



ST. JOSEPH'S
COLLEGE OF ENGINEERING
AND TECHNOLOGY,
- PALAI -
AUTONOMOUS

Choondacherry P.O., Pala, Kottayam - 686579
Kerala, India



SYLLABUS
INDUSTRY LINKED ELECTIVE-I
MECHANICAL ENGINEERING
(B. Tech 2024 SCHEME)



Semester VI

INDUSTRIAL LINKED ELECTIVE 1

Design & Prototype Engineering

Course Code	24SJIEMET611	CIE Marks	40
Teaching Hours/Week (L:T:P:R)	3:0:0:0	ESE Marks	60
Credits	3	Exam Hours	2 Hrs. 30 Min.
Pre-requisites (if any)	Nil	Course Type	ILE

Course Objectives:

- To introduce basic engineering design concepts in a simple and practical manner
- To familiarize students with common manufacturing and fabrication methods
- To help students understand how ideas become physical products
- To prepare students for participation in beginner-level engineering projects and competitions

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Explain basic steps in engineering design	K2
CO2	Identify common materials, tools, and fabrication processes	K2
CO3	Understand simple engineering drawings and CAD models	K2
CO4	Describe how prototypes are developed and tested	K2

K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2
CO1	2	2	-	-	2	-	-	-	-	-	1	2	2
CO2	2	2	-	-	2	2	-	-	-	-	1	2	-
CO3	2	2	1	-	2	2	-	-	-	-	1	-	2
CO4	2	3	2	-	3	2	-	2	-	-	2	2	2

1- Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High), '-' - No Correlation

SYLLABUS

Module	Syllabus Description	Contact Hours	CO
1	Basics of Engineering Design Basics of engineering design, Difference between idea, design, and product. Steps in design process: Problem identification, Need analysis, Concept. Concept generation techniques (brainstorming, morphological charts), Product Design Specifications (PDS), Introduction to simple engineering drawings, CAD modeling (demonstration-based learning)	9	1
2	Introduction to Design Analysis & Assembly Design Analysis, Basic concepts: Load, stress, deformation (conceptual only). Introduction to FEA tools, Failure theories and safety factors Basics of assembly: Fits and tolerances. Introduction to CAD assemblies (demonstration),	9	2
3	Fabrication and Manufacturing Material selection (Ashby charts), Conventional manufacturing (machining, welding), Sheet metal and fabrication techniques, Vat photopolymerization (SLA/DLP) principles, Photocurable resin chemistry basics. Design for additive manufacturing (DfAM), STL file preparation and slicing. Tolerances, fits, and assembly practices, Quality control and inspection	9	3
4	Prototype Development Definition of a prototype, Types (concept model, functional model). Steps to build a simple prototype: Idea Sketch Material Selection Fabrication Testing Assembly techniques and tolerance considerations, Prototype development workflow, Instrumentation and testing methods, Performance evaluation and validation. Basic project planning: Time, cost, teamwork. Documentation: Simple reports, drawings, and presentations.	9	4



Course Assessment Method (CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

End Semester Examination Marks (ESE):

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
➤ 2 Questions from each module. ➤ Total of 8 Questions, each carrying 3 marks (8x3 = 24marks)	➤ Each question carries 9 marks. ➤ Two questions will be given from each module, out of which one question should be answered. ➤ Each question can have a maximum of 3 sub divisions. (4x9 = 36 marks)	60

Text Books

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Alternate Fuels for IC Engines	Anand Krishnasamy & Saurabh K. Gupta	McGraw Hill	1 st , 2024
2	Non-Conventional Energy Resources	B.H. Khan,	McGraw Hill Education	3 rd , 2016
3	Energy Systems Engineering: Evaluation and Implementation	Francis Vanek	McGraw Hill Education	4 th , 2021
4	Alternative Fuels for Internal Combustion Engines	Praveen Harari	LAMBERT Academic publishing	1 st , 2018



Reference Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Engineering Design and Rapid Prototyping	Ali K. Kamrani, Emad Abouel Nasr	Springer	1 st , 2010
2	Introduction to Mechanical Design and Manufacturing	David Jensen	University of Arkansas (Open Textbook)	1 st , 2024
3	Engineering Design A Systematic Approach	G. Pahl, W. Beitz	Springer	3 rd , 2007

Video Links (NPTEL, SWAYAM...)		
Module No.	Topic	Link ID
1	Engineering Design Course	https://onlinecourses.nptel.ac.in/noc21_me128/preview
2	Manufacturing Processes I & II	https://onlinecourses.nptel.ac.in/noc22_me28/preview
3	Introduction to CAD/CAM	https://nptel.ac.in/courses/112102102
4	Product Design and Development	https://nptel.ac.in/courses/112107217





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SYLLABUS

INDUSTRY LINKED ELECTIVE-1

CIVIL ENGINEERING

B.TECH 2024 SCHEME



Semester VI

CONSTRUCTION MATERIALS AND PRACTICES

Course Code	24SJIECET611	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3:0:0	ESE Marks	60
Credits	3	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)		Course Type	Industry Linked Elective

PREAMBLE

The construction industry is rapidly evolving with the introduction of advanced materials, sustainable practices, mechanized construction techniques, and digital fabrication technologies. This course introduces students to conventional and modern construction materials along with contemporary construction practices used in real projects. The course bridges academic learning with industry requirements by exposing students to practical aspects of material selection, construction methodologies, quality control, site practices, prefabrication, and emerging technologies such as 3D printed construction.

