03

**Prof. Surender Singh**  
Department of Civil Engineering  
IIT Madras



### About the module

This particular course will consist of 6 modules covering most of the aspects of both bituminous and concrete pavements. These modules will focus mainly on pavement material characterization, formulation of mixture designs for unbound as well as bound layers, construction, quality control and repair & rehabilitation of pavements etc. Also, successful case studies will be discussed.

### Learning outcomes of this module

At the end of this course, the candidates will be able to decide the suitability of various materials as well as pavement types for different highway applications. The candidates will be able to formulate the materials to be used for construction of different layers of the pavements. Construction and quality control techniques are expected to be fully learnt at the end of this course. It is expected that the candidates will be able to identify different structural as well as functional distresses in pavements and will be able to address the same.

### Applications of this module

The candidates working in industries will be able to use the knowledge learnt for solving various field related issues; also, the knowledge will help them to make cost-effective decisions.



# Construction Planning and Control

## Module 04

**Prof. Sivakumar Palaniappan**  
**Prof. Ashwin Mahalingam**  
Department of Civil Engineering  
IIT Madras



### About the module

This module on project planning and control consists of three components:

- 1. Introduction:** Project management, project planning and scheduling, work breakdown structure and bar charts.
- 2. Project scheduling:** Critical Path Method, Precedence Diagram Method, Floats, and Resource Planning.
- 3. Project control:** Earned value analysis and cumulative 'S' curves.

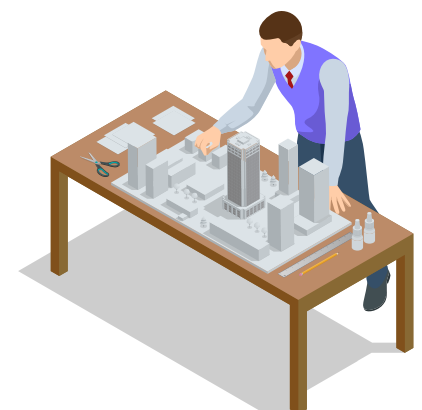
### Learning outcomes of this module

The course participants will complete the following learning outcomes:

1. How to prepare work breakdown structure and use this for preparing a construction schedule?
2. How to use CPM and PDM methods for project scheduling?
3. How to interpret the concept of floats in a construction schedule?
4. Demonstrate the application of Resource leveling and Resource constrained planning.
5. Demonstrate the application of earned value analysis for monitoring the schedule and cost performance of construction projects.

### Applications of this module

Effective project planning and execution will minimize schedule delays and cost overrun, which are common in the construction industry. This module will be useful for construction managers, planning managers, scheduling professionals and cost managers to promote effective project planning, monitoring and control.





# Construction Processes & Productivity

## Module 05

**Prof. Koshy Varghese**  
Department of Civil Engineering  
IIT Madras



### About the module

Activities towards planning and delivery of built environment have conventionally been modeled using Project Management tools such as Critical Path Method (CPM). While the CPM based approach is essential for modeling and coordinating construction activities at a macro level, micro level planning and modeling of the activities is also important for effective project control. Construction activities at a micro level are repetitive and can be modeled using a production/process approach. This module will cover concepts, methods and tools that can be used to model construction activities as production/process.

### Learning outcomes of this module

1. Understand the difference between project and process management in the context of a construction project and basic concepts in project production process planning and measurement
2. Exposure to Tools to plan and monitor project production processes (Productivity measurement systems, Work Sampling, Collaboration)
3. Illustrate the application of the tools through case-studies

### Applications of this module

This module is relevant to practicing engineers and those who want to improve project performance at the site level. The concepts covered in this module can be directly applied to planning and progress monitoring of project.



**Prof. Piyush Chaunsali**  
**Prof. Sivakumar Palaniappan**  
Department of Civil Engineering  
IIT Madras



### About the module

The materials module will cover the physical and chemical characteristics of basic ingredients of concrete. Testing procedures of ingredients (e.g. cement, mineral admixtures, aggregate, water) and concrete will be examined. Furthermore, important aspects dealing with curing and non-destructive evaluation of concrete will be discussed.

The construction module will cover the basics of quality management, management tools for quality and an overview of BIS standards available for quality management.

- 1. Basics of quality management:** Definition, eight dimensions of quality, total quality management, quality gurus, quality tools, cost of quality and quality function deployment.
- 2. Management tools for quality:** Deming's fourteen points for quality management, Juran's approach to quality (universal breakthrough sequence) and Crosby's fourteen steps for quality improvement.
3. An overview of BIS standards available for quality management.

### Learning outcomes of this module

The candidate will be able to understand the role of material selection and various measures in enhancing the quality of concrete. The candidate will be able to understand the concepts of total quality management and the management tools available for quality improvement and apply these concepts in practice. Further, the candidate will be aware of the relevant BIS standards in this area.

### Applications of this module

This model will help in ensuring construction quality in various projects. Candidates will learn how to control quality during construction from both technical and management perspectives and also how to observe quality defects during inspections.



