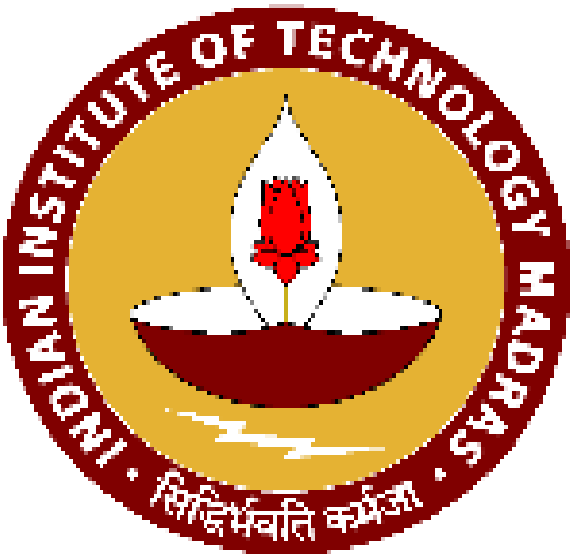

INDIAN INSTITUTE OF TECHNOLOGY MADRAS
CHENNAI 600 036

Curriculum for
M.Tech. Degree Programme
2024 Batch

Branch Code: EE1

M.Tech. in ELECTRICAL ENGINEERING

STREAM: COMMUNICATIONS AND SIGNAL PROCESSING

2024 Batch

Semester 1

S.No	Course No	Course Name	L	T	E	P	O	C
1		MTech core I^	4	0	0	0	8	12
2		MTech core II^	4	0	0	0	8	12
3		MTech core III^	4	0	0	0	8	12
4		MTech core IV^	3	0	0	0	6	9
5	GN5003	Personal and Professional Growth	1	0	0	0	2	0
		Total	**15**	**0**	**0**	**0**	**30**	**45**

^ Total number of core credits must be at least 45. Core courses are to be taken from the following basket of core courses (courses can be added to this basket with HOD approval):

No.	Course No.	Title	L	T	E	P	O	C
1	EE5110	Probability Foundations for Electrical Engineers	4	0	0	0	8	12
2	EE5120	Applied Linear Algebra I for EE	4	0	0	0	8	12
3	EE5130	Digital signal processing	4	0	0	0	8	12
4	EE5151	Communication techniques	4	0	0	0	8	12
5	EE5140	Digital modulation and coding	4	0	0	0	8	12
6	EE5150	Communication Networks	4	0	0	0	8	12
7	EE5505	Wave propagation in communications	4	0	0	0	8	12
8	EE5500	Introduction to photonics	4	0	0	0	8	12
9	EE5142	Introduction to Information Theory and Coding	4	0	0	0	8	12
10	EE5153	Foundations of Optical Networking	4	0	0	0	8	12
11	EE5143	Information Theory	3	0	0	0	6	9

Note: Only one of the two courses EE5142 and EE5143 can be taken to meet the credit requirement.

Semester 2

S.No	Course No	Course Name	L	T	E	P	O	C
1		Electives*	0	0	0	0	0	0

Semester	I	II	Summer	III	IV	Total
Credits	45	0*	0*	0*	0*	190

* Indicated credits are only for core programme excluding the project. See the appendix for details on the M.Tech project. In addition, 60 credits of electives have to be taken. Of these 60 elective credits, 48 credits of electives have to be taken from Elec. Engg. (or equivalent) at the 5000 level or higher, and 12 credits can be taken in any department at the 5000 level or higher. All elective lab courses will also be eligible. Courses from the core basket can also be taken as electives after the minimum requirement for core courses are satisfied.

