

# NPTEL DOMAIN CERTIFICATION



<https://nptel.ac.in/noc/Domain/>



Want to **Specialize**  
in an area of Study?

Complete an **NPTEL Domain**



**41 Domains**  
across 10 Disciplines

## DISCIPLINES

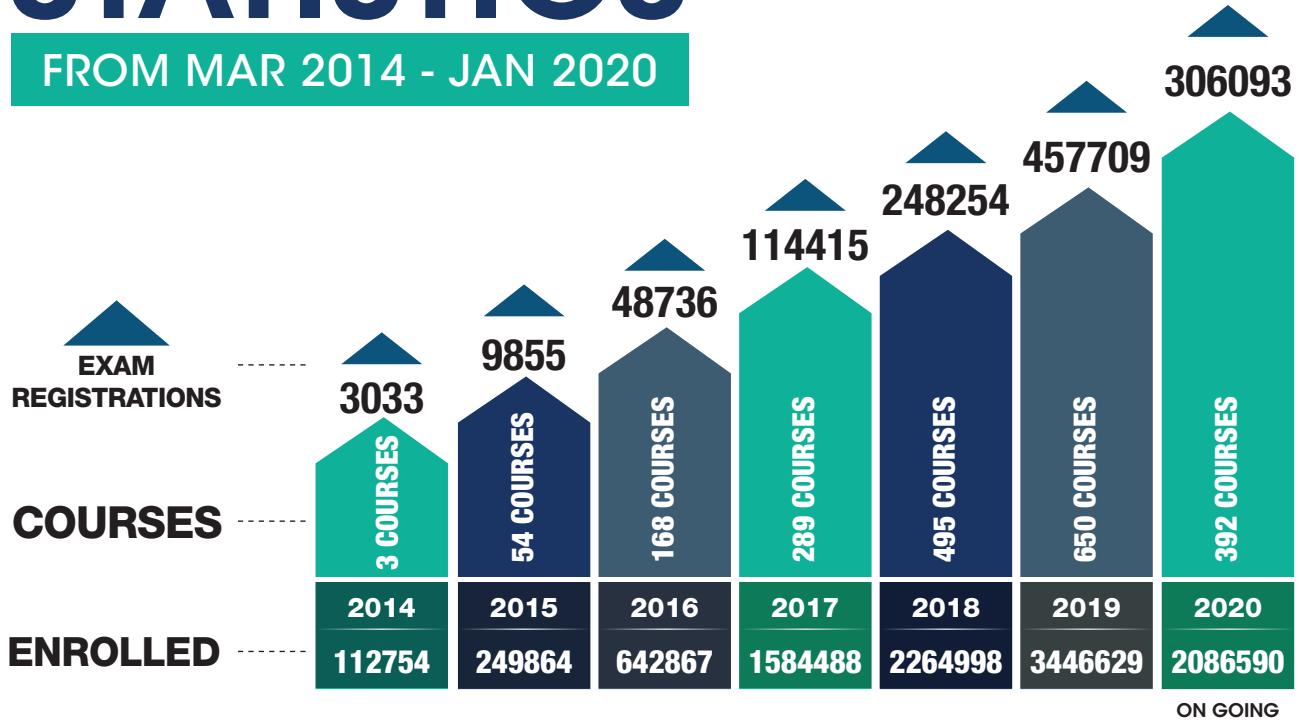
1. Aerospace Engineering, 2. Biotechnology and Bioscience / Bioengineering
3. Chemical Engineering, 4. Civil Engineering, 5. Computer Science
6. Electrical Engineering, 7. Management, 8. Mechanical Engineering
9. Metallurgical & Materials Engineering
10. Faculty Development

## About NPTEL

The National Programme on Technology Enhanced Learning (NPTEL) is a project funded by the Ministry of Human Resources Development, Govt. of India and carried out by seven IITs (Bombay, Delhi, Guwahati, Kanpur, Kharagpur, Madras, and Roorkee) along with IISc, Bangalore. Since 2014 NPTEL has been focusing on offering online courses for certification, with a unique, in person - at center, proctored final exam currently conducted in 160+ cities across India, that lends strong credibility to this process.

# STATISTICS

FROM MAR 2014 - JAN 2020



## Engaging with Indian Authorities

UGC and AICTE have approved that colleges can take these MOOC courses for credit in their Gazette notification of August 2016. These courses are being used by students to avail internship opportunities and prepare for the GATE exam too. About 15-20% of the total exam certified participants are faculty members from various colleges and hence these programmes are helping in faculty development and improvement. The advanced courses are recognized by AICTE as FDP.

# Domain Certification

- Register for domain-specific NPTEL courses
- No separate registration; no separate fees



## Possible Paths for students

Path - 1	
Sem 1	
Sem 2	1 Core
Sem 3	1 Core
Sem 4	1 Core
Sem 5	1 Core
Sem 6	1 Elective
Sem 7	1 Elective
Sem 8	1 Elective

Path - 2	
Sem 1	
Sem 2	1 Core
Sem 3	1 Core
Sem 4	1 Core
Sem 5	1 Core + 1 Elective
Sem 6	2 Elective
Sem 7	
Sem 8	

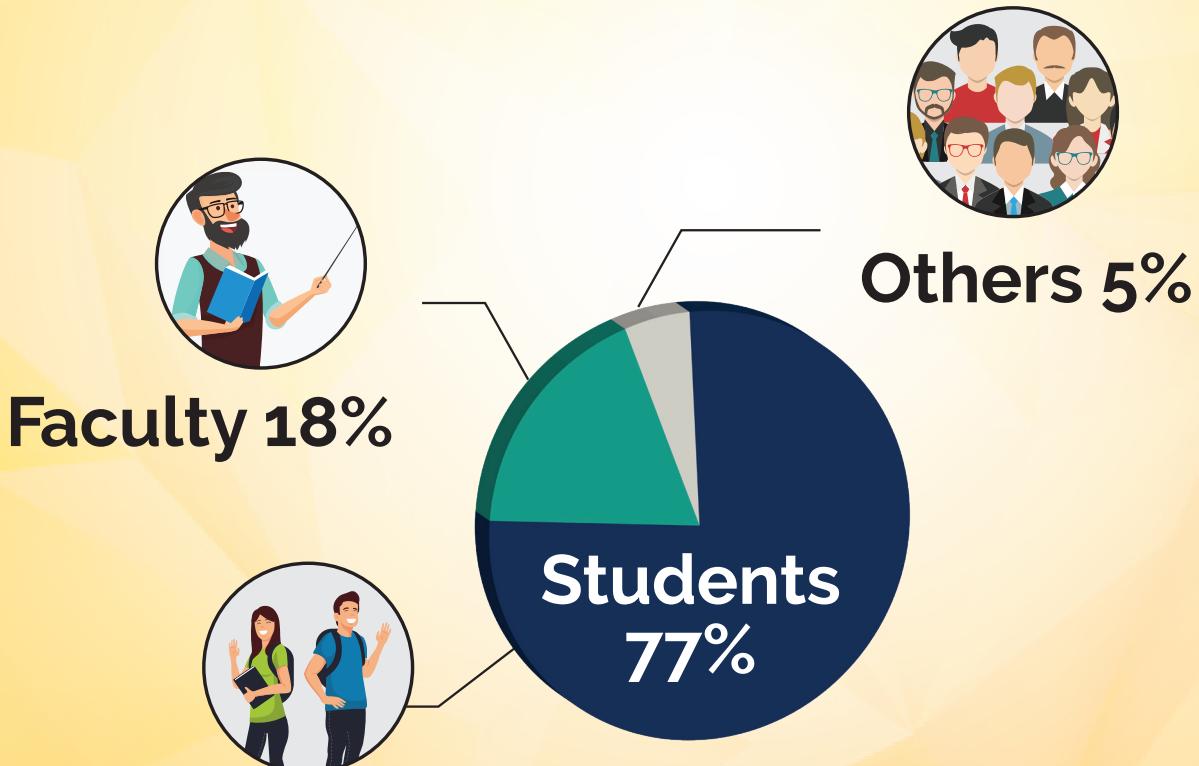
Path - 3	
Sem 1	
Sem 2	
Sem 3	2 Core
Sem 4	2 Core
Sem 5	3 Electives
Sem 6	
Sem 7	
Sem 8	

Based on the capability of the student, they can space out the completion of the courses of a domain and ensure they do so before the placement season or before they appear for competitive exams.



## LEARNERS WHO HAVE PARTIALLY COMPLETED DOMAIN COURSES

Discipline	Students	Faculty
Aerospace Engineering	429	25
Biotechnology and Bioscience / Bioengineering	22201	2916
Chemical Engineering	5797	355
Civil Engineering	6192	2303
Computer Science	148441	15090
Electrical Engineering	18062	10207
Faculty	8495	15092
Management	8895	4097
Mechanical Engineering	16214	5154
Metallurgical & Materials Engineering	1317	509





# NPTEL DOMAIN CERTIFICATE

## 💡 What

- This is a Micro Certification where a learner can obtain expertise in an area by completing a group of related courses.
- 

## 🎯 Why

- Gain expertise in a specific area
  - Demonstrates motivation and dedication
  - Can prepare for competitive exams like GATE, NET etc by doing the Minors defined in various disciplines.
- 

## ❓ How

- Complete all core and the selected electives in a domain within a period of 3 years
- Get Average score  $>=60$  across courses with minimum of  $>=55$  in each course
- Complete the minimum number of weeks of study specified

# Index

## Aerospace Engineering

Flight Mechanics	2
------------------	---

## Biotechnology and Bioscience / Bioengineering

Bioprocesses	4
Bioengineering	5
Biosciences	6
Computational Biology	7

## Chemical Engineering

Minor 1	9
Computational Chemical Engineering	10
Energy and Environment	11
Minor 2	12
Minor 3	13

## Civil Engineering

Construction Materials Technology	15
Structural Analysis	16
Structural Design	17
Environment	18

## Computer Science Engineering

Artificial Intelligence	20
Data Science	21
Programming	22
Foundations of Computing	23
Systems	24

## Electrical Engineering

VLSI design	26
Communication and Signal Processing	27
Power Systems and Power Electronics	28
Control and Instrumentation	29
Photonics	30

## Faculty Development

Faculty Domain for Newly Joined	32
Faculty Domain for Experienced	33

## Management

Marketing	35
Operations	36
Minor	37
Patents and Intellectual Property Rights	38

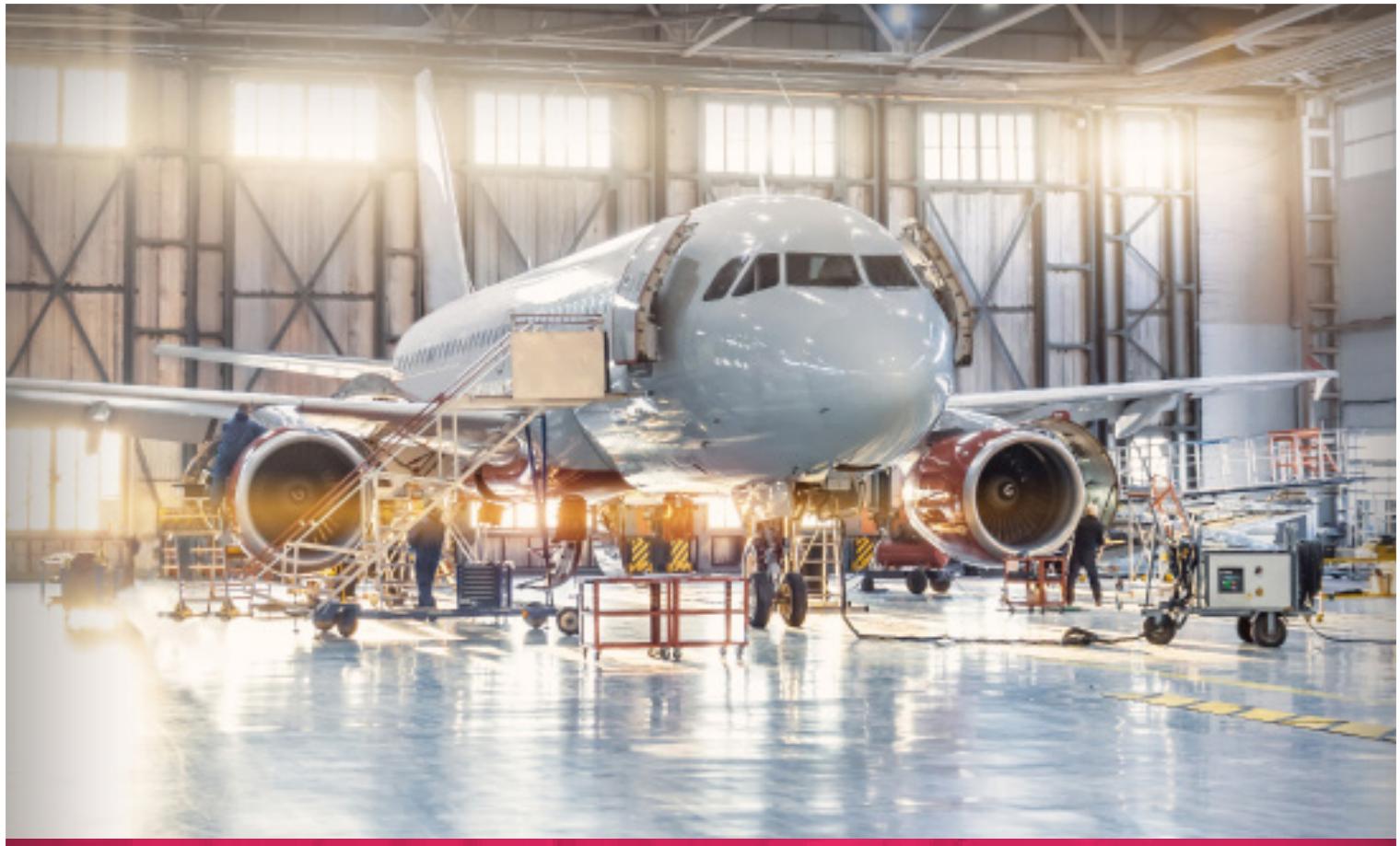
## Mechanical Engineering

Computational Engineering	40
Computational Thermo Fluids	41
Advanced Mechanics	42
Propulsion	43
Energy Systems	44
Manufacturing Processes and Technology	45
Product Design	46
Advanced Dynamics and Vibration	47
Computational Mechanics	48

## Metallurgical & Materials Engineering

Materials Joining	50
Electronic Materials	51





Discipline

# Aerospace Engineering

## Domains

1. Flight Mechanics

# Flight Mechanics

**(4 Core + 2 Elective) Minimum 50 Weeks**

Flight mechanics are relevant to fixed wing and rotary wing aircraft. An aeroplane, is defined in ICAO Document 9110 as, "a power-driven heavier than air aircraft, deriving its lift chiefly from aerodynamic reactions on surface which remain fixed under given conditions of flight". Intended audience: BTech and MTech Aerospace engineering.