# Durability and Repair

## Module 07

**Prof. Radhakrishna Pillai**  
Department of Civil Engineering  
IIT Madras



### About the module

This module will provide an introduction to various deterioration mechanisms of concrete and embedded reinforcement and how a structure can be designed for a target corrosion free service life. The course will provide introduction to the following topics:

1. Concepts on durability and service life design of concrete structures
2. Chloride-induced corrosion, carbonation-induced corrosion, sulphate attack
3. Advantages of using fly ash, slag, corrosion inhibitors, coated rebars, concrete surface coating, cathodic prevention
4. Service life design tools, performance parameters, specifications and acceptance criteria
5. Surface/Near surface repair, Material properties, Material selection for repair works, Surface preparation techniques
6. Design of durable repairs using cathodic protection techniques
7. Structural strengthening techniques
8. Water-proofing techniques

### Learning outcomes of this module

The candidate will be able to learn how the concrete structures would degrade in various exposure conditions and understand the root cause of deterioration; how to specify and select materials and design concrete structures to prevent such degradation and design concrete structures to achieve the target corrosion-free service life; how to identify critical parameters affecting service life and select various construction materials and systems; how to define performance specifications and acceptance criteria to control quality and how to specify and design for a target service life for repairs - thereby avoiding frequent repairs of concrete structures while allowing continued degradation/corrosion.

### Applications of this module

This module will enable the learners to enhance the service life of the new and existing structures and thereby contribute to reducing the economic burden. This is very much valuable for the structural engineers and consultants, concrete technologists, decision makers, construction managers, etc.

**Prof. Nikhil Bugalia**  
Department of Civil Engineering  
IIT Madras



### About the module

The construction sector continues to be among the poorest performing sectors regarding Occupational Health and Safety (OHS) issues. The construction sector is complex, where numerous humans, machines, organizational processes and policies interact together in an often difficult-to-predict manner to affect safety performance. However, conventionally Safety has been seen as a relatively simple problem agnostic of the underlying complexity involved. To address this gap in understanding what “Safety” is, the module will introduce the concepts of Safety Management through a lens of System Thinking. Such a lens will be helpful for the students in developing a comprehensive understanding of the OHS issues in the construction sector.

### Learning outcomes of this module

The course participants will gather an overview of System-Thinking for Safety Management by recognizing the interactions between various equipment, human, managers, organizational process and rules and how they affect safety. The participants will then examine the four major types of construction accidents (commonly known as Fatal 4) and their solutions through the lens of system thinking. The participants will also get an overview of Occupational Health issues and how system thinking can help them devise strategies for their organizations.

### Applications of this module

The module will be helpful for construction professionals to understand why even the most well-thought and well-intentioned safety interventions do not work in reality and what they could do to improve the effectiveness of these interventions.





# Construction Contracts

## Module 09

**Prof. KN Satyanarayana**  
Department of Civil Engineering  
IIT Tirupati

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### About the module

The topics covered in this module will include: Contracts legal framework; Comprehensive study of different types of contracts and their working; Problems in the operation of contracts; Claims and disputes; Dispute resolution mechanisms

### Learning outcomes of this module

The student will gain a rudimentary understanding of the following:

1. Parties involved in a construction contract
2. Legal framework and what constitutes a contract
3. Various types of contracts
4. Rules of interpreting a contract
5. Commercial terms
6. Conditions of a contract
7. Significant contract clauses
8. Dispute resolutions - litigation, arbitration and alternative dispute resolution techniques

### Applications of this module

All operations in the construction industry involve agreements between the various parties involved including owners, architects/engineers, constructors, material & equipment suppliers, legal & financial agencies, regulatory agencies etc. It is very important that the participants in the industry are well aware of the contractual framework they operate in.



# Resource Constrained Schedule Optimization

## Module 10

**Prof. Benny Raphael**  
Department of Civil engineering  
IIT Madras



### About the module

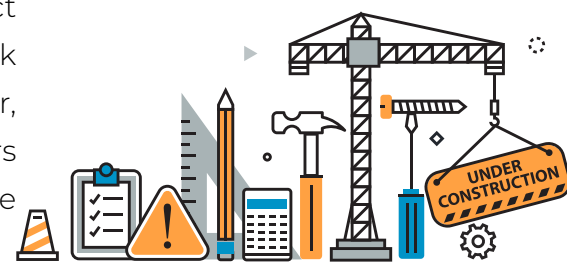
This module covers the fundamentals and applications of schedule optimization subject to resource constraints. Different types of constraints in the planning of construction projects are discussed. This includes aspects related to manpower, cash flow and the availability of work front, equipment and other resources. Mathematical modelling of the schedule optimization problem and solution techniques are explained. An introduction to optimization techniques is provided covering linear and non-linear problems with and without constraints. Algorithms for solving different types of optimization problems are discussed. Full-scale case studies are presented to illustrate the practical application. Different types of constraints in full-scale engineering projects are illustrated. Use of software tools for solving resource constrained scheduling problems is demonstrated.

### Learning outcomes of this module

1. Understanding of resource constrained scheduling problem
2. Knowledge of different types of constraints in construction projects and how they affect the project schedule.
3. Fundamentals of optimization techniques
4. Practical skills in solving resource constrained scheduling problems through software tools

### Applications of this module

The module will help construction professionals to understand how different types of constraints on resources affect project planning and scheduling. The amount of work done on site is constrained by the availability of manpower, equipment, capital and work front. This module covers modeling of these constraints and finding solutions to the project scheduling problem through optimization.





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