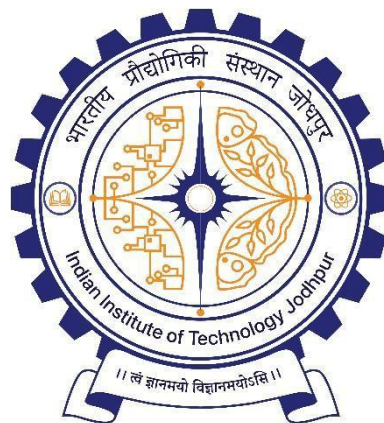


Curriculum

# BTech in Electronics Engineering



Department of Electronics Engineering  
Indian Institute of Technology Jodhpur

*This page is intentionally left blank.*



## Contents

1. Introduction .....	3
2. Objectives of Program .....	4
3. Expected Graduate Attributes .....	4
4. Learning Outcomes .....	4
5. Course categories, credit distribution and structure of BTech programme.....	5
6. Course categories, credit distribution and structure of BTech with Minor programme .....	6
7. List of Institute-wide Courses for Engineering (IE), Science (IS) and Essential Audit courses in Engineering (NH) and Humanities (NH) .....	7
8. List of Programme Compulsory (PC) Courses for Electronics Engineering .....	7
9. List of Programme Elective (PE) Courses for Electronics Engineering .....	8
10. Open Elective (OE) Courses from academic units .....	9
11. Curriculum of regular BTech programme and BTech with Minor in Electronics Engineering.....	9
12. Programme Core (PC) and Programme Elective (PE) Courses with Description.....	11
13. Guidelines for Curriculum Implementation .....	17

### 1. Introduction

The vision of the Department of Electronics Engineering is to be the leading center of excellence in electronics engineering that advances emerging technologies through transformative education, cutting-edge research, and innovation, contributing to sustainable technological progress and societal development. In alignment with India's national strategic priorities – including the *Bharat 6G vision*, the *India Semiconductor Mission*, *Digital India*, *Make in India* – the department aims to develop highly skilled graduates capable of leading the next generation of electronics-led technological transformation.

The program on **BTech in Electronics Engineering** is built on three key components: strong foundations in mathematics, computing, and engineering sciences; technical skills through selected courses; and general education for overall growth. The undergraduate program is designed for students interested in core and emerging areas of electronics engineering, including **micro-nano electronics, communication systems, photonics, embedded systems, RF, and semiconductor technologies**. The curriculum establishes a strong foundation in mathematics, physics, electronic devices, circuits, signals, systems, and computing, enabling students to develop analytical thinking, design capability, and advanced problem-solving skills. A strong set of elective courses enables students to gain knowledge in emerging areas of electronics engineering and strengthen domain-specific expertise. The curriculum is organized around four focus areas that reflect emerging national and global priorities:

1. Micro-Nano Electronics & VLSI
2. Communication & Networks
3. RF & Photonics
4. Intelligent and Embedded Computing

These areas build skills in semiconductor devices, VLSI, chip design, packaging, wireless and optical communication, RF and microwave systems, sensing, and photonic systems. The advanced



knowledge developed through these pathways directly supports India's strategic priorities in domestic semiconductor manufacturing, 5G/6G communication systems, and photonic integrated technologies, intelligent sensing, autonomous systems, and Industry 5.0 standards. The program also includes interdisciplinary learning, entrepreneurship, innovation, and research. It offers industrial internships, semiconductor projects, startup support, and mission-driven work to help India become self-reliant in electronics and chip technologies.

## 2. Objectives of Program

The program gives strong theory and practical skills in electronics engineering, focusing on the four areas. It prepares graduates for three main paths:

**I. Industrial pathway:** Technical roles in chip design, semiconductor services, VLSI, communication systems, RF-photonics, antennas, radar, embedded platforms, and tech management.

**II. Entrepreneurial pathway:** Apply the acquired knowledge for the development of electronics products, semiconductor solutions, intelligent systems, communication technologies, and deep-tech startups.

**III. Academic and research pathway:** Pursue advanced graduate studies and research in frontier areas such as VLSI, semiconductor devices, next-generation communication systems, RF-photonics, and intelligent embedded systems, leading to careers in research, innovation, and academia.

## 3. Expected Graduate Attributes

- Demonstrate technical competence, innovation, and adaptability in emerging electronics technologies.
- Design and optimize electronic systems to meet performance requirements and overcome practical bottlenecks.
- Develop and validate electronic circuits and systems within power and cost constraints.
- Contribute effectively to semiconductor, communication, RF, embedded, sensing, and deep-tech industries, with leadership and entrepreneurial abilities.
- Practice professional ethics, teamwork, and responsible engineering for societal benefit.
- Continuously learn and integrate emerging technologies such as AI hardware, 6G systems, quantum electronics, photonics, and advanced semiconductor packaging.