**Application:** Design and Development and maintenance of Flight Vehicles

Core/ Elective	Course Name	Duration	SME Name	Institute	NPTEL ID
Core 1	Introduction to Airplane Performance	8 Weeks	Prof. A K Ghosh	IIT Kanpur	101104061
Core 2	Aircraft Stability and Control	12 Weeks	Prof. A.K. Ghosh	IIT Kanpur	101104062
Core 3	Aircraft Design	12 Weeks	Prof. A.K.Ghosh	IIT Kanpur	101104069
	Introduction to Aircraft Design	12 Weeks	Prof. Rajkumar Pant	IIT Bombay	101101083
Core 4	Introduction to Experiments in Flight	4 Weeks	Prof. A.K.Ghosh	IIT Kanpur	101104066
	Introduction to Aerospace Engineering-Flight	12 Weeks	Prof. Rajkumar Pant	IIT Bombay	101101079
Elective 1	Combustion in Air Breathing Aero Engines	12 Weeks	Prof. Swetaprovo Chaudhuri	IISc Bangalore	101108068
Elective 2	Optimal Control, Guidance and Estimation	To be Developed	-	-	-
Elective 3	Space Flight Mechanics	12 Weeks	Prof. Manoranjan Sinha	IIT Kharagpur	101105083
Elective 4	UAV Design - Part II	8 Weeks	Prof. Saderla Subrahmanyam	IIT Kanpur	101104083
Elective 5	Introduction to Airbreathing Propulsion	12 Weeks	Prof. Ashoke De	IIT Kanpur	101104084



Discipline

# Biotechnology and Bioscience / Bioengineering

## Domains

1. Bioprocesses
2. Bioengineering
3. Biosciences
4. Computational Biology

# Bioprocesses

**(3 Core + 2 Elective) Minimum of 50 Weeks**

Bioprocess Engineering is an interdisciplinary area that looks at applying engineering principles to biological systems for large-scale manufacture of valuable products. The Bioprocess Engineering domain specialization from NPTEL seeks to provide a fundamental understanding of core engineering principles. Advances in bioenergy, biofuels, production of pharmaceuticals and fine chemicals, commodity and specialty chemicals, recombinant proteins, and vaccines are all contingent on a trained workforce of engineers in the 'bio' industries. In recent years, the Biotechnology Industry Research Assistance Council (BIRAC), Government of India, has also been aggressively pushing for innovation in many of these areas. In addition to industries, the development of skilled bioprocess engineers in higher education and research is also very much needed. This domain specialization from NPTEL will train the students in various aspects of Bioprocess Engineering and present many exciting opportunities. This domain is recommended for students whose educational background is in biotechnology/biochemical engineering or chemical engineering. Students from the basic biosciences background who have strong mathematical skills can also pursue this. Professionals who are working in the 'bio' space and looking to build their profile for career advancement will find this domain to be quite helpful.

Core/ Elective	Course Name	Duration	SME Name	Institute	NPTEL ID
Core 1	Aspects of Biochemical Engineering	12 weeks	Prof. Debabrata Das	IIT Kharagpur	102105064
Core 2	Principles Of Downstream Techniques In Bioprocess	12 weeks	Prof. Mukesh Doble	IIT Madras	102106022
Core 3	Material and Energy Balances	12 weeks	Prof. Vignesh Muthuvijayan	IIT Madras	102106069
Core 4	Transport Phenomena in Biological Systems	12 weeks	Prof. G. K. Suraishkumar	IIT Madras	102106083
Elective 1	Plant Cell Bioprocessing	8 weeks	Prof. Smita Srivastava	IIT Madras	102106080
Elective 2	Bio Energy	8 weeks	Prof. Mainak Das	IIT Kanpur	102104057
Elective 3	Bioprocess Control	To be Developed	-	-	-
Elective 4	Bioprocess Modeling and Simulation	To be Developed	-	-	-
Elective 5	Metabolic Engineering	To be Developed	-	-	-
Elective 6	Genetic Engineering: Theory and Application	12 weeks	Prof. Vishal Trivedi	IIT Guwahati	102103074
Elective 7	Thermodynamics for Biological Systems : Classical and Statistical Aspect	12 weeks	Prof. Suraishkumar G K Prof. Sanjib Senapati	IIT Madras	102106082
Elective 8	Experimental Biotechnology	12 weeks	Prof. Vishal Trivedi	IIT Guwahati	102103083

# Bioengineering

**(3 Core + 3 Elective) Minimum of 50 Weeks**

Bioengineering is a highly interdisciplinary area that aims at applying principles from mathematics, physical sciences, and engineering to biological systems for solving problems in medicine and healthcare. Engineers with varied backgrounds such as electrical, mechanical, chemical, materials, etc. can contribute towards developing innovative engineering solutions to long-standing biomedical challenges. From developing sensors and devices for healthcare applications to creating artificial tissues and organs, bioengineering provides a wide array of opportunities for research and entrepreneurship. Here, our NPTEL domain introduces the fundamentals of biology and materials for biomedical applications through the prescribed core courses. The electives provide comprehensive options ranging from mechanobiology to nanotechnology and microfluidics to tissue engineering. As more and more courses are added to NPTEL, we expect the basket of electives to grow and provide an opportunity to learn the cutting edge technologies and applications of bioengineering. This domain is recommended for all engineering students. Faculty who teach related courses, and professionals and entrepreneurs working in this domain will significantly benefit from the understanding that can be gained by pursuing this specialization.

Core/ Elective	Course Name	Duration	SME Name	Institute	NPTEL ID
Core 1	Bioengineering: An Interface with Biology and Medicine	8 weeks	Prof. Sanjeeva Srivastava	IIT Bombay	102101068
Core 2	Cell Culture Technologies	8 weeks	Prof. Mainak Das	IIT Kanpur	102104059
Core 3	Medical Biomaterials	8 weeks	Prof. Mukesh Doble	IIT Madras	102106057
Core 4	Biomaterials for Bioengineering Applications	To Be Developed			
Elective 1	Tissue engineering	8 weeks	Prof. Vignesh Muthuvijayan	IIT Madras	102106081
Elective 2	Drug Delivery: Principles and Engineering	12 weeks	Prof. Rachit Agarwal	IISc Bangalore	102108077
Elective 3	Biomicrofluidics	4 weeks	Prof. Tapas Kumar Maiti Prof. Suman Chakraborty	IIT Kharagpur	102105068
Elective 4	Introduction to mechanobiology	8 weeks	Prof. Shamik Sen	IIT Bombay	102101058
Elective 5	Biomedical nanotechnology	4 weeks	Prof. P.Gopinath	IIT Roorkee	102107058
Elective 6	Applications of interactomics using Genomics and proteomics technologies	8 weeks	Prof. Sanjeeva Srivastav	IIT Bombay	102101072
Elective 7	Transport Phenomena in Biological Systems	12 weeks	Prof. G. K. Suraishkumar	IIT Madras	102106083
Elective 8	Biofabrication	To Be Developed	-	-	-



# Biosciences

(3 Core + 2 Elective) Minimum of 50 Weeks

## About the domain - Yet to be update

Core/ Elective	Course Name	Duration	SME Name	Institute	NPTEL ID
Core 1	Biochemistry	12 weeks	Prof. Swagata Dasgupta	IIT Kharagpur	104105076
Core 2	Structural Biology	To Be Developed	-	-	-
Core 3	Molecular Biology	To Be Developed	-	-	-
Elective 1	Plant Developmental Biology	4 weeks	Prof. Shri Ram Yadav	IIT Roorkee	102107075
Elective 2	Cell Culture Technologies	8 weeks	Prof. Mainak Das	IIT Kanpur	102104059
Elective 3	Human Molecular Genetics	4 weeks	Prof. S.Ganesh	IIT Kanpur	102104052
Elective 4	Experimental Biochemistry	12 weeks	Prof. Swagata Dasgupta	IIT Kharagpur	104105102
Elective 5	Genetic Engineering: Theory and Application	12 weeks	Prof. Vishal Trivedi	IIT Guwahati	102103074
Elective 6	Interactomics : Basics & Applications	12 weeks	Prof. Sanjeeva Srivastava	IIT Bombay	102101082
Elective 7	Introduction to proteomics	8 weeks	Prof. Sanjeeva Srivastava	IIT Bombay	102101055
Elective 8	Experimental Biotechnology	12 Weeks	Prof. Vishal Trivedi	IIT Guwahati	102103083
Elective 9	Introduction to Developmental Biology	12 Weeks	Prof. Subramaniam K	IIT Madras	102106084
Elective 10	Immunology	12 weeks	Prof. Sudip Kumar Ghosh Prof. Agneyo Ganguly	IIT Kharagpur	102105083

# Computational Biology

**(3 Core + 2 Elective) Minimum of 50 Weeks**

Heralded by the human genome project in 2000, and the advent of large-scale genome sequencing, computational biology has become a very important discipline, transforming biology in many ways. The development of mathematical modelling techniques, computationally efficient algorithms, simulations, as well as data analytics and machine learning methods has impacted biology in numerous ways. Many popular tools of computation find direct applications in biology, as will be illustrated by the courses that make up this domain specialisation in computational biology. Beginning with a firm foundation in bioinformatics algorithms, programming and functional genomics, the domain also offers an array of electives in cutting-edge topics such as dynamic modelling, drug design, computational neuroscience, and systems biology. Such tools are being widely adopted in biochemical/bioprocess as well as pharmaceutical industries. These techniques also find many applications in the medical and healthcare domains as well.

Core/ Elective	Course Name	Duration	SME Name	Institute	NPTEL ID
Core 1	BioInformatics: Algorithms and Applications	12 weeks	Prof. Michael Gromiha	IIT Madras	102106065
Core 2	Programming, Data Structures and Algorithms in Python	8 weeks	Prof. Madhavan Mukund	Chennai Mathematical Institute	106106145
	MATLAB Programming for Numerical Computation	8 weeks	Prof. Niket Kaisare	IIT Madras	103106118
	Introduction to R Software	8 weeks	Prof. Shalab	IIT Kanpur	111104100
Core 3	Functional Genomics	4 weeks	Prof. S. Ganesh	IIT Kanpur	102104056
Elective 1	Computational Systems Biology	12 weeks	Prof. Karthik Raman	IIT Madras	102106068
Elective 2	Computer Aided Drug Design	8 weeks	Prof. Mukesh Doble	IIT Madras	102106070
Elective 3	Introduction to Dynamical Models in Biology	4 weeks	Prof. Biplob Bose	IIT Guwahati	102103056
Elective 4	Introduction to Proteogenomics	12 weeks	Prof. Sanjeeva Srivastava	IIT Bombay	102101076
Elective 5	Computational Neuroscience	To Be Developed	-	-	-
Elective 6	Computational Ecology	To Be Developed	-	-	-



Discipline

# Chemical Engineering

## Domains

1. Minor 1
2. Computational Chemical Engineering
3. Energy and Environment
4. Minor 2
5. Minor 3

# Minor 1

**(3 Core + 2 Elective) Minimum of 50 Weeks**

Industrial processing of personal care products, foodstuffs, pharmaceuticals, agri-chemicals and transportation fuels are some examples of Chemical Engineering applications. In these industries chemical transformations (reactions from reactants to products) and separations (products from remaining reactants and by-products) are key operations. This minor provides an overall view of basic concepts and design challenges in these operations. The courses involve following areas: Preliminary formulation of a process, and carrying out material and energy balances for a given set of operations Basics of reaction engineering and phase equilibria Basics of heat transfer, and separations.

Core/ Elective	Course Name	Duration	SME Name	Institute	NPTEL ID
Core 1	Basic Principles and Calculations in Chemical Engineering	12 weeks	Prof. Subrata Kumar Majumdar	IIT Guwahati	103103165
	Fundamental of Chemical Process Calculations	To Be Developed	-	-	-
Core 2	Chemical Reaction Engineering-I	12 weeks	Prof. Bishnupada Mandal	IIT Guwahati	103103153
Core 3	Chemical Engineering Thermodynamics	12 weeks	Prof. Jayant Singh	IIT Kanpur	103104151
	Chemical Engineering Thermodynamics	12 weeks	Prof. Sasidhar Gumma	IIT Guwahati	103103144
	Phase equilibrium thermodynamics	8 weeks	Prof. Gargi Das	IIT Kharagpur	103105127
Elective 1	Mass Transfer Operations - I	12 weeks	Prof. Bishnupada Mandal	IIT Guwahati	103103145
	Mass Transfer Operations II	12 weeks	Prof. Chandan Das	IIT Guwahati	103103154
	Mechanical Unit Operations	12 weeks	Prof. Nanda Kishore	IIT Guwahati	103103155
Elective 2	Heat Transfer	12 weeks	Prof. Ganesh Viswanathan	IIT Bombay	103101137
	Heat Transfer	12 weeks	Prof. Sunando Dasgupta	IIT Kharagpur	103105140

# Computational Chemical Engineering

**(2 Core + 3 Elective) Minimum of 50 Weeks**

Computational Chemical Engineering deals with the development and application of mathematical models and computational methods for analysis, design, control and optimization of chemical processes. We harness the power of computers to solve complex problems that were previously difficult or impossible to solve. The two core courses lay the foundation for this domain, whereas the electives allow learners to explore its applications.

**Intended Audience:** Senior undergraduate students in chemical engineering or allied fields will benefit from Post-graduate students in engineering and sciences will also benefit, since the fundamentals are applicable across multiple disciplines. This domain is especially relevant to industrial audience looking to reskill or upskill, across all disciplines

**Certification:** Domain certification in Computational Chemical Engineering requires students to successfully complete at least 50 credits, which are earned from at least five courses. Two of these courses must be core courses, whereas the remaining three (or more) could be chosen from a basket of electives. All other rules of NPTEL domain certification are applicable as well..

Core/ Elective	Course Name	Duration	SME Name	Institute	NPTEL ID
Core 1	Numerical Methods for Engineers	12 weeks	Prof. Niket S Kaisare	IIT Madras	127106019
Core 2	Process Control - Design, Analysis and Assessment	12 weeks	Prof. Ragunathan Rengasamy	IIT Madras	103106148
	Chemical Process Control	8 weeks	Prof. Sujit Jogwar	IIT Bombay	103101142
Elective 1	Optimization in Chemical Engineering	12 weeks	Prof. Debasis Sarkar	IIT Kharagpur	103105139
Elective 2	Computational Fluid Dynamics	12 weeks	Prof. Sreenivas Jayanti	IIT Madras	103106119
Elective 3	Process Design	To Be Developed	-	-	-
Elective 4	Model Predictive Control	To Be Developed	-	-	-
Elective 5	Aspen	To Be Developed	-	-	-
Elective 6	Computer Aided Applied Single Objective Optimization	8 weeks	Prof. Prakash Kotecha	IIT Guwahati	103103164

# Energy and Environment

**(3 Core + 2 Elective) Minimum of 50 Weeks**

The domain of energy and environment is a key challenge in the current society especially from the perspective of environmental sustainability. Increasingly, corporations and governments are required to follow all procedures and designs on the basis of a sound sustainability policy. Professionals in this area are necessary to design energy and environmental solutions keeping in mind the principles of sustainability. Individual courses in this domain address a few specific key aspects of this domain. The courses will equip engineers with tools and the background to approach sustainable design.

Core/ Elective	Course Name	Duration	SME Name	Institute	NPTEL ID
Core 1	Environmental Quality Monitoring & Analysis	12 weeks	Prof. Ravi Krishna R	IIT Madras	103106162
Core 2	Non-Conventional Energy Resources	12 weeks	Prof. Prathap Haridoss	IIT Madras	121106014
Core 3	Ecology and Environment	8 weeks	Prof. Abhijit Deshpande Prof. R. Ravi Krishna	IIT Madras	127106004
Elective 1	Waste to Energy Conversion	8 weeks	Prof. P. Mondal	IIT Roorkee	103107125
Elective 2	Technologies for clean and renewable energy production	8 weeks	Prof. P. Mondal	IIT Roorkee	103107157
Elective 3	Energy conservation and waste heat recovery	12 weeks	Prof. Prasanta Kumar Das Prof. A Bhattacharya	IIT Kharagpur	112105221
Elective 4	Energy Economics and Policy	8 weeks	Prof. Shyamasree Dasgupta	IIT Mandi	109106161
Elective 5	Electrochemical Technology in Pollution Control	8 weeks	Prof. J. R. Mudakavi	IISc Bangalore	103108162

## Minor 2

**(3 Core + 2 Elective) Minimum of 50 Weeks**

Industrial processing of personal care products, foodstuffs, pharmaceuticals, agri-chemicals and transportation fuels are some examples of Chemical Engineering applications. Each of these applications involves a process, batch or continuous, encompassing several unit operations. This minor provides learnings related to design and control of the individual unit operations and the overall process.