SUGGESTED LIST OF ELECTIVES

EE5110	Probability Foundations for Electrical Engineers	12
EE5111	Estimation Theory	12
EE5112	Detection Theory	12
EE5120	Applied Linear Algebra I for EE	12
EE5121	Convex Optimization	12
EE5130	Digital Signal Processing	12
EE5131	Selected Topics in Digital Signal Processing	9
EE5140	Digital Modulation and Coding	12
EE5141	Introduction to Wireless and Cellular Communication	12
EE5142	Introduction to Information Theory and Coding	12
EE5143	Information Theory	9
EE5150	Communication Networks	12
EE5151	Communication Techniques	12
EE5155	Wireless Networks	12
EE5156	Internet of Things and Management of discrete entities	6
EE5158	Communication Networks for IoT	9
EE5160	Error Control Coding	9
EE5161	Modern Coding Theory	9
EE5162	Topics in Information Theory	9
EE5163	Digital Signal Compression	9
EE5170	Speech Signal Processing	12
EE5171	Deep Learning based Speech Processing	12
EE5175	Image Signal Processing	12
EE5176	Computational Photography	12
EE5178	Modern Computer Vision	12
EE5179	Deep Learning for Imaging	12
EE5180	Introduction to Machine Learning	12
EE6110	Adaptive Signal Processing	12
EE6111	Spectral Estimation	9
EE6112	Topics in Random Processes and Concentrations	12
EE6130	Advanced Topics in Signal Processing	9

EE6131	Digital Filter Design	9
EE6133	Multirate Digital Signal Processing	9
EE6140	Multi-Antenna Digital Communications	12
EE6141	Multi-carrier Communications	12
EE6143	Advanced Topics in Communications	9
EE6150	Stochastic Modeling and the Theory of Queues	12
EE6151	Advanced Topics in Networks	9
EE6180	Advanced Topics in Artificial Intelligence	9

Branch Code: EE2

M.Tech. in ELECTRICAL ENGINEERING
STREAM: Power Systems and Power Electronics
2024 Batch

Semester 1

S.No	Course No	Course Name	L	T	E	P	O	C
1	EE5200	Power Converter Analysis and Design	3	0	0	0	6	9
2	EE5201	Modeling and Analysis of Electric Machines	3	0	0	0	6	9
3	EE5253	Computer Method in Power System Analysis	3	0	0	0	6	9
4		Elective1 **						**
5		Elective2 **						
6	GN5003	Personal and Professional Growth	1	0	0	0	2	0
		Total						**27***

Semester 2

S.No	Course No	Course Name	L	T	E	P	O	C
1	EE5254	High Voltage Engineering	3	0	0	0	6	9
2	EE5262	Distributed Generation and Microgrid Systems	3	0	0	0	6	9
3	EE6255	Power System Protection	3	0	0	0	6	9
4	EE5702	Laboratory (Power)	0	0	0	3	3	6
5		Elective3 **						**
6		Elective4 **						
		Total						**33***

Semester	I	II	Summer	III	IV	Total
Credits	27*	33*	0*	0*	0*	190

* Indicated credits are only for core programme excluding the project. See the appendix for details on the M.Tech project. In addition, a minimum of 45 credits of electives have to be credited. Out of the 45 elective credits, at least 27 elective credits are to be taken from the EE2 list of electives listed below. The rest 18 elective credits can be any course offered in the institute at the 5000 level or higher.

** The semester-wise breakup of the electives is just for a preliminary guidance. The students are advised to take the help of the faculty advisor to decide on the number of electives to be taken in each of the three semesters.

$ One of the project guides should be from the Department of Electrical Engineering.

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SUGGESTED LIST OF ELECTIVES

S.No	Course No	Course Name	L	T	E	P	O	C
1.	EE5202	Computer Aided Design of Electrical Machines	3	0	0	0	6	9
2.	EE5203	Switched mode power conversion	3	0	0	0	6	9
3.	EE5212	Digital Control of Power Electronics	3	0	0	0	6	9
4.	EE5257	Energy Management Systems and SCADA	3	0	0	0	6	9
5.	EE5260	Power Quality	3	0	0	0	6	9
6.	EE5261	Flexible AC Transmission Systems	3	0	0	0	6	9
7.	EE6010	Smart Power Grids	3	0	0	0	6	9
8.	EE6200	Power electronic control of electrical machines	3	0	0	0	6	9
9.	EE6203	Power Electronic System Design	3	0	0	0	6	9
10.	EE6253	Power System Stability and Control	3	0	0	0	6	9
11.	EE6254	Advanced topics in Insulation	3	0	0	0	6	9
12.	EE6258	DC Power Transmission	3	0	0	0	6	9
13.	EE6260	Digital Simulation of Power Systems	3	0	0	0	6	9
14.	EE6261	Restructured Power Systems	3	0	0	0	6	9
15.	EE6262	Advanced motor control	3	0	0	0	6	9
16.	EE6265	Power System Operation and Planning	3	0	0	0	6	9
17.	EE7201	Directed study on Research Topics	4	0	0	0	8	12