## 4. Learning Outcomes

- Build a strong foundation in math, science, engineering basics, and computing to solve problems related to electronics engineering.
- Develop a strong understanding of electronic devices, circuits, signals, communication, embedded systems, VLSI, AI hardware, antennas, and related interdisciplinary fields.
- Model, analyze, and build complex electronic circuits, devices, and systems integrating hardware and software.
- Apply modern design, simulation, prototyping, and testing tools to solve real engineering problems through lab work and projects.
- Review literature, assess technologies, and study patents to support new ideas and research.
- Work effectively in multidisciplinary teams and adapt to emerging technological domains.
- Follow professional ethics, social responsibility, and sustainable engineering practices.
- Share technical ideas clearly through reports, talks, and product demos.
- Engage in independent learning in the context of technological advancements.



- Develop an innovation-driven approach for product design, technology ventures, and semiconductor technologies.

## 5. Course categories, credit distribution and structure of BTech programme

The regular BTech programme in Electronics Engineering (ECE) requires a total of 153 credits for the award of the degree. As shown in Table II, the UG curriculum structure has four components: Institute Core, Programme Core, Open Electives, and Essential Audit requirements.

**a) Institute Core:** The Institute Core component contributes 39 credits and provides students with a broad foundational base in Engineering, Science, and Humanities & Social Sciences. These courses develop analytical thinking, scientific understanding, engineering fundamentals, and communication skills required for electronics engineers. The Institute Core courses are offered during the 1<sup>st</sup> year, primarily in Semesters I & II.

**b) Programme Core:** The Programme Core constitutes the major discipline-specific part of the curriculum with 90 credits, including compulsory courses and elective courses offered by the ECE Department. This component develops strong expertise in core areas of electronics engineering such as electronic devices, circuits, signals, communication systems, embedded systems, semiconductor technologies, antennas, VLSI, and emerging electronic systems. The Programme Core courses are offered in the 2<sup>nd</sup> year (Sem III & IV) and the 3<sup>rd</sup> year (Sem V & VI).

**c) Open Electives:** The Open Elective component contributes 12 credits and provides flexibility for students to pursue interdisciplinary courses beyond the programme domain, promoting multidisciplinary learning, innovation, and exposure to emerging technologies and allied fields. The credits under this component are offered across the 3<sup>rd</sup> year (Sem V & VI) and the 4<sup>th</sup> year (Sem VII & VIII) of the BTech programme.

**d) Essential Audit:** The Essential Audit component includes 12 non-graded credits, comprising Humanities audit courses, Engineering audit courses, Industry-Academia summer internships, and Design credits. This component enhances professional development, industry readiness, practical exposure, product design skills, and experiential learning essential for modern electronics engineering practice. The credits under this component are covered during the 1<sup>st</sup> and 4<sup>th</sup> years of the BTech programme.

**Table II:** Proposed Institute-wide BTech Curriculum Structure

S.N.	Course Type	Course Category	Credits	Minimum Total
1	Institute Core (I)	Engineering (IE)	16	39 (27.7%)
		Science (IS)	17	
		HSS (IH)	06	
2	Programme Core (P)	Programme Compulsory (PC)	66	90 (63.8%)
		Programme Electives (PE)	18	
		(BTech) Project (PP)	6	
3	Open (O)	Electives (OE)	12	12 (8.5%)
<b>Total (Graded)</b>				<b>141 (100%)</b>
4	Essential Audit	Humanities (NH)	3	12
		Engineering (NE)	3	



		Industry-Academia Summer Internship outside IIT Jodhpur (two summers, minimum 45 days)	4	
		Design Credit	2	
<b>Total for award of Degree (Graded + Non-Graded)</b>				<b>153</b>

## 6. Course categories, credit distribution and structure of BTech with Minor programme

At the Indian Institute of Technology Jodhpur, the **BTech with Minor** programme enables students to pursue their primary BTech degree in their parent academic unit while undertaking an interdisciplinary specialization (Minor) in a different academic unit. The Minor is awarded upon completion of the prescribed courses, comprising an additional 18 credits from the academic unit offering the Minor. Consequently, the open elective credit requirement for students pursuing a 'BTech with Minor' programme is reduced to zero, as detailed in Table III. The remaining course requirements (Institute Core, Programme Core, and Essential Audit) remain the same as those in the institute-wide regular BTech curriculum structure.