**The courses involve following areas:**

Preliminary formulation of a process, and carrying out material and energy balances for a given set of operations

Basics of reaction engineering and phase equilibria

Process design, process control, and safety

Core/ Elective	Course Name	Duration	SME Name	Institute	NPTEL ID
Core 1	Basic Principles and Calculations in Chemical Engineering	12 weeks	Prof. Subrata Kumar Majumdar	IIT Guwahati	103103165
	Process Calculations	To Be Developed	-	-	-
Core 2	Chemical Reaction Engineering-I	12 weeks	Prof. Bishnupada Mandal	IIT Guwahati	103103153
Core 3	Chemical Engineering Thermodynamics	12 weeks	Prof. Jayant Singh	IIT Kanpur	103104151
	Chemical Engineering Thermodynamics	12 weeks	Prof. Sasidhar Gumma	IIT Guwahati	103103144
	Phase equilibrium thermodynamics	8 weeks	Prof. Gargi Das	IIT Kharagpur	103105127
Elective 1	Process Control - Design, Analysis and Assessment	12 weeks	Prof. Ragunathan Rengasamy	IIT Madras	103106148
Elective 2	Plant design and Economics	12 weeks	Prof. Debasis Sarkar	IIT Kharagpur	103105166
Elective 3	Chemical Process Safety	12 weeks	Prof. Shishir Sinha	IIT Roorkee	103107156

# Minor 3

**(3 Core + 2 Elective) Minimum of 50 Weeks**

Industrial processing of personal care products, foodstuffs, pharmaceuticals, agri-chemicals and transportation fuels are some examples of Chemical Engineering applications. A generic process in these applications involves raw material handling, molecular transformations in the form of reactions and separations to obtain products and by-products. Each step in the process can be understood by analyzing equilibrium states, and transport phenomena associated with non-equilibrium states. This course provides an overview of thermodynamics and transport phenomena as the central aspects of Chemical Engineering Science.

**The courses involve following areas:**

Preliminary formulation of a process, and carrying out material and energy balances for a given set of operations

Basics of reaction engineering and phase equilibria

Transport phenomena, continuum mechanics and particle mechanics

Core/ Elective	Course Name	Duration	SME Name	Institute	NPTEL ID
Core1	Basic Principles and Calculations in Chemical Engineering	12 weeks	Prof. Subrata Kumar Majumdar	IIT Guwahati	103103165
	Process Calculations	To Be Developed	-	-	-
Core 2	Chemical Reaction Engineering-I	12 weeks	Prof. Bishnupada Mandal	IIT Guwahati	103103153
Core 3	Chemical Engineering Thermodynamics	12 weeks	Prof. Jayant Singh	IIT Kanpur	103104151
	Chemical Engineering Thermodynamics	12 weeks	Prof. Sasidhar Gumma	IIT Guwahati	103103144
	Phase equilibrium thermodynamics	8 weeks	Prof. Gargi Das	IIT Kharagpur	103105127
Elective 1	Transport phenomena	12 weeks	Prof. Sunando DasGupta	IIT Kharagpur	103105128
	Continuum Mechanics and Transport Phenomena	12 weeks	Prof. T. Renganathan	IIT Madras	103106159
Elective 2	Fluid and Particle Mechanics	12 weeks	Prof. Sumesh Prof. Basavaraju	IIT Madras	103106158



Discipline

# Civil Engineering

## Domains

1. Construction Materials Technology
2. Structural Analysis
3. Structural Design
4. Environment

# Construction Materials Technology

**(4 Core + 2 Elective) Minimum of 60 Weeks**

The application of materials science and chemistry to the understanding of construction materials has brought about a sea change in the way that such materials are processed and utilized. It is essential for a construction engineer to explore the fundamentals of material structure and properties, and understand the deterioration mechanisms that would affect the long term service life with such materials. The courses in this domain attempt to bring out these aspects at different levels - starting from a preliminary understanding of material characteristics, and developing into a closer look at the microstructure - chemistry - property relationships that control the behaviour of these materials. The emphasis is on concrete, which is the most widely used construction material. The course contents also explore the aspect of life cycle assessment, which has become central to the judicious selection of future technologies. The courses are aimed at preparing specialists in concrete technology, who can go on to make a major difference in the construction industry, which at present lacks such personnel. Thus, the domain is applicable to post graduate students as well as practicing engineers who have an interest in exploring material technology.

Core/ Elective	Course Name	Duration	SME Name	Institute	NPTEL ID
Core 1	Concrete Technology	12 weeks	Prof. B. Bhattacharjee	IIT Delhi	105102012
Core 2	Advanced Concrete Technology	12 weeks	Prof. Manu Santhanam	IIT Madras	105106176
Core 3	Modern Construction materials	12 weeks	Prof. Ravindra Gettu Prof. Radhakrishna G. Pillai	IIT Madras	105106053
Core 4	Basic construction materials	To Be Developed	-	-	-
Elective 1	Hydration, Porosity and Strength of Cementitious Materials	8 weeks	Prof. Sudhir Misra Prof. K. V. Harish	IIT Kanpur	105104157
Elective 2	Advanced Topics in the Science and Technology of Concrete	4 weeks	Prof. Ravindra Gettu Prof. Manu Santhanam	IIT Madras	105106187
Elective 3	Characterization of Construction Materials	12 weeks	Prof. Manu Santhanam Prof. Piyush Chaunsali	IIT Madras	105106200
Elective 4	Maintenance and Repair of Concrete Structures	12 weeks	Prof. Radhakrishna G. Pillai	IIT Madras	105106202
Elective 5	Sustainable Materials and Green Buildings	12 weeks	Prof. B Bhattacharjee	IIT Delhi	105102195
Elective 6	Building Materials and Composites	8 weeks	Prof. Sumana Gupta	IIT Kharagpur	124105013

# Structural Analysis

**(4 Core + 2 Elective) Minimum of 60 Weeks**

## About the domain - Yet to be update

Core/ Elective	Course Name	Duration	SME Name	Institute	NPTEL ID
Pre-Requisite	Engineering Mechanics - Statics and Dynamics	8 weeks	Prof. Mahesh V Panchagnula	IIT Madras	112106180
Core 1	Mechanics of Solids	12 weeks	Prof. Priyanka Ghosh	IIT Kanpur	105104160
Core 2	Structural Analysis - I	12 weeks	Prof. Amit Shaw	IIT Kharagpur	105105166
Core 3	Matrix Method of Structural Analysis	8 weeks	Prof. Amit Shaw Prof. Biswanath Banerjee	IIT Kharagpur	105105180
Core 4	Structural Dynamics	12 weeks	Prof. Ramancharala Pradeep Kumar	IIT Hyderabad	105106151
Elective 1	Mechanics of Materials	12 weeks	Prof. U. Saravanan	IIT Madras	105106172
	Theory of Elasticity	12 weeks	Prof. Amit Shaw Prof. Biswanath Banjerjee	IIT Kharagpur	105105177
Elective 2	Stability of structures	To Be Developed	-	-	-
Elective 3	Finite Element Analysis	To Be Developed	-	-	-
Elective 4	Soil Structure Interaction	12 weeks	Prof. Koushik Deb	IIT Kharagpur	105105200

# Structural Design

(4 Core + 2 Elective) Minimum of 60 Weeks

## About the domain - Yet to be update

Core/ Elective	Course Name	Duration	SME Name	Institute	NPTEL ID
Pre-Requisite	Engineering Mechanics - Statics and Dynamics	8 weeks	Prof. Mahesh V Panchagnula	IIT Madras	112106180
Core 1	Mechanics of Solids	12 weeks	Prof. Priyanka Ghosh	IIT Kanpur	105104160
Core 2	Structural Analysis - I	12 weeks	Prof. Amit Shaw	IIT Kharagpur	105105166
Core 3	Design of reinforced concrete structures	12 weeks	Prof. Nirjhar Dhang	IIT Kharagpur	105105105
Core 4	Design of Steel Structures	12 weeks	Prof. Damodar Maiti	IIT Kharagpur	105105162
Elective 1	Design of Masonry Structures	12 weeks	Prof. Arun Menon	IIT Madras	105106197
Elective 2	Wind and earthquake analysis and design	To Be Developed	-	-	-
Elective 3	Prestressed concrete	To Be Developed	-	-	-
Elective 4	Bridge engineering	To Be Developed	-	-	-

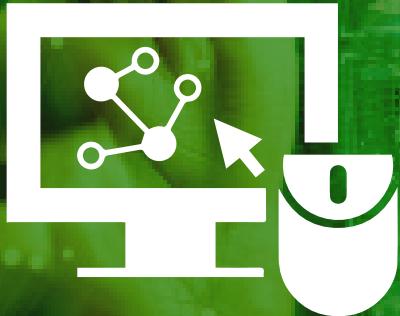
# Environment

**(5 Core + 1 Elective) Minimum of 60 Weeks**

Environmental science and engineering is rapidly expanding in scale and in professional scope. Professionals in this field still have primary responsibility for air pollution controls and water and wastewater treatment, however the field now encompasses tremendous workforce aspects in water resource management, remediation and environmental protection; solid waste management; industrial/institutional environmental management; and even overall 'sustainability' aspects of our greater society. Some of the newer specific topics of this field include environmental risk assessments (including fate and transport) of new generation of pollutants and industrial products, sustainable remediation technologies, including Bio-Remediation techniques, greenhouse gases and climate change issues, resource recovery, life cycle analysis, energy and environment among others.

Through the list of courses being offered as part of this domain, a student can enrich their knowledge and skills in the emerging areas of environmental management. The set of courses included will help the participant to acquire all the tools for the betterment of their career in this subject area, whether they are looking for a job in industry as a consultant, regulator, city/municipal engineers or pursuing further research and academic career. Based on present global conditions, there is a good demand of environmental professional and this certification program will be helpful to a student in this regard.

Core/ Elective	Course Name	Duration	SME Name	Institute	NPTEL ID
Core 1	Applied Environmental Microbiology	12 weeks	Prof. Gargi Singh	IIT Roorkee	105107173
Core 2	Environmental Engineering- Chemical Processes	12 weeks	Prof. Bhanu Prakash Vellanki	IIT Roorkee	105107176
Core 3	Integrated Waste Management for a Smart City	12 weeks	Prof. Brajesh Kumar Dubey	IIT Kharagpur	105105160
Core 4	Life Cycle Assessment	8 weeks	Prof. Brajesh Kumar Dubey	IIT Kharagpur	105105157
Core 5	Wastewater Treatment and Recycling	12 weeks	Prof. Manoj Kumar Tiwari	IIT Kharagpur	105105178
Elective 1	Electronic Waste Management - Issues And Challenges	4 weeks	Prof. Brajesh Kumar Dubey	IIT Kharagpur	105105169
Elective 2	Energy Efficiency, Acoustics and Daylighting in Building	12 weeks	Prof. B. Bhattacharjee	IIT Delhi	105102175
Elective 3	Environmental Remediation of Contaminated Sites	12 weeks	Prof. Bhanu Prakash Vellanki	IIT Roorkee	105107181
Elective 4	Sustainable River Basin Management	8 weeks	Prof. Franziska Steinbruch	IIT Madras	105106145
Elective 5	Plastic Waste Management	8 weeks	Prof. Brajesh Kumar Dubey	IIT Kharagpur	105105184



Discipline

# Computer Science Engineering

## Domains

1. Artificial Intelligence
2. Data Science
3. Programming
4. Foundations of Computing
5. Systems

# Artificial Intelligence

**(4 Core + 2 Elective) Minimum of 60 Weeks**

The AI domain includes courses in artificial intelligence and machine learning. This set of courses introduce the learner to tools that would go into building intelligent agents, including the ability to solve problems, represent and reason about the agent's environment, learning from data, implementing neural networks, and being able to handle text and images.

Core/ Elective	Course Name	Duration	SME Name	Institute	NPTEL ID
Core 1	Artificial Intelligence : Search Methods For Problem solving	12 weeks	Prof. Deepak Khemani	IIT Madras	106106126
	An Introduction to Artificial Intelligence	12 weeks	Prof. Mausam	IIT Delhi	106102220
Core 2	Artificial Intelligence: Knowledge Representation and Reasoning	12 weeks	Prof. Deepak Khemani	IIT Madras	106106140
Core 3	Programming, Data Structures and Algorithms in Python	8 weeks	Prof. Madhavan Mukund	Chennai Mathematical Institute	106106145
	Python for Data Science	4 weeks	Prof. Raghunathan Rengasamy	IIT Madras	106106212
Core 4	Introduction to Machine Learning	8 weeks	Prof. Sudeshna Sarkar	IIT Kharagpur	106105152
	Introduction to Machine Learning	12 weeks	Prof. Balaraman Ravindran	IIT Madras	106106139
Elective 1	Deep Learning	12 weeks	Prof. Mitesh Khapra	IIT Madras	106106184
	Deep Learning	12 weeks	Prof. Prabir Kumar Biswas	IIT Kharagpur	106105215
	Deep Learning for Computer Vision	12 weeks	Prof. Vineeth N Balasubramanian	IIT Hyderabad	106106224
Elective 2	Reinforcement Learning	12 weeks	Prof. Balaraman Ravindran	IIT Madras	106106143
Elective 3	AI:Constraint Satisfaction	8 weeks	Prof. Deepak Khemani	IIT Madras	106106158
Elective 4	Computer Vision	12 weeks	Prof. Jayanta Mukhopadhyay	IIT Kharagpur	106105216
Elective 5	Natural Language Processing	12 weeks	Prof. Pawan Goyal	IIT Kharagpur	106105158
	Applied Natural Language Processing	12 weeks	Prof. Ramaseshan R	Chennai Mathematical Institute	106106211
Elective 6	Practical Machine Learning with Tensorflow	8 weeks	Prof. Ashish Tendulkar Prof. B. Ravindran	IIT Madras & Google	106106213



# Data Science

**(3 Core + 3 Elective) Minimum of 60 Weeks**

The Data Science domain includes courses that contribute to implementing programs that can handle and make sense of large amounts of data. The focus is on machine learning techniques to help make sense of data, often dealing with text and images, but there is also possible exposure to symbolic artificial intelligence methods.