Branch Code: EE3

M.Tech. in ELECTRICAL ENGINEERING

STREAM: Microelectronics and VLSI Design

2024 Batch

Semester 1

S.No	Course No	Course Name	L	T	E	P	O	C
1	EE5313	Semiconductor Device Modeling	4	0	0	0	8	12
2	EE5312	VLSI Technology	4	0	0	0	8	12
3		MTech Elective 1*						
4		MTech Elective 2*						
5	GN5003	Personal and Professional Growth	1	0	0	0	2	0
		Total						**24***

Semester 2

S.No	Course No	Course Name	L	T	E	P	O	C
1	EE 5314	Microelectronics Lab	0	0	0	3	3	6
2		MTech Elective 3*						
		MTech Elective 4*						
		MTech Elective 5*						
		MTech Elective 6*						
		Total						6*

Semester	I	II	Summer	III	IV	Total
Credits	24*	6*	0*	0*	0*	190

* Indicated credits are only for core programme excluding the project. See the appendix for details on the M.Tech project. In addition, a minimum of 75 credits of electives have to be taken. Elective courses are divided into two baskets. 27 credits of electives have to be taken from each basket. Courses can be added to this basket with stream coordinator's and HoD's approval.

SUGGESTED LIST OF EE3 ELECTIVES

Materials and Devices basket (Minimum 27 credits)	Circuits and Systems basket (Minimum 27 credits)
EE5340 Microelectromechanical Systems	EE5311 Digital IC Design
EE5341 MOS Device modeling & Characterization	EE5130 Digital Signal Processing
EE5342 Compound Semiconductors	EE5310 Analog Electronic Circuits
EE5343 Solar Cell Device Physics and Material Tech	EE5320 Analog IC Design
EE5345 Semiconductor Power Devices	EE5323 Advanced Electrical Networks
EE5347 Electronic and Photonic Nano Devices	EE5325 VLSI Power Management Circuits
EE6346 Advanced CMOS devices & technology	EE5350 Linear Algebra for data analysis
EE6500 Integrated Optoelectronic Devices	EE6320 RF Integrated Circuits
EE5311 Introduction to Plastic Electronics	EE6321 VLSI Data Conversion circuits
EE6362 Advanced Topics in Microelectronics and MEMS	EE6322 VLSI Broadband Communication Circuits
EE6341 Compact Modeling of Devices for Integrated Circuit Design	EE6361 Advanced topics in VLSI

EE6345 Advanced Memory Technology	EE5331 DSP Architectures and Embedded Systems
EE6347 - Devices and technologies for AI & neuromorphic computing	EE5332 Mapping Signal Processing Algorithms to DSP Architectures
EE5348 - OLED Display Technology	EE6324 Phase Locked Loops
	EE6350 Analysis of Noise in Systems
	CS6330 Digital System Testing and Testable Design
	CS6230 CAD for VLSI

Remaining elective credits can be fulfilled by taking any course in Elec. Engg. (or equivalent) at the 5000 level or higher. Courses from the two baskets can also be taken as electives after the minimum requirement for basket courses are satisfied. All elective lab courses will also be eligible.

Branch Code: EE4

M.Tech. in ELECTRICAL ENGINEERING
STREAM: Electronic System Design and Instrumentation
2024 Batch

Semester 1

S.No	Course No	Course Name	L	T	E	P	O	C
1	EE5400	Analog and Digital Systems	2	0	0	3	7	12
2	EE5412	Mathematical Methods in Systems Engg.	4	0	0	0	8	12
3		Core I #						12
4		Core II #						12
5		Electives *						*
6	GN5003	Personal and Professional Growth	1	0	0	0	2	0
		Total						**48***