The course is designed with inputs inspired from Indian Institute of Technology Madras civil engineering curriculum and current industry practices.

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Describe the engineering properties and applications of conventional construction materials used in civil engineering projects.	K2
CO2	Evaluate modern and sustainable construction materials for specific field applications.	K3
CO3	Identify construction practices involved in foundation, masonry, concrete, steel, and finishing works.	K3
CO4	Apply quality control, safety practices, and construction equipment selection principles in real projects.	K3
CO5	Explain emerging technologies such as prefabrication, modular construction, BIM integration, and 3D printed construction systems.	K3



Mapping of Course Outcomes with Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	1	2	1
CO2	2	3	1	1	-	-	-	-	-	-	1	2	1
CO3	2	2	3	-	1	-	-	-	-	-	1	2	1
CO4	1	2	2	1	3	-	-	1	-	-	1	3	1
CO5	1	2	2	2	3	-	-	-	-	-	2	2	1

Note: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	CONVENTIONAL CONSTRUCTION MATERIALS - Cement and Cement Products - Types of cement, properties, testing, special cements, blended cement Aggregates - Classification, grading, desirable properties, testing Concrete - Fresh concrete, hardened concrete, admixtures, durability issues Steel - Structural steel, reinforcement steel, corrosion issues Masonry Materials - Bricks, blocks, stones, mortar, tiles Timber and Glass - Properties, applications, limitations	9
2	MODERN AND SUSTAINABLE MATERIALS - High Performance Materials - High performance concrete, Self-compacting concrete, Fiber reinforced concrete, Geopolymer concrete Sustainable Materials - Fly ash bricks, GGBS concrete, Recycled aggregates, Green concrete Composite Materials- FRP materials, Sandwich panels, Engineered wood products Smart Materials - Self-healing concrete, Phase change materials Photocatalytic concrete	9



3	CONSTRUCTION PRACTICES - Site Preparation - Site investigation, Setting out, Earthwork operations Foundation Construction - Shallow foundations, Pile foundations, Dewatering practices Concrete Construction Practices – Formwork, Reinforcement placement, concreting operations, Curing methods Masonry Construction Practices - Brick masonry, Block masonry, Partition systems Steel Construction Practice – Fabrication, Erection methods Connections	9
4	ADVANCED CONSTRUCTION PRACTICES & 3D PRINTING Prefabrication and Modular Construction - Precast systems, Modular buildings, Industrialized construction Building Information Modelling (BIM) in Construction – Coordination, Clash detection, Material estimation Construction Automation - Robotics in construction, Drone-based monitoring, IoT in construction 3D Printing in Construction - Introduction to additive manufacturing in construction, Concrete extrusion systems, Printable materials, Layer bonding issues, Structural limitations Future Trends - Net-zero buildings, Circular construction economy	9

Text Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Concrete Technology,	Shetty M.S.,	Chand Publishers	9th Edition (2026)
2	Building Materials,	Varghese P.C.,	PHI Learning	2nd Edition (reprint, 2015)
3	Building Construction,	Varghese P.C.,	PHI Learning	2nd Edition
4	Building Materials,	S.K. Duggal,	New Age International	4th Edition
5	Construction Technology	Roy Chudley and Roger Greeno,	Pearson Education.	11th Edition (2016)



Reference Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Properties of Concrete,	Neville A.M	Pearson.	5th Edition (2011)
2	Concrete: Microstructure, Properties and Materials	Mehta P.K. and Monteiro P.J.M	McGraw Hill.	4th Edition (2014)
3	Concrete Technology	Gambhir M.L	Tata McGraw Hill	6th Edition (2025)
4	Construction Process Planning and Management	Sidney M. Levy	Elsevier.	2nd Edition (2010)
5	3D Concrete Printing Technology,	Buswell, Leal de Silva, Jones & Dirrenberger	Elsevier.	1st Edition (2018)

INDUSTRY COMPONENTS

Students shall undergo at least one of the following:

- Site visit to ready-mix concrete plant
- Visit to precast manufacturing yard
- Visit to construction project site
- Interaction session with contractor/project manager
- Demonstration/video case study of 3D printed construction project

Course Assessment Method (CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Material case study	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40



END SEMESTER EXAMINATION (ESE)

Total Marks	CIE	ESE	Duration
100	40	60	2.5 Hours

SUGGESTED NPTEL / MOOC COURSES

From NPTEL

1. Building Materials and Construction – Indian Institute of Technology Madras
2. Advanced Concrete Technology – Indian Institute of Technology Delhi
3. Construction Technology and Management – Indian Institute of Technology Roorkee
4. Digital Construction and Automation (for emerging construction technologies)