Core/ Elective	Course Name	Duration	SME Name	Institute	NPTEL ID
Core 1	Python for Data Science	4 weeks	Prof. Raghunathan Rengasamy	IIT Madras	106106212
	Programming, Data Structures and Algorithms in Python	8 weeks	Prof. Madhavan Mukund	Chennai Mathematical Institute	106106145
Core 2	Introduction to Data Analytics	8 weeks	Prof. Nandan Sudarsanam Prof. Balaraman Ravindran	IIT Madras	110106072
	Data Science for Engineers	8 weeks	Prof. Ragunathan Rengasamy, Prof. Shankar Narasimhan	IIT Madras	106106179
	Data Analytics with Python	12 weeks	Prof. A. Ramesh	IIT Roorkee	106107220
Core 3	Introduction to Machine Learning	8 weeks	Prof. Sudeshna Sarkar	IIT Kharagpur	106105152
	Introduction to Machine Learning	12 weeks	Prof. Balaraman Ravindran	IIT Madras	106106139
Elective 1	Deep Learning	12 weeks	Prof. Mitesh Khapra	IIT Madras	106106184
	Deep Learning	12 weeks	Prof. Prabir Kumar Biswas	IIT Kharagpur	106105215
	Deep Learning for Computer Vision	12 weeks	Prof. Vineeth N Balasubramanian	IIT Hyderabad	106106224
Elective 2	Reinforcement Learning	12 weeks	Prof. Balaraman Ravindran	IIT Madras	106106143
Elective 3	Artificial Intelligence : Search Methods For Problem solving	12 weeks	Prof. Deepak Khemani	IIT Madras	106106126
	An Introduction to Artificial Intelligence	12 weeks	Prof. Mausam	IIT Delhi	106102220
Elective 4	Artificial Intelligence: Knowledge Representation and Reasoning	12 weeks	Prof. Deepak Khemani	IIT Madras	106106140
Elective 5	Computer Vision	12 weeks	Prof. Jayanta Mukhopadhyay	IIT Kharagpur	106105216
Elective 6	Natural Language Processing	12 weeks	Prof. Pawan Goyal	IIT Kharagpur	106105158
	Applied Natural Language Processing	12 weeks	Prof. Ramaseshan R	Chennai Mathematical Institute	106106211
Elective 7	Practical Machine Learning with Tensorflow	8 weeks	Prof. Ashish Tendulkar Prof. B. Ravindran	IIT Madras & Google	106106213
Elective 8	Learning Analytics Tools	12 weeks	Prof. Ramkumar Rajendran	IIT Bombay	106101224

# Programming

**(4 Core + 2 Elective) Minimum of 60 Weeks**

The Programming domain lays emphasis on the tools needed to implement application software systems. Starting with programming fundamentals one moves on to databases, and then there options to study cloud computing, internet of things, machine learning and data science.

Core/ Elective	Course Name	Duration	SME Name	Institute	NPTEL ID
Core 1	Programming, Data Structures and Algorithms in Python	8 weeks	Prof. Madhavan Mukund	Chennai Mathematical Institute	106106145
	Data Structure and algorithms using Java	12 Weeks	Prof. Debasis Samanta	IIT Kharagpur	106105225
Core 2	Programming in C++	8 weeks	Prof. Partha Pratim Das	IIT Kharagpur	106105151
	An Introduction to Programming through C++	12 weeks	Prof. Abhiram Ranade	IIT Bombay	106101208
Core 3	Programming in Java	12 weeks	Prof. Debasis Samanta	IIT Kharagpur	106105191
	Object Oriented System Development using UML, Java and Patterns	12 weeks	Prof. Rajib Mall	IIT Kharagpur	106105224
Core 4	Database Management System	8 weeks	Prof. Partha Pratim Das	IIT Kharagpur	106105175
	Introduction to Database Systems	12 weeks	Prof. Sreenivasa Kumar	IIT Madras	106106220
Elective 1	Data Science for Engineers	8 weeks	Prof. Ragunathan Rengasamy, Prof. Shankar Narasimhan	IIT Madras	106106179
Elective 2	Cloud computing	8 weeks	Prof. Soumya Kanti Ghosh	IIT Kharagpur	106105167
Elective 3	Introduction to Internet of Things	12 weeks	Prof. Sudip Misra	IIT Kharagpur	106105166
Elective 4	Introduction to Machine Learning	8 weeks	Prof. Sudeshna Sarkar	IIT Kharagpur	106105152
	Introduction to Machine Learning	12 weeks	Prof. Balaraman Ravindran	IIT Madras	106106139
Elective 5	Modern Application Development	12 weeks	Prof. Aamod Sane Prof. Abhijat Vichare Prof. Madhavan Mukund	Persistent Computing Systems & CMI	106106222

# Foundations of Computing

**(4 Core + 2 Elective) Minimum of 60 Weeks**

The Foundations domain looks at the theoretical foundations of computing. Starting with the mathematics related to computing, one moves on to the study of algorithms and their associated complexity. One has options to further study graphs formally, parallel algorithms, logic and computational geometry.

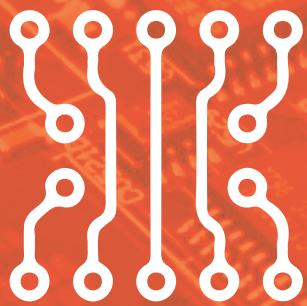
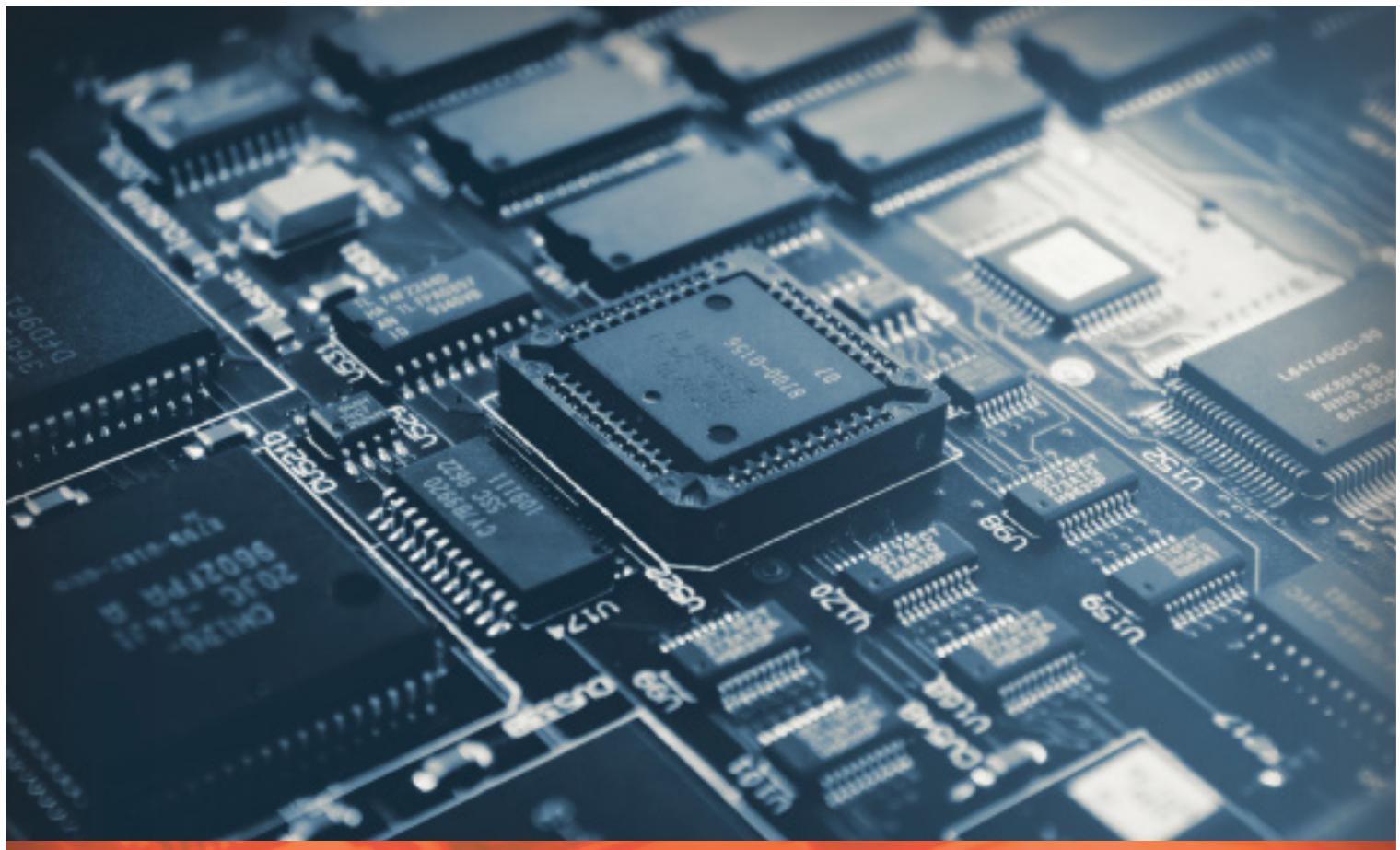
Core/ Elective	Course Name	Duration	SME Name	Institute	NPTEL ID
Core 1	Discrete Mathematics	12 weeks	Prof. Sourav Chakraborty	Chennai Mathematical Institute	111106086
	Discrete Mathematics	12 weeks	Prof. Sudarshan Iyengar	IIT Ropar	106106183
	Discrete Mathematics	12 weeks	Prof. Sajith Gopalan Prof. Benny George K	IIT Guwahati	106103205
Core 2	Design and Analysis of Algorithms	8 weeks	Prof. Madhavan Mukund	Chennai Mathematical Institute	106106131
Core 3	Programming, Data Structures and Algorithms in Python	8 weeks	Prof. Madhavan Mukund	Chennai Mathematical Institute	106106145
Core 4	Theory of Computation	8 weeks	Prof. Raghunath Tewari	IIT Kanpur	106104148
Elective 1	Randomized Algorithms	12 weeks	Prof. Benny George K	IIT Guwahati	106103187
Elective 2	Parallel Algorithms	12 weeks	Prof. Sajith Gopalan	IIT Guwahati	106103188
Elective 3	Modern Algebra	8 weeks	Prof. Manindra Agrawal	IIT Kanpur	106104149
Elective 4	Graph Theory	8 weeks	Prof. Soumen Maity	IISER PUNE	111106102
Elective 5	Computational Geometry	12 weeks	Prof. Amit Kumar	IIT Delhi	106102011
Elective 6	Arithmetic Circuit Complexity	12 weeks	Prof. Nitin Saxena	IIT Kanpur	106104221
Elective 7	Foundations of Cryptography	12 weeks	Prof. Ashish Choudhury	IIT Bangalore	106106221
Elective 8	Computer Graphics	8 weeks	Prof. Samit Bhattacharya	IIT Guwahati	106103224
Elective 9	Computational Complexity	To Be Developed	-	-	-
Elective 10	Mathematical Logic	To Be Developed	-	-	-

# Systems

**(4 Core + 2 Elective) Minimum of 60 Weeks**

The Systems domain is concerned with innerware, that makes the application software relate to the hardware. The core subjects are compilers, operating systems, databases and networks. There are opportunities to learn cryptography and security, internet of things, cloud computing, and multicore systems.

Core/ Elective	Course Name	Duration	SME Name	Institute	NPTEL ID
Core 1	Compiler Design	12 weeks	Prof. Santanu Chattopadhyay	IIT Kharagpur	106105190
Core 2	Introduction to Operating Systems	8 weeks	Prof. Chester Rebeiro	IIT Madras	106106144
	Operating System	12 weeks	Prof. Sorav Bansal	IIT Delhi	106102132
	Operating System Fundamentals	12 weeks	Prof. Santanu Chattopadhyay	IIT Kharagpur	106105214
Core 3	Computer Networks and Internet Protocol	12 weeks	Prof. Soumya Kanti Ghosh Prof. Sandip Chakraborty	IIT Kharagpur	106105183
Core 4	Introduction to Database Systems	12 weeks	Prof. Sreenivasa Kumar	IIT Madras	106106220
Elective 1	Cloud computing	8 weeks	Prof. Soumya Kanti Ghosh	IIT Kharagpur	106105167
Elective 2	Information Security - 5 - Secure Systems Engineering	8 weeks	Prof. Chester Robeiro	IIT Madras	106106199
Elective 3	Introduction to Parallel Programming in OpenMP	4 weeks	Prof. Yogish Sabharwal	IIT Delhi	106102163
Elective 4	Introduction to Internet of Things	12 weeks	Prof. Sudip Misra	IIT Kharagpur	106105166
Elective 5	MultiCore Computer Architecture-Storage and Interconnects	8 weeks	Prof. John Jose	IIT Guwahati	106103183
Elective 6	Internetwork Security	12 weeks	Prof. Sourav Mukhopadhyay	IIT Kharagpur	106105162
Elective 7	Advanced Computer Architecture	8 weeks	Prof. John Jose	IIT Guwahati	106103206
Elective 8	Ethical Hacking	12 weeks	Prof. Indranil Sengupta	IIT Kharagpur	106105217
Elective 9	Introduction to Blockchain Technology and Applications	8 weeks	Prof. Sandeep Shukla	IIT Kanpur	106104220
	Blockchain Architecture Design and Use Cases	12 weeks	Prof. Sandip Chakraborty Prof. Praveen Jayachandran	IIT Kharagpur IBM	106105184
Elective 10	GPU Architectures and Programming	12 weeks	Prof. Soumyajit Dey	IIT Kharagpur	106105220



Discipline

# Electrical Engineering

## Domains

1. VLSI design
2. Communication and Signal Processing
3. Power Systems and Power Electronics
4. Control and Instrumentation
5. Photonics

# VLSI design

**(4 Core + 2 Elective) Minimum of 60 Weeks**

**VLSI Design:** There is little that one can do with just device physics and semiconductor models in order to build a full-fledged microprocessor. Various levels of abstraction are necessary to ensure quick design and turn around time. A Register Transfer Logic (RTL) level abstraction allows large designs to be written in a behavioral manner through Hardware Description Languages (HDL) such as Verilog and VHDL. Translating this to a design that can be manufactured in a semiconductor foundry requires a lot of automation that is covered under the umbrella of Electronic Design Automation (EDA), where a behavioral model is synthesized, placed, and routed to obtain a layout that can be manufactured. This is the only way a microprocessor with 8 billion transistors can be manufactured! A high level of automation comes with the caveat of not being as efficient in terms of performance and area. A VLSI design engineer is expected to understand the caveats of such an automation flow and identify performance-critical blocks that can be handcrafted to meet the specifications. This requires knowledge of how a CMOS transistor responds to the applied terminal voltages and what kind of current flows through it. Dealing with extreme voltage levels ( $0$  and  $VDD$ )

**Application:** Most cool electronic gadgets that you see today have a significant amount of VLSI in them.

**Intended Audience:** Any curious Engineer who has done basic courses on Basic Circuit Theory, Signals and Systems, Network Analysis, and Control Systems can take up this domain.

Core/ Elective	Course Name	Duration	SME Name	Institute	NPTEL ID
Core 1	Basic electrical circuits	12 weeks	Prof. Nagendra Krishnapura	IIT Madras	117106108
	Basic Electric Circuits	12 weeks	Prof. Ankush Sharma	IIT Kanpur	108104139
	Network Analysis	12 weeks	Prof. Tapas Kumar Bhattacharya	IIT Kharagpur	108105159
Core 2	Analog circuits	12 weeks	Prof. Nagendra Krishnapura	IIT Madras	108106084
	Analog Electronic Circuit	12 weeks	Prof. Shouribrata Chatterjee	IIT Delhi	108102112
	Analog Circuits	8 weeks	Prof. Jayanta Mukherjee	IIT Bombay	108101094
	Analog Electronic Circuits	12 weeks	Prof. Pradip Mandal	IIT Kharagpur	108105158
	Microelectronics: Devices to Circuits	12 weeks	Prof. Sudeb Dasgupta	IIT Roorkee	108107142
Core 3	Digital Electronic Circuits	12 weeks	Prof. Goutam Saha	IIT Kharagpur	108105132
	Digital Circuits	12 weeks	Prof. Santanu Chattopadhyay	IIT Kharagpur	108105113
Core 4	Fundamentals of semiconductor devices	12 weeks	Prof. Digbijoy N. Nath	IISc Bangalore	108108122
	Semiconductor Devices and Circuits	12 weeks	Prof. Sanjiv Sambandan	IISc Bangalore	108108112
Core 5	Microprocessors and Microcontrollers	12 weeks	Prof. Santanu Chattopadhyay	IIT Kharagpur	108105102
Elective 1	Hardware modeling using verilog	8 weeks	Prof. Indranil Sengupta	IIT Kharagpur	106105165
Elective 2	VLSI Physical Design	12 weeks	Prof. Indranil Sengupta	IIT Kharagpur	106105161
Elective 3	Mapping Signal Processing Algorithms to Architectures	12 weeks	Prof. Nitin Chandrachoodan	IIT Madras	108106149
Elective 4	Digital IC Design	12 weeks	Prof. Janakiraman	IIT Madras	108106158
Elective 5	Power Management Integrated Circuits	12 weeks	Prof. Qadeer Ahmad Khan	IIT Madras	108106159
Elective 6	Microprocessors and Interfacing	12 weeks	Prof. Shaik Rafi Ahamed	IIT Guwahati	108103157

# Communication and Signal Processing

**(4 Core + 2 Elective) Minimum of 60 Weeks**

Modern signal processing techniques have wide-ranging applications in diverse areas such as Telecommunications, Audio/Speech processing, Medical, Defense and Power systems. On the other hand, the recent revolution in Telecommunication that has led to the development of 4G/ 5G cellular networks, Wi-Fi, Bluetooth and other technologies, has been possible only due to advances in the theory of communication. This domain of communication and signal processing aims to systematically introduce learners to the various theoretical and practical aspects of these technologies. It comprises of several courses beginning with the fundamental principles pertaining to signal processing and communication, and progressively covering more advanced and latest breakthrough technologies in these areas. The domain is self-contained and includes dedicated courses on linear algebra and probability, which are prerequisites for the advanced level courses. Furthermore, students will also find the various courses and domain knowledge helpful in their preparation for competitive exams and interviews.