 # Students must choose core I & II from the following core basket

Core Basket-I

S.No	Course No	Course Name	L	T	E	P	O	C
1	EE5411	Synthesis of Control Systems	4	0	0	0	8	12
2	EE5412	Mathematical Methods in Systems Engg.	4	0	0	0	8	12
3	EE5413	Linear Dynamical Systems	4	0	0	0	8	12
4	EE6415	Nonlinear Systems Analysis	3	1	0	0	8	12

Core Basket-II

S.No	Course No	Course Name	L	T	E	P	O	C
1	EE5410(note-2)	Introduction to Digital Signal Processing	3	1	0	0	8	12
2	EE5130(note-2)	Digital Signal Processing	4	0	0	0	8	12
3	EE5120	Applied Linear Algebra I for EE	4	0	0	0	8	12
4	EE5011	Computer Methods in Electrical Engineering	2	0	0	3	7	12
5	EE5110	Probability Foundations for Electrical Engineers	3	1	0	0	8	12
6	EE5500	Introduction to Photonics	3	0	0	0	6	9

(note-2): One can register for either EE5130 or EE5410 but not both.

Semester II

S.No	Course No	Course Name	L	T	E	P	O	C
1		Electives						

Semester	I	II	Summer	III	IV	Total
Credits	48*	9/12/21*	0*	0*	0*	190

* Indicated credits are only for core programme excluding the project. See the appendix for details on the M.Tech project. In addition, 60 credits of electives have to be taken. Of these 60 elective credits,

40 credits of electives have to be taken from the list of electives from Elec. Engg. (or equivalent) at the 5000 level or higher, and 20 credits can be taken in any department at the 5000 level or higher. All elective lab courses will also be eligible. Courses from the core basket can also be taken as electives, from Elec. Engg., after the minimum requirement for core courses are satisfied.

List of Electives (EE):

S. No.	Course No.	Course Name	C
1	EE6403	Transducers	12
2	EE6402	Biomedical Electronic Systems	9
3	EE5340	Microelectromechanical Systems	9
4	EE6404	Power System Instrumentation	9
5	EE6407	Instrumentation for Ocean Technology	9
6	EE6491	Advanced Topics in Instrumentation	9
7	EE6412	Optimal Control	12
8	EE5130	Digital Signal Processing	12
9	EE5002	Analysis of Networks & Systems	12
10	EE5331	DSP Architectures & Embedded Systems	12
11	EE6501	Optical Sensors	9
12	EE5311	Digital IC Design	12
13	EE5200	Power Converter Analysis and Design	9
14	EE5203	Switched Mode Power Conversion	9
15	EE5179	Deep Learning for Imaging	12
16	EE5180	Introduction to Machine Learning	12
17	EE6506	Computational Electromagnetics	12
18	EE5131	Selected Topics in Digital Signal Processing	9

19	EE5175	Image Signal Processing	12
20	EE7401	Directed Study on Research Topics	12

Suggested List of Electives (Outside EE)

S. No.	Course No.	Course Name	C
1	ED5052	Electromagnetic Compatibility for Product Design	11
2	ED5080	Mechatronics System Design	9
3	ED5160	Fundamentals of Automotive Systems	15
4	ED5314	Design, Analysis and Control of Robot Manipulators	9
5	ED5235	Power Electronics and Motor Drives for Electrified Vehicles	9
6	ED6001	Medical Image Analysis	12
7	ED5070	Design of Monitoring and Diagnostic System (L&P)	12
8	CH5350	Applied Time Series Analysis	9
9	CH5230	Data-driven Modelling of Process System	9
10	ED5340	Data Science: Theory and practice	12
11	ID6015	Advances in Machine Learning Solutions for Engineering Problems	10

Branch Code: EE5

M.Tech. in ELECTRICAL ENGINEERING
STREAM: RF and Photonics
2024 Batch

Semester 1

S.No	Course No	Course Name	L	T	E	P	O	C
1	EE5500	Introduction to photonics	3	1	0	0	5	9
2	EE5505	Wave propagation in communication	3	1	0	0	5	9
3	EE5400	Analog and Digital Circuits	2	0	0	3	7	12
4	EE5501	Photonics Laboratory	0	0	0	3	3	6
5	GN5003	Personal and Professional Growth	1	0	0	0	2	0
		Total						**36**

Semester 2

S.No	Course No	Course Name	L	T	E	P	O	C
1	EE5507	RF Systems Laboratory	0	0	0	3	3	6
2	EE6000	Seminar	1	0	0	0	2	3
		Total						**9**

Semester	I	II	Summer	III	IV	Total
Credits	36*	9*	0*	0*	0*	190

* Indicated credits are only for core programme excluding the project. See the appendix for details on the M.Tech project. In addition, 60 credits of electives have to be taken. All elective credits should be at the 5000 level or higher- courses of the institute, subject to the approval of the faculty advisor. Suggested list of elective courses are given below.