**Table III:** Proposed Institute-wide BTech with Minor Curriculum Structure

S.N.	Course Type	Course Category	BTech Regular	Dual Degree (BTech +PhD)	BTech With Minor
1	Institute Core (I)	Engineering (IE)	16	16	16
		Science (IS)	17	17	17
		Humanities (IH)	06	06	06
3	Programme Core (P)	Programme Compulsory (PC)	66	66	66
		Programme Electives (PE)	18	18	18
		BTech Project (PP)	6	6	6
4	Open (O)	Electives (OE)	12	12	0
5	Additional Credits	Programme Compulsory (PC)			18
6	PhD	Compulsory (DC)	0	12	0
		Electives (DE)		12	
		PhD. Thesis (MP)		64	
<b>Total Graded</b>			<b>141</b>	<b>229</b>	<b>147</b>
7	Essential Audit (Non-taught)	Humanities (NH)	3	3	3
		Engineering (NE)	3	3	3
		Design/Practical Experience (ND)	2	2	2
		Industry-Academia Summer Internship outside IIT Jodhpur (two summers, minimum 45 days each summer)	4	4	4
<b>Total Graded + Essential Audit</b>			<b>153</b>	<b>241</b>	<b>159</b>



## 7. List of Institute-wide Courses for Engineering (IE), Science (IS) and Essential Audit courses in Engineering (NH) and Humanities (NH)

Course Category	Course Name	L-T-P	Contact Hours	Credit
Institute-wide Engineering (IE) Courses (16 credits)	1. Engineering Mechanics	3-0-0	3	3
	2. Introduction to Computer Science	3-0-2	5	4
	3. Introduction to Machine Learning	3-0-2	5	4
	4. Engineering Workshop	0-0-2	2	1
	5. Engineering Drawing	0-0-2	2	1
	6. Environment and Sustainability	3-0-0	3	3
Institute-wide Science (IS) Courses (17 credits)	1. Physics	3-0-0	3	3
	2. Physics Lab	0-0-2	2	1
	3. Chemistry	3-0-0	3	3
	4. Chemistry Lab	0-0-2	2	1
	5. Mathematics I	2-1-0	3	3
	6. Mathematics II	2-1-0	3	3
	7. Introduction to Bioengineering	2-0-2	4	3
Institute-wide Humanities & Social Science (IH) Courses (6 credits)	1. HSS I	3-0-0	3	3
	2. HSS II	3-0-0	3	3
Institute-wide NH courses (3 credits)	1. Communication Skills	0-0-2	2	1
	2. Introduction to Professional	1-0-0	1	1
	3. Performing Arts /Sports	0-0-1	1	0.5
	4. Social Connect and Responsibilities	0-0-1	1	0.5
Institute-wide NE courses (3 credits)	1. Engineering Design I	0-0-2	2	1
	2. Engineering Design II	0-0-2	2	1
	3. Introduction to Profession II	0-0-2	2	1
<b>Total</b>				<b>45</b>

*\*\*Note: Physics and Chemistry courses will be offered in both semesters. Other institute-wide courses will be offered once a year, as per the semester-wise plan mentioned in Table II & III.*

## 8. List of Programme Compulsory (PC) Courses for Electronics Engineering

The list of Programme Compulsory (PC) courses for BTech in Electronics Engineering is presented in Table IV for the regular programme. For students pursuing a BTech with a Minor in Electronics Engineering, Table V presents the list of compulsory courses to be completed to fulfill the 18 additional credits requirement for the Minor.

**Table IV.** Programme Compulsory (PC) Courses for BTech in Electronics Engineering

Sr. No.	Course Name	L-T-P	Contact Hours	Credit
1	Basic Electronics Engineering	3-0-0	3	3
2	Signals and Systems	3-1-0	4	4
3	Data Structures and Algorithms (DSA)	3-0-0	3	3
4	Probability, Statistics and Stochastic Processes	3-1-0	4	4
5	Physics of Semiconductor Devices	3-0-0	3	3
6	Circuit Theory	3-0-0	3	3



7	Engineering Electromagnetics	3-1-0	4	4
8	Semiconductor Devices and Technology	3-0-0	3	3
9	Digital Design	3-0-0	3	3
10	ECE Lab I	0-0-6	6	3
11	Analog Circuits	3-0-0	3	3
12	Communication Systems	3-0-0	3	3
13	Microwave Engineering	3-0-0	3	3
14	Control Systems	3-0-0	3	3
15	VLSI Design	3-0-0	3	3
16	ECE Lab II	0-0-6	6	3
17	Digital Systems Architecture	3-0-0	3	3
18	Digital Signal Processing (DSP)	3-0-0	3	3
19	Data Communication and Networks	3-0-0	3	3
20	Embedded Systems	3-0-0	3	3
21	ECE Lab III	0-0-6	6	3
<b>Total</b>				<b>66</b>