Core/ Elective	Course Name	Duration	SME Name	Institute	NPTEL ID
Core 1	Principles of Signals and Systems	12 weeks	Prof. Aditya Jagannathan	IIT Kanpur	108104100
	Signals and Systems	12 weeks	Prof. Kushal K. Shah	IISER Bhopal	108106163
Core 2	Discrete Time Signal Processing	8 weeks	Prof. Mrityunjoy Chakraborty	IITKGP	117105134
	Digital Signal Processing	12 weeks	Prof. C. S. Ramalingam	IIT Madras	108106151
Core 3	Probability Foundations for Electrical Engineers	8 weeks	Prof. Andrew Thangaraj Prof. R. Aravind EE	IIT Madras	108106106
Core 4	Principles of Communication Systems - I	12 weeks	Prof. Aditya Jagannatham	IIT Kanpur	108104091
Core 5	Principles of Communication Systems: Part - II	8 weeks	Prof. Aditya K. Jagannatham	IIT Kanpur	108104098
	Principles of Digital Communications	12 weeks	Prof. Abhishek Dixit	IIT Delhi	108102120
	Principles of Digital Communications	12 weeks	Prof. S. N. Merchant	IIT Bombay	108101113
Core 6	Linear Algebra for Engineers	To Be Developed	-	-	-
Elective 1	An Introduction to Information Theory	8 weeks	Prof. Adrish Banerjee	IIT Kanpur	117104129
	An Introduction to Coding Theory	8 weeks	Prof. Adrish Banerjee	IIT Kanpur	108104092
	Information Theory	12 weeks	Prof. Himanshu Tyagi	IISc Bangalore	108108168
Elective 2	Introduction to Wireless and Cellular Communications	12 weeks	Prof. David Kovil Pillai	IIT Madras	106106167
Elective 3	Digital Image Processing	12 weeks	Prof. Prabir Kumar Biswas	IIT Kharagpur	117105135
	Image Signal Processing	12 weeks	Prof. A. N. Rajagopalan	IIT Madras	108106168
Elective 4	Multirate DSP	12 weeks	Prof. R. David Koilpillai	IIT Madras	108106136
Elective 5	Principles and Techniques of Modern Radar Systems	12 weeks	Prof. Amitabha Bhattacharya	IIT Kharagpur	108105154
Elective 6	Statistical Signal Processing	12 weeks	Prof. Prabin Kumar Bora	IIT Guwahati	108103158
Elective 7	Communication Networks	To Be Developed	-	-	-

# Power Systems and Power Electronics

**(4 Core + 2 Elective) Minimum of 60 Weeks**

The area of power systems has seen a renewed interest with most generation wanting to shift to renewables, and also with the advent of smart and micro grids. This offers new challenges in terms of grid integration of renewables, load forecasting, unit commitment, demand response, to name a few.

Power electronics contributes significantly in power generation, power transmission, power quality, energy storage as well as the integration of distributed and renewable energy sources into the grid. Power electronics and drives is a contemporary subject which focuses application of solid-state electronics to the control and conversion of electric power and more recently in electric vehicle technologies.

These set of course will serve as a treatise into the area of power systems and power electronics and also serve as an excellent platform to pursue research in future technologies like smart grids and electric vehicles.

Core/ Elective	Course Name	Duration	SME Name	Institute	NPTEL ID
Core 1	Basic electrical circuits	12 weeks	Prof. Nagendra Krishnapura	IIT Madras	117106108
	Basic Electric Circuits	12 weeks	Prof. Ankush Sharma	IIT Kanpur	108104139
	Network Analysis	12 weeks	Prof. Tapas Kumar Bhattacharya	IIT Kharagpur	108105159
Core 2	Electrical machines - I	12 weeks	Prof. D Kastha Prof. Suman Maiti	IIT Kharagpur	108105017
	Electrical Machines	12 weeks	Prof. G. Bhuvaneswari	IIT Delhi	108102146
	Electrical Machines - I	12 weeks	Prof. Tapas Kumar Bhattacharya	IIT Kharagpur	108105155
	Electrical Machines - II	12 weeks	Prof. Tapas Kumar Bhattacharya	IIT Kharagpur	108105131
Core 3	Power System Engineering	12 weeks	Prof. Debapriya Das	IIT Kharagpur	108105104
	Power system analysis	12 weeks	Prof. Debapriya Das	IIT Kharagpur	117105140
Core 4	Fundamentals of Power Electronics	12 weeks	Prof. Vivek Agarwal Prof. L Umanand	IISc Bangalore	108101126
	Power Electronics	12 weeks	Prof. G. Bhuvaneshwari	IIT Delhi	108102145
Elective 1	Control engineering	12 weeks	Prof. Ramakrishna Pasumarthy	IIT Madras	108106098
Elective 2	Electrical Measurement and Electronic Instruments	12 weeks	Prof. Avishek Chatterjee	IIT Kharagpur	108105153
Elective 3	Computer Aided Power System Analysis	12 weeks	Prof. Biswarup Das	IIT Roorkee	108107127
Elective 4	Fundamentals of Electric Drives	8 weeks	Prof. Shyama Prasad Das	IIT Kanpur	108104140
Elective 5	High Power Multilevel Converters-Analysis, design and operational issues	12 weeks	Prof. Anandarup Das	IIT Delhi	108102157
Elective 6	Power Management Integrated Circuits	12 weeks	Prof. Qadeer Ahmad Khan	IIT Madras	108106159
Elective 7	DC Power Transmission Systems	12 weeks	Prof. Krishna S	IIT Madras	108106160
Elective 8	Design of Power Electronic Converters	To Be Developed	-		
Elective 9	Power System Protection and Switchgear	To Be Developed	-		
Elective 10	Power System Protection	12 weeks	Prof. Ashok Kumar Pradhan	IIT Kharagpur	108105167
Elective 11	Introduction to Smart Grid	8 Weeks	Prof. N. P. Padhy Prof. Premalata Jena	IIT Roorkee	108107113

# Control and Instrumentation

**(4 Core + 2 Elective) Minimum of 60 Weeks**

The area of Control and Instrumentation has been an integral part of any process industry and industrial automation related companies, in addition to defense and aerospace domains. This domain gets all the more important in the current context where the aim is to make everything around us "smart". The control and instrumentation domain offers courses with a flavor of courses related basic concepts electrical engineering and advanced courses in control theory and advanced sensing and instrumentation techniques, offering learners a unique opportunity to be Industry ready or pursue core academic research. Furthermore, as new frontiers continue to emerge, the domain specific courses serve as a platform to pursue career or research in application based areas (such as Internet of Things), conceptual directions (such as Cyber Physical systems and date driven control).

Core/ Elective	Course Name	Duration	SME Name	Institute	NPTEL ID
Core 1	Principles of Signals and Systems	12 weeks	Prof. Aditya Jagannathan	IIT Kanpur	108104100
	Signals and Systems	12 weeks	Prof. Kushal K. Shah	IISER Bhopal	108106163
Core 2	Basic electrical circuits	12 weeks	Prof. Nagendra Krishnapura	IIT Madras	117106108
	Basic Electric Circuits	12 weeks	Prof. Ankush Sharma	IIT Kanpur	108104139
	Network Analysis	12 weeks	Prof. Tapas Kumar Bhattacharya	IIT Kharagpur	108105159
Core 3	Control engineering	12 weeks	Prof. Ramakrishna Pasumarthy	IIT Madras	108106098
Core 4	Electrical Measurement and Electronic Instruments	12 weeks	Prof. Avishek Chatterjee	IIT Kharagpur	108105153
Core 5	Analog circuits	12 weeks	Prof. Nagendra Krishnapura	IIT Madras	108106084
	Analog Electronic Circuit	12 weeks	Prof. Shouribrata Chatterjee	IIT Delhi	108102112
	Analog Circuits	8 weeks	Prof. Jayanta Mukherjee	IIT Bombay	108101094
	Analog Electronic Circuits	12 weeks	Prof. Pradip Mandal	IIT Kharagpur	108105158
	Microelectronics: Devices to Circuits	12 weeks	Prof. Sudeb Dasgupta	IIT Roorkee	108107142
Core 6	Microprocessors and Microcontrollers	12 weeks	Prof. Santanu Chattpadhyay	IIT Kharagpur	108105102
Core 7	Linear Algebra for Engineers	To Be Developed	-	-	-
Elective 1	Linear System Theory	12 weeks	Prof. Ramkrishna Pasumarthy	IIT Madras	108106150
	Linear Dynamical Systems	8 weeks	Prof. Tushar Jain	IIT Mandi	108106164
Elective 2	Control System Design	12 weeks	Prof. G R Jayanth	IISc Bangalore	115108104
Elective 3	Industrial Instrumentation	12 weeks	Prof. Alok Barua	IIT Kharagpur	108105064
Elective 4	Design for internet of things	8 weeks	Prof. T V Prabhakar	IISc Bangalore	108108098
Elective 5	Advanced IOT Applications	8 weeks	Prof. T V Prabhakar	IISc Bangalore	108108123
Elective 6	Sensors and Actuators	12 weeks	Prof Hardik J Pandya	IISc Bangalore	108108147
Elective 7	Statistical Signal Processing	12 weeks	Prof. Prabin Kumar Bora	IIT Guwahati	108103158
Elective 8	Nonlinear System Analysis	12 weeks	Prof. Ramkrishna Pasumarthy , Prof. Arunkumar D Mahindrakar	IIT Madras	108106162
Elective 9	Transducers for Instrumentation	To Be Developed	-	-	-
Elective 10	Biomedical Electronic Systems	To Be Developed	-	-	-

# Photonics

**(3 Core + 2 Elective) Minimum of 60 Weeks**

Photonics is at the forefront of a technology revolution in several key areas of cyber-physical systems including telecommunications, sensing, lithography, displays, photovoltaics, data storage, computing and material processing. There is a growing need globally for highly skilled personnel trained in photonics to cater to an ever-rising demand in the above industries.

In India, such a trend has only recently gained momentum - as evidenced by the setting up of dedicated teams in some of the Indian IT/ITES major companies due to heavy demand from their global Engineering Services clients. It is expected to be only a matter of time before this trend spreads around in the IT industry, creating a need for highly skilled manpower. In addition, there have been several small scale companies that have been started in the past few years in India as part of the Make in India program, and Digital India program, which are also anticipated to grow over the next 5-10 years. Yet another aspect is the anticipated need for such manpower by Government laboratories such as DRDO, CSIR and ISRO as they push ahead for indigenous development of photonics-related technologies/equipment as part of the recent Atmanirbhar Bharat drive.

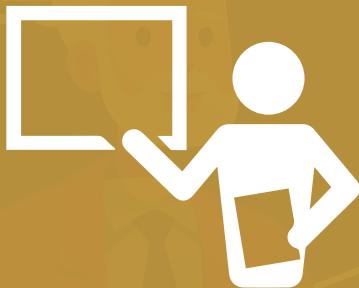
In order to cater to the above demand, several faculty carrying out photonics-related research in the premier institutes in India have been offering a wide variety of photonics-related courses under the NPTEL/Swayam umbrella. It is envisaged that students specializing in photonics through basic courses such as Introduction to Photonics, Electromagnetic Waves, and Optical Engineering followed by advanced courses such as Optical Communications, Fiber Optic Communication Technology, Optical Sensors, Integrated Photonic Circuits, and Biophotonics will have adequate knowledge to meet the above industry requirements.

Core/ Elective	Course Name	Duration	SME Name	Institute	NPTEL ID
Core 1	Introduction to Photonics	12 weeks	Prof. Balaji Srinivasan	IIT Madras	108106135
Core 2	Optical Engineering	12 weeks	Prof. Shanti Bhattacharya	IIT Madras	108106161
Core 3	Applied Electromagnetics For Engineers	12 weeks	Prof. Pradeep Kumar K	IIT Kanpur	108104099
	Transmission lines and electromagnetic waves	12 weeks	Prof. Ananth Krishnan	IIT Madras	108106157
Elective 1	Optical Sensors	4 weeks	Prof. Sachin Kumar Srivastava	IIT Roorkee	115107122
Elective 2	Optical communications	12 weeks	Prof. Pradeep Kumar K	IIT Kanpur	117104127
Elective 3	Computational Electromagnetics	12 weeks	Prof. Uday Khankhoje	IIT Madras	108106152
Elective 4	Fiber Optics	8 weeks	Prof. Vipul Rastogi	IIT Roorkee	115107095
Elective 5	Microwave Engineering	12 weeks	Prof. Ratnajit Bhattacharjee	IIT Guwahati	108103141
Elective 6	Photonic integrated circuits	To Be Developed	-	-	-
Elective 7	Biophotonics	To Be Developed	-	-	-
Elective 8	Fiber Optic Communication Technology	12 weeks	Prof. Deepa Venkitesh	IIT Madras	108106167
Elective 9	Semiconductor Opto-electronics	12 Weeks	Prof. M.R. Shenoy	IIT Delhi	115102103
Elective 10	Ultrafast Optics and Spectroscopy	12 Weeks	Prof. Atanu Bhattacharya	IISc Bangalore	104108118
Elective 11	LASER fundamentals and application	8 weeks	Prof. Manabendra Chandra	IIT Kanpur	104104085
Elective 12	Optical Spectroscopy and Microscopy : Fundamentals of optical measurements and instrumentation	12 Weeks	Prof. Balaji Jayaprakash	IISc Bangalore	102108082



Discipline

# Faculty Development



## Domains

1. Faculty Domain for Newly Joined
2. Faculty Domain for Experienced

# Faculty Domain for Newly Joined

**(5 Core + 2 Elective) Minimum of 40 Weeks**

Apart from subject matter expertise, today's faculty need to acquire skills of pedagogic expertise, organizational management, change management, ethical practice, documentation and communication skills. While some amount of these skills may come from the choice of electives that the faculty candidate had taken during their post graduation or doctorate studies, there is a need for a more focussed learning related to these areas based on the experience and aspirations of the faculty. The courses in the 'Faculty' domain will help existing faculty and future teachers to equip themselves in skill sets that are aligned both to their personal aspirations and organizational needs. At present, we are looking at two broad categories of courses in the Faculty domain based on their experience - Newly Joined and Experienced. The courses under the 'Newly Joined' is ideal for faculty with less than 3 years of teaching experience. We suggest that the more experienced faculty look at courses coming under the 'Experienced Faculty Domain'

The courses under the 'Newly Joined' faculty have an explicit focus on the pedagogical perspective of teaching. There are core courses related to student-centered teaching-learning practices, ethical dimensions and effective professional communication, which are important for a newly inducted faculty to understand. The electives in this domain allow the newly joined faculty to explore aspects related teaching-learning with technology, learning analytics, learning sciences and disciplinary research.