Suggested List of Elective Courses

Course No.	Course Name	Credits
EE5502	Optical Engineering	12
EE5504	Fibre Optic Communication Technology	12
EE5410/ EE5130	Introduction to DSP/Digital Signal Processing	11
EE6500	Integrated Optoelectronic Devices and Circuits	12
EE6501	Optical Sensors	9
EE6700	Advanced Photonics Laboratory	9
EE6505	Waveguides, microwave circuits and antennas	12
ED5316	Antenna Theory and Design	10
	Radar and Signal Processing/ Radar Systems	
EE6320	RF Integrated Circuits	9
ED5052	Electromagnetic Compatibility for Product Design	11
EE8007	Microwave Photonics- Technologies, Systems and Networks	6
EE5153	Foundations of Optical Networking	12
EE5011	Computer Methods in EE	9
EE5312	VLSI Technology	12

PH5814	Laser Theory (Physics Dept)	9
EE5110	Probability Foundations for Signal Processing	11
EE5150	Communication Networks	12
EE5340	Micro Electro Mechanical Systems	9
EE5182	Computational Electromagnetics	12
PH5620	Coherent and Quantum Optics	9
PH6360	Nonlinear optical proc and devices	9
PH5890	Ultrafast Laser and Applications	9
EE6420	Optical Communication Networks	9
EE6502	Optical Signal Processing and Quantum Comm	9
EE7500	Advanced topics in RF and Photoincs	9
EE7001	Directed Study on Research Topics	9

Remaining elective credits can be any 5xxx/6xxx/7xxx courses with the approval of faculty advisor.

Branch Code: EE6

M.Tech. in ELECTRICAL ENGINEERING
STREAM: Integrated Circuits & Systems
2024 Batch

Semester 1

S.No	Course No	Course Name	L	T	E	P	O	C
1	EE5310	Analog Electronic Circuits	4	0	0	0	8	12
2	EE5311	Digital IC Design	4	0	0	0	8	12
3		Elective Courses						**
4	GN5003	Personal and Professional Growth	1	0	0	0	2	0
		Total						**24***

Semester 2

S.No	Course No	Course Name	L	T	E	P	O	C
		Elective Courses						*

Semester	I	II	Summer	III	IV	Total
Credits	24*	0*	0*	0*	0*	190

** Indicated credits are only for core programme excluding the project. See the appendix for details on M.Tech project. In the EE6 curriculum, 81 credits of electives have to be taken. Of these 81 credits, 48 credits of electives have to be taken from the specified basket of EE6 electives, and 24 credits can be taken from any course in Elec. Engg. (or equivalent) at the 5000 level or higher. All elective lab courses will also be eligible. All course credits should be finished in the first two semesters. EE6 students will be allowed to register only for project credits in the second year (including summer between second and third semesters).

Elective courses in the EE6 area are to be taken from the following basket of courses (courses can be added to this basket with HOD approval):

1) EE5130 Digital Signal Processing
2) EE5410 Introduction to DSP
3) EE5110 Probability Foundations for Electrical Engineers
4) EE5330 Computer-Aided Design and Analysis of Digital ICs
5) EE5331 DSP Architectures & Embedded Systems
6) EE5332 Mapping Signal Processing Algorithms to DSP Architectures
7) EE5320 Analog IC Design
8) EE5321 Active Filter Design
9) EE5323 Advanced Electrical Networks
10) EE5325 Power Management Integrated Circuits
11) EE5350 Linear algebra techniques for data analysis and modelling
12) EE6320 RF Integrated Circuits
13) EE6321 VLSI Data Conversion Circuits
14) EE6322 VLSI Broadband Communication Circuits
15) EE6323 Wireless System Design
16) EE6324 Phase-Locked Loops
17) EE6325 Advanced Power Management Systems
18) EE6350 Analysis of noise in systems