**Intended Audience :**Faculty with less than 3 years of experience or PhD scholars who have interest in pursuing teaching as a career

Core/ Elective	Course Name	Duration	SME Name	Institute	NPTEL ID
Core 1	Effective Engineering Teaching in Practice	4 weeks	Prof. G. K. Suraishkumar	IIT Madras	121106012
Core 2	Ethics in Engineering Practice	8 weeks	Prof. Susmita Mukhopadhyay	IIT Kharagpur	110105097
Core 3	Introduction to Professional Scientific Communication	4 weeks	Prof. S. Ganesh	IIT Kanpur	102104061
	Effective Writing	4 weeks	Prof. Binod Mishra	IIT Roorkee	109107172
Core 4	Teaching And Learning in Engineering (TALE)	4 weeks	Prof. N J Rao	IISc Bangalore	127108005
	Teaching and Learning in General Programs: TALG	4 weeks	Prof. N J Rao	IISc Bangalore	127108015
Core 5	Accreditation and Outcome based Learning	8 weeks	Prof. Ak Ray (retd.) Prof. Sk Das Mandal	IIT Kharagpur	127105017
	Outcome Based Pedagogic Principles for Effective Teaching	4 weeks	Prof. Shyamal Kumar Das Mandal	IIT Kharagpur	121105010
	NBA Accreditation and Teaching - Learning in Engineering (NATE)	12 weeks	Prof. N J Rao. Prof. K. Rajanikanth	IISc Bangalore	127108135
Elective 1	Introduction to learning analytics	4 weeks	Prof. Ramkumar Rajendran	IIT Bombay	127101012
	Learning Analytics Tools	12 weeks	Prof. Ramkumar Rajendran	IIT Bombay	106101224
Elective 2	Introduction to Research	8 weeks	Prof. Prathap Haridoss	IIT Madras	121106007
Elective 3	Introduction to Basic Cognitive Processes	8 weeks	Prof. Ark Verma	IIT Kanpur	109104123
Elective 4	Basics of e-learning design	To Be Developed	-	-	-
Elective 5	Foundations of Learning Sciences	To Be Developed	-	-	-
Elective 6	Designing learner-centric e-learning in STEM disciplines	4 weeks	Prof. Sahana Murthy	IIT Bombay	127101013

# Faculty Domain for Experienced

**(5 Core + 2 Elective) Minimum of 40 Weeks**

Apart from subject matter expertise, today's faculty need to acquire skills of pedagogic expertise, organizational management, change management, ethical practice, documentation and communication skills. While some amount of these skills may come from the choice of electives that the faculty candidate had taken during their post graduation or doctorate studies, there is a need for a more focussed learning related to these areas based on the experience and aspirations of the faculty. The courses in the 'Faculty' domain will help existing faculty and future teachers to equip themselves in skill sets that are aligned both to their personal aspirations and organizational needs. At present, we are looking at two broad categories of courses in the Faculty domain based on their experience - Newly Joined and Experienced. The courses under the 'Newly Joined' is ideal for faculty with less than 3 years of teaching experience. We suggest that the more experienced faculty look at courses coming under the 'Experienced Faculty Domain'. The core courses for experienced faculty focus on student-centered pedagogic practices with the objective that they will be able to contextualize these in their settings more appropriately. The electives for experienced faculty provide them opportunity to explore dimensions like organizational management, intellectual property, MOOC creation, Educational leadership, etc.

**Intended Audience:** Faculty with more than 3 years of experience or People from industry with more than 10 years of experience and interested in shifting to academic positions.

Core/ Elective	Course Name	Duration	SME Name	Institute	NPTEL ID
Core 1	Effective Engineering Teaching in Practice	4 weeks	Prof. G. K. Suraishkumar	IIT Madras	121106012
Core 2	Ethics in Engineering Practice	8 weeks	Prof. Susmita Mukhopadhyay	IIT Kharagpur	110105097
Core 3	Introduction to Professional Scientific Communication	4 weeks	Prof. S. Ganesh	IIT Kanpur	102104061
Core 4	Teaching And Learning in Engineering (TALE)	4 weeks	Prof. N J Rao	IISc Bangalore	127108005
	Teaching and Learning in General Programs: TALG	4 weeks	Prof. N J Rao	IISc Bangalore	127108015
Core 5	Accreditation and Outcome based Learning	8 weeks	Prof. Ak Ray (retd.) Prof. Sk Das Mandal	IIT Kharagpur	127105017
	Outcome Based Pedagogic Principles for Effective Teaching	4 weeks	Prof. Shyamal Kumar Das Mandal	IIT Kharagpur	121105010
Elective 1	Designing Learner-Centric MOOCs	4 weeks	Prof. Sridhar Iyer Prof. Sahana Murthy Prof. Jayakrishnan M. Prof. Sameer Sahasrabudhe	IIT Bombay	127101010
	Designing learner-centric e-learning in STEM disciplines	4 weeks	Prof. Sahana Murthy	IIT Bombay	127101013
Elective 2	Qualitative Research Methods and Research Writing	12 weeks	Prof. Aradhna Malik	IIT Kharagpur	109105115
	Learning Analytics Tools	12 weeks	Prof. Ramkumar Rajendran	IIT Bombay	106101224
Elective 3	Development Research Methods	8 weeks	Prof. Rajshree Bedamatta	IIT Guwahati	109103153
Elective 4	Educational leadership	8 weeks	Prof. Atasi Mohanty	IIT Kharagpur	109105122
	Organization Development and Change in 21st Century	8 weeks	Prof. Ashish Pandey	IIT Bombay	110101146
Elective 5	Introduction on Intellectual Property to Engineers and Technologists	8 weeks	Prof. Tapas Kumar Bandyopadhyay	IIT Kharagpur	109105112
	Entrepreneurship and IP strategy	8 weeks	Prof. Gouri Gargate	IIT Kharagpur	109105176
Elective 6	Intellectual Property	12 weeks	Prof. Feroz Ali	IIT Madras	109106137
Elective 7	Patent Law for Engineers and Scientists	12 weeks	Prof. Feroze Ali	IIT Madras	110106081
Elective 8	Patent Drafting for Beginners	4 weeks	Prof. Feroz Ali	IIT Madras	109106128
Elective 9	Training of Trainers	12 weeks	Prof. Santosh Rangnekar	IIT Roorkee	110107126
Elective 10	Entrepreneurship	12 weeks	Prof. C Bhaktavatsala Rao	IIT Madras	110106141



## Domains

1. Marketing
2. Operations
3. Minor
4. Patents and Intellectual Property Rights

# Marketing

**(4 Core + 3 Elective) Minimum of 50 Weeks**

Marketing is one of the crucial activities in all businesses is viewed with enhanced importance in the current business scenario where the borders are blurred. The course will teach you core concepts and tools that will help you better understand the function of Marketing. The objective of the set of courses introduces students to the concepts and activities that comprise Marketing Management. The set of courses are foundation course for advanced electives in Marketing as well as in other business /social disciplines. The set of courses brings in a marketing lens to complex business and organization challenges and aid in holistic decision-making that aligns with customer and company goals.

Core/ Elective	Course Name	Duration	SME Name	Institute	NPTEL ID
Core 1	Marketing Management-I	8 weeks	Prof. Jayanta Chatterjee Prof. Shashi Shekhar Mishra	IIT Kanpur	110104068
Core 2	Marketing Management - II	8 weeks	Prof. Jayanta Chatterjee Prof. Shashi Shekhar Mishra	IIT Kanpur	110104070
Core 3	Consumer Behaviour	8 weeks	Prof. Srabanti Mukherjee	IIT Kharagpur	110105074
Core 4	Marketing research and analysis	8 weeks	Prof. J. K. Nayak	IIT Roorkee	110107080
Elective 1	Services Marketing: A Practical Approach	4 weeks	Prof. Biplab Datta	IIT Kharagpur	110105078
Elective 2	Sales and Distribution Management	8 weeks	Prof. Sangeeta Sahney	IIT Kharagpur	110105122
Elective 3	Management of Field Sales	4 weeks	Prof. Jayanta Chatterjee	IIT Kanpur	110104117
Elective 4	Global Marketing Management	8 weeks	Prof. Z. Rahman	IIT Roorkee	110107112
Elective 5	Marketing Research and Analysis - II	12 weeks	Prof. J. K. Nayak	IIT Roorkee	110107113
Elective 6	Managing Services	8 weeks	Prof. Jayanta Chatterjee	IIT Kanpur	110104065
Elective 7	Customer Relationship Management	8 weeks	Prof. Swagato Chatterjee	IIT Kharagpur	110105145
Elective 8	Introduction to Retail Management	To Be Developed	-	-	-
Elective 9	Marketing and Innovation	To Be Developed	-	-	-
Elective 10	Introduction to Marketing Essentials	8 weeks	Prof. Zillur Rahman	IIT Roorkee	110107147

# Operations

**(4 Core + 2 Elective) Minimum of 50 Weeks**

Operations Management aims at planning, controlling and implementing programmes that result in products and services with high quality to meet customer requirement. This module has several courses in tools such as Operations Research, data analytics, data and decision analysis as well as domain areas such as Quality, Supply Chain Management and manufacturing. This will help the student gain knowledge in specific problem solving tools as well as in the domain Operations function.

Core/ Elective	Course Name	Duration	SME Name	Institute	NPTEL ID
Core 1	Introduction to probability and Statistics	4 weeks	Prof. G. Srinivasan	IIT Madras	111106112
	Data Analysis and Decision Making - I	12 weeks	Prof. Raghunandan Sengupta	IIT Kanpur	110104094
Core 2	Introduction to Operations Research	8 weeks	Prof. G. Srinivasan	IIT Madras	110106062
Core 3	Operations and Supply Chain Management	12 weeks	Prof. G. Srinivasan	IIT Madras	110106045
Core 4	Introduction to Data Analytics	8 weeks	Prof. Nandan Sudarsanam, Prof. Balaraman Ravindran	IIT Madras	110106072
	Business Statistics	12 weeks	Prof. Mukesh Kumar Barua	IIT Roorkee	110107114
Elective 1	Project Management	8 weeks	Prof. Raghunandan Sengupta	IIT Kanpur	110104073
	Project management for managers	12 weeks	Prof. Mukesh Kumar Barua	IIT Roorkee	110107081
Elective 2	Total Quality Management - I	8 weeks	Prof. Raghunandan Sengupta	IIT Kanpur	110104080
Elective 3	Total Quality Management - II	8 weeks	Prof. Raghunandan Sengupta	IIT Kanpur	110104085
Elective 4	Strategy: An Introduction to game Theory	8 weeks	Prof. Aditya Jagannatham Prof. Vimal Kumar	IIT Kanpur	110104063
Elective 5	Six Sigma	12 weeks	Prof. Jitesh J. Thakkar	IIT Kharagpur	110105123
Elective 6	Quality Design and Control	12 weeks	Prof. Pradip Kumar Ray	IIT Kharagpur	110105088
Elective 7	Supply Chain Analytics	8 weeks	Prof. Rajat Agrawal	IIT Roorkee	110107074
Elective 8	Management of Inventory Systems	12 weeks	Prof. Pk Ray	IIT Kharagpur	110105095
Elective 9	Decision modeling	8 weeks	Prof. Biswajit Mahanty	IIT Kharagpur	110105082
Elective 10	Decision-Making Under Uncertainty	4 weeks	Prof. N. Gautam	Texas A&M Univ.	110106134
Elective 11	Design and Analysis of Experiments	12 weeks	Prof. Jhareswar Maiti	IIT Kharagpur	110105087
Elective 12	Practitioners Course In Descriptive, Predictive And Prescriptive Analytics	8 weeks	Prof. Deepu Philip Prof. Sanjeev Newar	IIT Kanpur	110104086
Elective 13	Business Analytics for Management Decision	12 weeks	Prof. Rudra P Pradhan	IIT Kharagpur	110105089
Elective 14	Selected Topics in Decision Modeling	8 weeks	Prof. Biswajit Mahanty	IIT Kharagpur	110105096
Elective 15	Data Analysis & Decision Making - II	12 weeks	Prof. Raghunandan Sengupta	IIT Kanpur	110104118
Elective 16	Data Analysis & Decision Making - III	12 weeks	Prof. Raghunandan Sengupta	IIT Kanpur	110104125
Elective 17	MCDM Techniques Using R	4 weeks	Prof. Gaurav Dixit	IIT Roorkee	110107115
Elective 18	Manufacturing Strategy	8 weeks	Prof. Rajat Agarwal	IIT Roorkee	110107116
Elective 19	Advanced Green Manufacturing Systems	12 weeks	Prof. Deepu Philip Prof. Amadeep Singh	IIT Kanpur	110104119
Elective 20	Toyota Production System	8 weeks	Prof. Rajat Agrawal	IIT Roorkee	110107130
Elective 21	The Future of Manufacturing Business: Role of Additive Manufacturing	8 weeks	Prof. R. K. Amit Prof. U. Chandrasekhar	IITM & Wipro 3D	110106146

# Minor

**(5 Core + 1 Elective)Minimum of 50 Weeks**

Management is a set of theories and principles related to planning organizing and control of physical financial and information resources in an organization. This management minor has introductory courses in general management, finance, marketing and Operations that will prepare a student to specialize in any of these domains further.

Core/ Elective	Course Name	Duration	SME Name	Institute	NPTEL ID
Core 1	Introduction to Operations Research	8 weeks	Prof. G. Srinivasan	IIT Madras	110106062
Core 2	Marketing Management-I	8 weeks	Prof. Jayanta Chatterjee Prof. Shashi Shekhar Mishra	IIT Kanpur	110104068
Core 3	Operations and Supply Chain Management	12 weeks	Prof. G. Srinivasan	IIT Madras	110106045
Core 4	Financial Accounting	8 weeks	Prof. Varadraj Bapat	IIT Bombay	110101131
	Decision making using financial accounting	8 weeks	Prof. G Arun Kumar	IIT Madras	110106135
	Financial Accounting	12 weeks	Prof. Puran Singh	IIT Mandi	110106147
Core 5	Project Management for Managers	12 weeks	Prof. Susmita Muhopadhyay Prof. S. Srinivasan	IIT Kharagpur	110105146
Elective	To be Developed	To Be Developed	-	-	-

# Patents and Intellectual Property Rights

**(4 Core + 2 Elective) Minimum of 40 Weeks**

Intellectual property deals with creations of the mind such as inventions, literary artistic works, symbols and images. The field of intellectual property rights tells us what the rights of the creator are and how they can be protected. Patent gives the right to the creator to exclude others from the use of creation for a specific period of time. This module discusses patent searching, creation and drafting that is useful to understand the intellectual property rights of the creator.

Core/ Elective	Course Name	Duration	SME Name	Institute	NPTEL ID
Core 1	Patent Law for Engineers and Scientists	12 weeks	Prof. Feroze Ali	IIT Madras	110106081
Core 2	Patent Search for Engineers and Lawyers	8 weeks	Prof. M. Padmavati Prof. Shreya Matilal	IIT Kharagpur	110105140
Core 3	Patent Drafting for Beginners	4 weeks	Prof. Feroze Ali	IIT Madras	109106128
Core 4	Roadmap for patent creation	8 weeks	Prof. Gouri Gargate	IIT Kharagpur	127105008
Elective 1	Intellectual Property Rights and Competition Law	8 weeks	Prof. K. D. Raju Prof. Niharika Sahoo Bhattacharya	IIT Kharagpur	110105139
Elective 2	Innovation, Business Models and Entrepreneurship	8 weeks	Prof. Rajat Agarwal Prof. Vinay Sharma	IIT Roorkee	110107094
Elective 3	Innovation by Design	4 weeks	Prof. B. K. Chakravarthy	IIT Bombay	107101086
Elective 4	Managing Intellectual Property in Universities	4 weeks	Prof. Feroze Ali	IIT Madras	109106148



Discipline

# Mechanical Engineering

## Domains

1. Computational Engineering
2. Computational Thermo Fluids
3. Advanced Mechanics
4. Propulsion
5. Energy Systems
6. Manufacturing Processes and Technology
7. Product Design
8. Advanced Dynamics and Vibration
9. Computational Mechanics

# Computational Engineering

**(3 Core + 3 Elective) Minimum of 50 Weeks**

The domain of Computational Engineering encompasses several fundamental courses which aim to provide a unique skill set to the participants. The courses are carefully chosen from several domains and are designed in such a way that a minimum prerequisite will suffice to understand the material. The assortment of courses are chosen from broad areas of mechanics, mathematics and materials science. At the end of the course, the participant will have gained significant expertise in writing codes to solve engineering problems and will also be exposed to a wide variety of existing software on many topics.

Core/ Elective	Course Name	Duration	SME Name	Institute	NPTEL ID
Pre-Req	Engineering Mechanics	12 weeks	Prof. K. Ramesh	IIT Madras	112106286
Core 1	Numerical Methods for Engineers	12 weeks	Prof. Niket S Kaisare	IIT Madras	127106019
Core 2	Basics of Finite Element Analysis-I	8 weeks	Prof. Nachiketa Tiwari K	IIT Kanpur	112104193
	Introduction to Finite Volume Methods I	8 weeks	Prof. Ashoke De	IIT Kanpur	101104074
Core 3	Tools in Scientific computing	To Be Developed	-	-	-
Core 4	Finite Element Method: Variational Methods to Computer Programming	12 weeks	Prof. Atanu Banerjee Prof. Arup Nandy	IIT Guwahati	112103295
Elective 1	Foundations of Computational Materials Modelling	12 weeks	Prof. Narasimhan Swaminathan	IIT Madras	112106289
Elective 2	A short lecture series on contour integration in the complex plane	4 weeks	Prof. Venkata Sonti	IISc Bangalore	112108285
Elective 3	Ab-initio methods	To Be Developed	-	-	-
Elective 4	Molecular dynamics simulations	To Be Developed	-	-	-
Elective 5	Monte-carlo simulations	To Be Developed	-	-	-
Elective 6	Fundamentals of Compressible Flow	8 weeks	Prof. Niranjan Sahoo	IIT Guwahati	112103294
Elective 7	High Performance Computing for Scientists and Engineers	8 weeks	Prof. Somnath Roy	IIT Kharagpur	112105293
Elective 8	Fundamentals of Convective Heat Transfer	12 weeks	Prof. Amaresh Dalal	IIT Guwahati	112103297
Elective 9	Computational Fluid Dynamics using Finite Volume Method	12 weeks	Prof. Kameswararao Anupindi	IIT Madras	112106294

# Computational Thermo Fluids

**(3 Core + 3 Elective) Minimum of 50 Weeks**

Conservation equations governing the fluid flow are nonlinear, coupled, partial differential equations. What this implies is that, except in some very simplistic (usually unrealistically simplified) situations, the solution to these equations cannot be found analytically. The complexity of the equations is further increased by addition of chemical reactions and multiple-phases. The best engineering approach that is available today is to numerically solve these equations on computers. In this approach the differential equations are approximated into a set of algebraic equations, for which algorithms exist or can be developed. The computational thermo-fluids domain is aimed at students interested in learning the fundamentals as well as applied aspects of the numerical solution of fluid flow equations. One might wonder what is the point of learning the intricacies of the formulation and solution procedure for CFD when one can directly use open source (OpenFOAM) or commercial (ANSYS Fluent, Converge CFD, etc.) codes to solve problems. It is indeed a very good question. The short answer is that a lack of the knowledge of the fundamentals often leads to incorrect use of CFD and misinterpretation of the beautiful physics of fluid flow phenomena. Sign up to find out more!

Core/ Elective	Course Name	Duration	SME Name	Institute	NPTEL ID
Core 1	Introduction to Fluid Mechanics	12 weeks	Prof. Suman Chakraborty	IIT Kharagpur	112105269
	Advanced Fluid Mechanics	12 weeks	Prof. Suman Chakraborty	IIT Kharagpur	112105218
	Advanced Concepts in Fluid Mechanics	12 weeks	Prof. Suman Chakraborty Prof. Aditya Bandopadhyay	IIT Kharagpur	112105287
Core 2	Transport Processes I: Heat and Mass Transfer	12 weeks	Prof. V. Kumaran	IISc Bangalore	103108123
Core 3	Numerical methods	8 weeks	Prof. Ameeya Kumar Nayak Prof. Sanjeev Kumar	IIT Roorkee	111107105
Core 4	Computational Fluid Dynamics	12 weeks	Prof. Sreenivas Jayanti	IIT Madras	103106119
	Foundation of Computational Fluid Dynamics	8 weeks	Prof. Vengadesan	IIT Madras	112106186
	Computational Fluid Dynamics for Incompressible Flows	12 weeks	Prof. Amaresh Dalal	IIT Guwahati	112103289
	Computational Fluid Dynamics using Finite Volume Method	12 weeks	Prof. Kameswararao Anupindi	IIT Madras	112106294
Elective 1	Turbulent Combustion: Theory and Modelling	12 weeks	Prof. Ashok De	IIT Kanpur	112104272
Elective 2	Optimization of thermal systems	To Be Developed	-	-	-
Elective 3	Computational modeling of reacting flows	To Be Developed	-	-	-
Elective 4	Computational modeling of multiphase flows	To Be Developed	-	-	-
Elective 5	Fundamentals of Compressible Flow	8 weeks	Prof. Niranjan Sahoo	IIT Guwahati	112103294
Elective 6	Fundamentals of Convective Heat Transfer	12 weeks	Prof. Amaresh Dalal	IIT Guwahati	112103297
Elective 7	Computational Continuum Mechanics	12 weeks	Prof. Sachin Singh Gautam	IIT Guwahati	112103296

# Advanced Mechanics

**(3 Core + 3 Elective) Minimum of 50 Weeks**

A thorough understanding of how deformable solids behave under a range of conditions is of great practical interest. The "Advanced Mechanics" domain is for learners interested in the ideas underlying solid mechanics and wave propagation. An essential computational tool namely the finite element technique is also included to complete the arc from theory to practice.

Core/ Elective	Course Name	Duration	SME Name	Institute	NPTEL ID
Pre-Req	Engineering Mechanics	12 weeks	Prof. K. Ramesh	IIT Madras	112106286
Core 1	Solid Mechanics	12 weeks	Prof. Ajeet Kumar	IIT Delhi	112102284
Core 2	Vibrations of structures	12 weeks	Prof. Anirvam Dasgupta	IIT Kharagpur	112105197
	Introduction to Mechanical Vibration	8 weeks	Prof. Anil Kumar	IIT Roorkee	112107212
	Vibration and Structural Dynamics	8 weeks	Prof. Mira Mitra	IIT Kharagpur	101105081
Core 3	Basics of Finite Element Analysis-I	8 weeks	Prof. Nachiketa Tiwari K	IIT Kanpur	112104193
	Basics of Finite Element Analysis - II	8 weeks	Prof. Nachiketa Tiwari	IIT Kanpur	112104205
Core 4	Basics of Materials Engineering	12 weeks	Prof. Ratna Kumar Annabattula	IIT Madras	112106293
Elective 1	Numerical Methods for Engineers	12 weeks	Prof. Niket S Kaisare	IIT Madras	127106019
Elective 2	Foundations of Computational Materials Modelling	12 weeks	Prof. Narasimhan Swaminathan	IIT Madras	112106289
Elective 3	A short lecture series on contour integration in the complex plane	4 weeks	Prof. Venkata Sonti	IISc Bangalore	112108285
Elective 4	Dynamic Behaviour of Materials	12 weeks	Prof. Prasenjit Khanikar	IIT Guwahati	112103278
Elective 5	Theory of elasticity	To Be Developed	-	-	-
Elective 6	Non linear Elasticity	To Be Developed	-	-	-
Elective 7	Plasticity	To Be Developed	-	-	-
Elective 8	Finite Element Method: Variational Methods to Computer Programming	12 weeks	Prof. Atanu Banerjee Prof. Arup Nandy	IIT Guwahati	112103295
Elective 9	Computational Continuum Mechanics	12 weeks	Prof. Sachin Singh Gautam	IIT Guwahati	112103296

# Propulsion

**(4 Core + 2 Elective) Minimum of 50 Weeks**

The science and engineering of propulsion enabled four revolutions in the 20 th century - (1) personal automobiles, (2) cheap air travel, (3) access to space and (4) missile defence. The challenges facing each one of these technologies in the 21 st century are formidable. The automobile and aviation technologies need a quantum leap in performance and emission control to meet the demands of the stringent environmental norms. Large scale access to space is needed at a fraction of the cost of the 20 th century to enable economic development. The ever increasing need for power and precision in missile defence systems is pushing the limits of stability of rockets. If you want to be a part of the solution to these challenges you have made the right choice. Sign up to learn the fundamentals of propulsion, the 20 th century challenges and solutions, and the way forward to facing the challenges of the 21 st century.

Core/ Elective	Course Name	Duration	SME Name	Institute	NPTEL ID
Pre-Req	Thermodynamics	12 weeks	Prof. Anand T. N. C	IIT Madras	127106135
Core 1	Fundamentals of combustion for propulsion	8 weeks	Prof. S Varunkumar Prof. H S Mukunda	IIT Madras	112106290
	Fundamentals of Combustion - I	8 weeks	Prof. D. P. Mishra	IIT Kanpur	101104070
	Fundamentals of Combustion (Part 2)	8 weeks	Prof. D. P. Mishra	IIT Kanpur	101104070
Core 2	Aircraft Propulsion	12 weeks	Prof. Vinayak N. Kulkarni	IIT Guwahati	112103281
Core 3	Rocket Propulsion	12 weeks	Prof. K. Ramamurthi Prof. S. Varunkumar	IIT Madras	101106082
Core 4	Applied Thermodynamics for Engineers	12 weeks	Prof. Dipankar N. Basu	IIT Guwahati	112103275
Core 5	Fluid Mechanics	8 weeks	Prof. Subashisa Dutta	IIT Guwahati	105103192
Elective 1	Alternate fuels	To Be Developed	-	-	-
Elective 2	CFD for IC engines	To Be Developed	-	-	-
Elective 3	Laser diagnostics for engines	To Be Developed	-	-	-
Elective 4	Simulation of IC engine processes	To Be Developed	-	-	-

# Energy Systems

**(4 Core + 2 Elective) Minimum of 50 Weeks**

Currently, on an average, 60% of all the electricity we receive at our homes, offices and factories is from coal power plants. In the coming times, the fraction of electric power from other sources like micro-hydro, wind, solar etc., will increase. Similarly, almost all of the heat and/or reductants needed in manufacturing of cement, steel and other metals, hydrogen needed for fertilizer synthesis and in other process industries, are derived from fossil fuels. This will undergo change in the coming days. We will see an increased use of alternative fuels in these industries as well. These alternatives could be relatively cleaner fossil fuels (natural gas instead of coal) and/or locally available biomass, refuse derived fuels, etc. Use of these alternative sources present different kinds of challenges in the electric power sector and process industries. In the electric power sector, storage and load management using smart-grids is the key challenge in integrating alternative sources with the existing systems. In the process industries, it will be in developing the know-how for using alternative fuels in existing or retrofitted reactors, to ensure comparable or enhanced productivity. Understanding the emissions associated with new fuels is another key issue to be addressed. The mere scale of these industries makes even marginal improvements in performance substantial in terms of environmental and economic benefits. Principles of thermal engineering played a key role in the development of the existing technologies and will be the foundation for the emerging technologies. Courses in this domain are aimed at providing a foundation in thermal engineering, with focus on conventional and emerging energy systems.

Core/ Elective	Course Name	Duration	SME Name	Institute	NPTEL ID
Pre-Req	Thermodynamics	12 weeks	Prof. Anand T. N. C	IIT Madras	127106135
Core 1	Applied Thermodynamics for Engineers	12 weeks	Prof. Dipankar N. Basu	IIT Guwahati	112103275
Core 2	Fluid Dynamics and Turbomachines	8 weeks	Prof. Dhiman Chatterjee Prof. Shamit Bakshi	IIT Madras	112106200
Core 3	Heat Transfer	12 weeks	Prof. Sunando Dasgupta	IIT Kharagpur	103105140
	Heat Transfer	12 weeks	Prof. Ganesh Viswanathan	IIT Bombay	103101137
	Conduction and Convection Heat Transfer	12 weeks	Prof. Sankar Kumar Som Prof. Suman Chakraborty	IIT Kharagpur	112105271
	Transport Processes I: Heat and Mass Transfer	12 weeks	Prof. V. Kumaran	IISc Bangalore	103108123
	Fundamentals of Conduction and Radiation	12 weeks	Prof. Amaresh Dalal Prof. Dipankar N. Basu	IIT Guwahati	112103276
Core 4	Power Plant Engineering	8 weeks	Prof. Ravi Kumar	IIT Roorkee	112107291
Elective 1	Energy conservation and waste heat recovery	12 weeks	Prof. Prasanta Kumar Das Prof. A Bhattacharya	IIT Kharagpur	112105221
Elective 2	Bioenergy	8 weeks	Prof. Mainak Das	IIT Kanpur	102104057
	Waste to Energy Conversion	8 weeks	Prof. P. Mondal	IIT Roorkee	103107125
Elective 3	Energy Economics and Policy	8 weeks	Prof. Shyamasree Dasgupta	IIT Mandi	109106161
Elective 4	Non-Conventional Energy Resources	12 weeks	Prof. Prathap Haridoss	IIT Madras	121106014
	Technologies for clean and renewable energy production	12 weeks	Prof. P. Mondal	IIT Roorkee	103107157
Elective 5	Aircraft Propulsion	12 weeks	Prof. Vinayak N. Kulkarni	IIT Guwahati	112103281
Elective 6	Selection of Nanomaterials for Energy Harvesting and Storage Application	4 weeks	Prof. Kaushik Pal	IIT Roorkee	112107283
Elective 7	Steam Power Engineering	8 weeks	Prof. Vinayak N. Kulkarni	IIT Guwahati	112103277
Elective 8	Solar Energy	To Be Developed	-	-	-
Elective 9	Fundamentals of Convective Heat Transfer	12 weeks	Prof. Amaresh Dalal	IIT Guwahati	112103297