19) EE6360 Advanced topics in VLSI
20) EE6361 Advanced topics in VLSI
21) EE7301 Directed Study on Research Topics
22) CS6330 Digital System Testing & Testable Design
23) CS6230 CAD for VLSI
24) EE5313 Semiconductor Device Modelling
25) EE5200 Power converter analysis and design
26) EE5140 Digital modulation and coding
27) EE6402 Biomedical Electronic Systems
28) EE6402 Transducers for Instrumentation
29) EE5401 Measurements and Instrumentation
30) EE5203 Switched mode power conversion

Branch Code: EE7

M.Tech. in ELECTRICAL ENGINEERING
STREAM: Control and Optimization
2024 Batch

Semester 1

S.No	Course No	Course Name	L	T	E	P	O	C
1		MTech Core 1	4	0	0	0	8	12
2		MTech Core 2	4	0	0	0	8	12
3		MTech Core 3	3	0	0	0	6	9
4	GN5003	Personal and Professional Growth	1	0	0	0	2	0
5		Elective**						
		Total						**39**

Semester 2

S.No	Course No	Course Name	L	T	E	P	O	C
1	EE5419	Advanced Control Laboratory	0	0	0	3	3	6
2		Elective *						

Semester	I	II	Summer	III	IV	Total
Credits	39*	0*	0*	0*	0*	190

* Indicated credits are only for core programme excluding the project. See the appendix for details on the M.Tech project. Total number of credits to be earned is 190. At least 33 credits have to be earned from the courses in the core basket. In addition to the 33 credits from the core basket, at least 48 credits have to be earned from the courses in the core basket and the suggested lists of electives. Up to 18 elective credits can be taken in any department at the 5000 level or higher, subject to the approval of the Faculty Advisor.

Core basket

No	Course No	Course Name	Credits
1	EE5413	Linear Dynamical Systems	12
2	EE5412	Mathematical Methods in Systems Engineering	12
3	EE6412	Optimal Control	12
4	EE6415	Nonlinear Systems Analysis	12
5	EE6430	Fundamentals of Linear Optimization	9
6	EE5411	Synthesis of Control Systems	12

Suggested List of Electives (From EE)

S No	Course No	Course Name	Credits
1	EE6432	Stochastic Control	12
2	EE6433	Distributed Optimization for Control	12
3	EE6417	Allied topics in Control Systems	9
4	EE6419	Geometric Nonlinear Control Theory	9
5	EE6418	Dynamic Games - Theory and Applications	9
6	EE6431	Nonsmooth Analysis in Control and Optimization	9
7	EE5110	Probability Foundations for Electrical Engineers	12
8	EE5121	Convex Optimization	12

Suggested List of Electives (Outside EE)

S No	Course No	Course Name	Credits
1	CH5120	Modern Control Theory	9
2	CH5115	Parameter and State Estimation	10
3	CS6700	Reinforcement Learning	12
4	ED6007	Mechanics and Control of Serial Robots	12
5	CH5350	Applied Time Series Analysis	9
6	CH 5230	Data-driven Modelling of Process Systems	9

Appendix - MTech project (common for all EE streams)

M.Tech project can be done under these three options to enable a student to pursue summer internship. The project won't be allowed to extend to the summer after the 4th semester. At the end of the 3rd semester, the student should submit a report and make a presentation. The evaluation committee will then recommend whether or not the student is eligible to continue the project in the 4th semester. If the student is not found eligible, additional course work has to be done so as to meet the total credit requirements for obtaining the M.Tech degree.

	Credits completed at the end of the 4th year	Summer	Sem 3	Sem 4
Option 1	>= 105	Internship	EE6905 (45 credits) + courses	EE6904 (40 credits)
Option2		Start project EE6901 (25 credits)	EE6902 (20 credits) + courses	EE6904 (40 credits)
Option 3	< 105	Internship	EE6902 (20 credits) + courses	EE6904 (40 credits)
Option 4		Start project EE6901 (25 credits)	EE6902 (20 credits) + courses	EE6904 (40 credits)