# Manufacturing Processes and Technology

**(4 Core + 2 Elective) Minimum of 50 Weeks**

## About the domain - Yet to be update

Core/ Elective	Course Name	Duration	SME Name	Institute	NPTEL ID
Core 1	Manufacturing Process Technology I & II	12 weeks	Prof. Shantanu Bhattacharya	IIT Kanpur	112104195
	Manufacturing Process Technology - II	8 weeks	Prof. Shantanu Bhattacharya	IIT Kanpur	112104204
	Theory of Production Processes	12 weeks	Prof. Pradeep K. Jha	IIT Roorkee	112107239
Core 2	Manufacturing Systems Technology I & II	12 weeks	Prof. Shantanu Bhattacharya	IIT Kanpur	112104188
Core 3	Mechanics of Machining	8 weeks	Prof. Uday S. Dixit	IIT Guwahati	112103248
Core 4	Industrial Automation and Control	12 weeks	Prof. Siddhartha Mukhopadhyay	IIT Kharagpur	108105088
	Automation in Manufacturing	12 weeks	Prof. Shrikrishna N. Joshi	IIT Guwahati	112103293
Elective 1	Introduction to Mechanical Micro Machining	12 weeks	Prof. Ajay M Sidpara	IIT Kharagpur	112105231
Elective 2	Metal Cutting and Machine Tools	4 weeks	Prof. Asimava Roy Choudhury	IIT Kharagpur	112105233
Elective 3	Machinery Fault Diagnosis and Signal Processing	12 weeks	Prof. Amiya Ranjan Mohanty	IIT Kharagpur	112105232
Elective 4	Non Traditional Abrasive Machining Processes-Ultrasonic, Abrasive Jet and Abrasive Water Jet Machining	4 weeks	Prof. Asimava Roy Choudhury	IIT Kharagpur	112105212
Elective 5	Sustainability through Green Manufacturing Systems: An Applied Approach	8 weeks	Prof. Deepu Philip Prof. Amandeep Singh	IIT Kanpur	112104225
Elective 6	Rapid Manufacturing	12 weeks	Prof. J. Ramkumar	IIT Kanpur	112104265
Elective 7	Theory and Practice of Non Destructive Testing	8 weeks	Prof. Ranjit Bauri	IIT Madras	113106070
Elective 8	Operations Management	12 weeks	Prof. Inderdeep Singh	IIT Roorkee	112107238
Elective 9	Mathematical Modeling Of Manufacturing Processes	12 weeks	Prof. Swarup Bag	IIT Guwahati	112103273
Elective 10	Design for Quality, Manufacturing and Assembly	8 weeks	Prof. Palaniappaan Ramu	IIT Madras	112106249
Elective 11	Principles of Industrial Engineering	12 weeks	Prof. D K Dwivedi	IIT Roorkee	112107292
Elective 12	Computer Integrated Manufacturing	12 weeks	Prof. J. Ramkumar Prof. Amandeep Singh	IIT Kanpur	112104289
Elective 13	Machining Science	4 weeks	Prof. Sounak Kumar Choudhury	IIT Kanpur	112104290
Elective 14	Plastic Working of Metallic Materials	12 weeks	Prof. P. S. Robi	IIT Guwahati	112103279
Elective 15	Engineering drawing and computer graphics	12 weeks	Prof. Rajaram Lakkaraju	IIT Kharagpur	112105294

# Product Design

**(4 Core + 3 Elective) Minimum of 50 Weeks**

## About the domain - Yet to be update

Core/ Elective	Course Name	Duration	SME Name	Institute	NPTEL ID
Core 1	Manufacturing Guidelines for Product Design	8 weeks	Prof. Inderdeep Singh	IIT Roorkee	112107258
Core 2	Product Design and Development	4 weeks	Prof. Inderdeep Singh	IIT Roorkee	112107217
Core 3	Product Design and Manufacturing	12 weeks	Prof. J. Ramkumar	IIT Kanpur	112104230
Core 4	Design Practice	8 weeks	Prof. Shantanu Bhattacharya	IIT Kanpur	112104228
Core 5	Basics of Materials Engineering	12 weeks	Prof. Ratna Kumar Annabattula	IIT Madras	112106293
Elective 1	Design Practice - II	8 weeks	Prof. Shantanu Bhattacharya	IIT Kanpur	112104252
Elective 2	Ergonomics in Automotive Design	4 weeks	Prof. Sougata Karmakar	IIT Guwahati	107103084
	Ergonomics Workplace Analysis	4 weeks	Prof. Urmila R. Salve	IIT Guwahati	107103085
Elective 3	System Design for Sustainability	12 weeks	Prof. Sharmistha Banerjee	IIT Guwahati	107103081
Elective 4	Digital Human Modeling and Simulation for Virtual Ergonomics Evaluation	8 weeks	Prof. Sougata Karmakar	IIT Guwahati	109103101
Elective 5	Gear and Gear Unit Design : Theory and Practice	8 weeks	Prof. Rathindranath Maiti	IIT Kharagpur	112105234
Elective 6	Design for Quality, Manufacturing and Assembly	8 weeks	Prof. Palaniappa Ramu	IIT Madras	112106249
Elective 7	Robotics and Control : Theory and Practice	8 weeks	Prof. N. Sukavanam Prof. M. Felix Orlando	IIT Roorkee	112107289
Elective 8	Turbulent Combustion: Theory and Modelling	12 weeks	Prof. Ashok De	IIT Kanpur	112104272
Elective 9	Engineering drawing and computer graphics	12 weeks	Prof. Rajaram Lakkaraju	IIT Kharagpur	112105294

# Advanced Dynamics and Vibration

**(3 Core + 3 Elective) Minimum of 50 Weeks**

## About the domain - Yet to be update

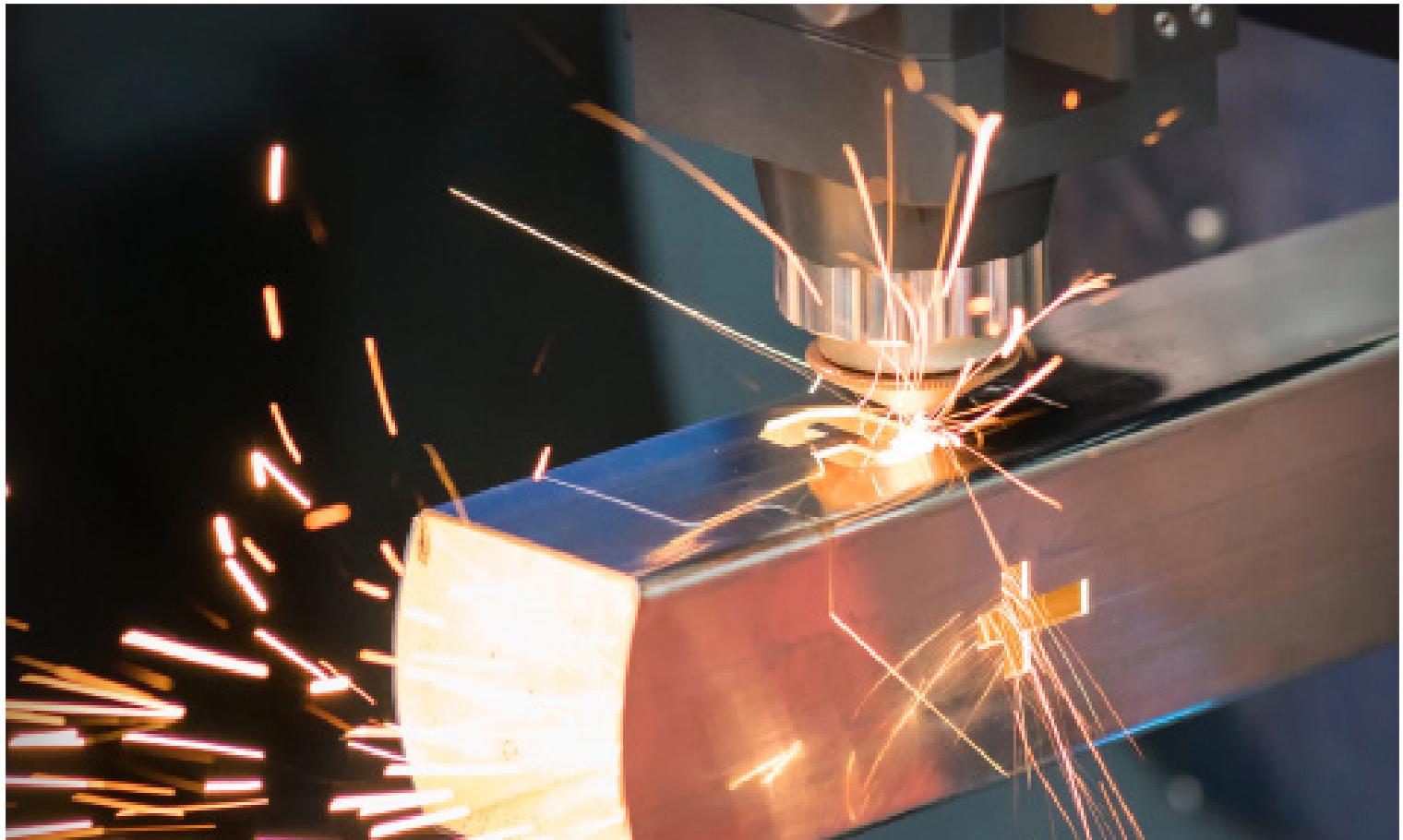
Core/ Elective	Course Name	Duration	SME Name	Institute	NPTEL ID
Pre-Req	Engineering Mechanics	12 weeks	Prof. K. Ramesh	IIT Madras	112106286
Core 1	Vibrations of structures	12 weeks	Prof. Anirvam Dasgupta	IIT Kharagpur	112105197
	Introduction to Mechanical Vibration	8 weeks	Prof. Anil Kumar	IIT Roorkee	112107212
Core 2	Advanced Dynamics	To Be Developed	-	-	-
Core 3	To Be Developed	To Be Developed	-	-	-
Elective 1	Robotics and Control : Theory and Practice	8 weeks	Prof. N. Sukavanam Prof. M. Felix Orlando	IIT Roorkee	112107289
Elective 2	Fundamentals of Acoustics	12 weeks	Prof. Nachiketa Tiwari	IIT Kanpur	112104212
	Acoustic and Noise Control	12 weeks	Prof. Abijith Sarkar	IIT Madras	112106225
Elective 3	Acoustic Materials and Metamaterials	8 weeks	Prof. Sneha Singh	IIT Roorkee	112107290
Elective 4	A short lecture series on contour integration in the complex plane	4 weeks	Prof. Venkata Sonti	IISc Bangalore	112108285
Elective 5	Non-linear vibrations	To Be Developed	-	-	-
Elective 6	Chaos theory	To Be Developed	-	-	-
	Computational Continuum Mechanics	12 weeks	Prof. Sachin Singh Gautam	IIT Guwahati	112103296

# Computational Mechanics

**(3 Core + 3 Elective) Minimum of 50 Weeks**

Computational techniques are a crucial component of the engineering toolkit. The theories of mechanics depend on numerical implementation to bridge the gap to practice. In the "Computational Mechanics" domain the focus is on applying such solution techniques to problems in mechanics with a strong focus on the finite element methods.

Core/ Elective	Course Name	Duration	SME Name	Institute	NPTEL ID
Pre-Req	Engineering Mechanics	12 weeks	Prof. K. Ramesh	IIT Madras	112106286
Core 1	Numerical Methods for Engineers	12 weeks	Prof. Niket S Kaisare	IIT Madras	127106019
Core 2	Basics of Finite Element Analysis-I	8 weeks	Prof. Nachiketa Tiwari K	IIT Kanpur	112104193
	Introduction to Finite Volume Methods I	8 weeks	Prof. Ashoke De	IIT Kanpur	101104074
Core 3	Tools in Scientific computing	To Be Developed	-	-	-
Core 4	Finite Element Method: Variational Methods to Computer Programming	12 weeks	Prof. Atanu Banerjee Prof. Arup Nandy	IIT Guwahati	112103295
Elective 1	Foundations of Computational Materials Modelling	12 weeks	Prof. Narasimhan Swaminathan	IIT Madras	112106289
Elective 2	A short lecture series on contour integration in the complex plane	4 weeks	Prof. Venkata Sonti	IISc Bangalore	112108285
Elective 3	Optimization	To Be Developed	-	-	-
Elective 4	Advanced Finite element methods	To Be Developed	-	-	-
Elective 5	Computational Plasticity	To Be Developed	-	-	-
Elective 6	Computational Continuum Mechanics	12 weeks	Prof. Sachin Singh Gautam	IIT Guwahati	112103296



Discipline

# Metallurgical & Materials Engineering

## Domains

1. Materials Joining
2. Electronic Materials

# Materials Joining

**(2 Core + 3 Elective) Minimum of 40 Weeks**

The modern material assemblies require the combined use of alloys for given commercial applications. Materials Joining technologies are of critical importance for the construction of virtually all the components of the assemblies. This minor course aims to elaborate the importance of material joining processes, their physical principles, operational conditions, the metallurgy of joining, design of welded structures, and performance of the welded structures under service loading.

Core/ Elective	Course Name	Duration	SME Name	Institute	NPTEL ID
Core1	Weldability of Metals	8 weeks	Prof. Dheerendra Kumar Dwivedi	IIT Roorkee	112107257
	Welding Metallurgy	12 Weeks	Prof. Pradeep K. Jha	IIT Roorkee	113107092
Core2	Welding Processes	12 Weeks	Prof. Murugaiyan Amirthalingam	IIT Madras	113106087
	Joining Technologies for metals	8 weeks	Prof. Dheerendra Kumar Dwivedi	IIT Roorkee	112107213
Elective1	Advances in welding and joining technologies	8 weeks	Prof. Swarup Bag	IIT Guwahati	112103244
Elective2	Theory and Practice of Non Destructive Testing	8 Weeks	Prof. Ranjit Bauri	IIT Madras	113106070
Elective3	Analysis and Modeling of Welding	8 Weeks	Prof. Gandham Phanikumar	IIT Madras	113106067
Elective4	Welding of Advanced High Strength Steels for Automotive Applications.	4 weeks	Prof. Murugaiyan Amirthalingam	IIT Madras	113106082
Elective5	Thermo-Mechanical And Thermo-Chemical Processes	8 weeks	Prof. Vivek Pancholi Prof. S. R. Meka	IIT Roorkee	113107091
Elective6	Aqueous Corrosion and Its Control	12 Weeks	Prof. V. S. Raja	IIT Bombay	113101098



# Electronic Materials

**(3 Core + 2 Elective) Minimum of 40 Weeks**

Electronic materials are used in a wide range of electronic devices that pervade the gadgets we use today, and are likely to continue to use in the foreseeable future. The NPTEL Domain in Electronic Materials aims to make you understand fundamental as well as practical and industrial aspects of this area.

The core course, Physics of Materials, takes you through the core scientific aspects of properties of materials and helps you understand why specific materials demonstrate specific properties. This course will be accessible to almost any student in Engineering. The other core courses Fundamentals of electronic device fabrication, Fundamentals of electronic materials and devices (or) Fundamentals of semiconductor devices, look at how practical devices are built based on the science of their operation. Practical and industrial aspects are described and the behavior of devices examined.

The electives listed aim to give the learner an edge by providing deeper insight into specific aspects related to this domain. Material Characterization is very important in this domain since very high purity materials are required. Material Characterization is the process of analyzing materials using appropriate techniques to determine the nature and quality of the material. Another elective takes the learner deeper into the area of Photovoltaics, the basis for Solar cells, the electronic device likely to power our world

Core/ Elective	Course Name	Duration	SME Name	Institute	NPTEL ID
Core1	Physics of Materials	12 weeks	Prof. Prathap Haridoss	IIT Madras	113106039
Core2	Fundamentals of electronic device fabrication	4 weeks	Prof. Parasuraman S	IIT Madras	113106062
	Fundamentals of electronic materials and devices	8 weeks	Prof. Parasuraman Swaminathan	IIT Madras	113106065
Core3	Fundamentals of semiconductor devices	12 weeks	Prof. Digbijoy N. Nath	IISc Bangalore	108108122
Elective1	Solar Photovoltaics: Principles, Technologies & Materials	8 weeks	Prof. Ashish Garg	IIT Kanpur	113104084
Elective2	Material Characterization	12 weeks	Prof. Sankaran. S	IIT Madras	113106034
Elective3	Analysis of defects in devices	To Be Developed	-	-	-



# NPTEL DOMAIN CERTIFICATION

👉 <https://nptel.ac.in/noc/Domain/>

NPTEL Office, IC & SR Building (3rd Floor), IIT Madras, Chennai 600 036

**Tel: +91 44 2257 5905, +91 44 2257 5908E**

Mail: support@nptel.iitm.ac.in | Web URL: <https://nptel.ac.in/>