**Table V.** Compulsory Courses for BTech with Minor in Electronics Engineering

Sr. No.	Course Name	L-T-P	Contact Hours	Credit
1	Basic Electronics Engineering	3-0-0	3	3
2	Physics of Semiconductor Devices	3-0-0	3	3
3	Signals and Systems##	3-1-0	4	4
4	Communication Systems	3-0-0	3	3
5	Digital Design##	3-0-0	3	3
6	Analog Circuits	3-0-0	3	3
<b>Total (additional credits)</b>				<b>19</b>

*Note: For a Minor in Electronics Engineering, the minimum additional credit requirement is 18 credits.*

##Note: If UG students opting for a Minor in Electronics Engineering have already completed courses on Signals and Systems and/or Digital Design under the Programme Compulsory (PC) courses in their parent academic unit, then these courses will be substituted with the 3-credit courses Digital Signal Processing (DSP) and/or VLSI Design, respectively.

## 9. List of Programme Elective (PE) Courses for Electronics Engineering

The Department of Electronics Engineering focuses on advancing innovation and applications in emerging areas, with programme elective course basket specifically designed to align with national missions (Indian Semiconductor Mission, Bharat 6G Vision, Digital India, and AI), while also addressing key industrial and societal needs. These electives are organized into four focus areas within the discipline of Electronics Engineering, as presented in Table VI.

**Table VI:** Focus area wise Program Elective (PE) courses

Sr. No.	Focus Area	PE Course	L-T-P	Credit
1	Communication & Networks	Information Theory and Coding (400)	3-0-0	3
		Satellite Communications (400)	3-0-0	3
		Multi-rate Digital Signal Processing (400)	3-0-0	3
		Digital Image Processing (400)	3-0-0	3



		Wireless Communications (700)	3-0-0	3
		Design & Analysis of Communication Networks (700)	3-0-0	3
		Machine Learning for Communications (700)	3-0-0	3
2	RF & Photonics	Antenna Theory & Design (400)	3-0-0	3
		Optical Fiber Communication (400)	3-0-0	3
		Microwave Photonics (400)	3-0-0	3
		Advanced Electromagnetics (700)	3-0-0	3
		RF system design for Communications (700)	3-0-0	3
		RFIC & MMIC (700)	3-0-0	3
		Fiber Optic Devices and Components (700)	3-0-0	3
3	Micro/Nano Electronics & VLSI	Sensors and Actuators (400)	3-0-0	3
		Semiconductor Memory Technologies (400)	3-0-0	3
		Mixed signal Circuit Design (700)	3-0-0	3
		Semiconductor Optoelectronics (700)	3-0-0	3
		Semiconductor Device Characterization (700)	3-0-0	3
		Signal and Power Integrity (700)	3-0-0	3
4	Intelligent and Embedded Computing	Processor Design (400)	3-0-0	3
		In-memory computing (700)	3-0-0	3
		Formal Verification (700)	3-0-0	3
		Hardware Design for Artificial Intelligence (700)	3-0-0	3

Note: 400 level courses are specific to BTech students, while 700 level courses are open to BTech, MTech and Ph.D. students.

### 10. Open Elective (OE) Courses from academic units

Open elective courses enable students to explore subjects beyond their core discipline

OE Course	Description
Objective	To encourage interdisciplinary learning and broaden knowledge across different engineering domains.
Eligibility	Open to students from different departments, subject to prerequisites of the courses offered from the Electronics Engineering department or different academic units.
Credits	Students are required to complete 12 credits under open elective courses.

### 11. Curriculum of regular BTech programme and BTech with Minor in Electronics Engineering

Tables VII and VIII present the semester-wise placement of Institute-wide courses (IE, IS, IH, NE, NH) and Programme Compulsory (PC) courses for the regular BTech programme in Electronics Engineering and BTech with Minor in Electronics Engineering, respectively.

**Table VII.** Semester-wise plan for regular BTech programme in Electronics Engineering

Cat	Course	LTP	CH	NC	GC	Cat	Course	LTP	CH	NC	GC
	<b>I Semester</b>						<b>II Semester</b>				
IE	Engineering Mechanics	3-0-0	3	-	3	IE	Introduction to Machine Learning	3-0-2	5	-	4



IE	Introduction to Computer Science	3-0-2	5	-	4	IS	Chemistry	3-0-0	3	-	3	
IS	Physics	3-0-0	3	-	3	IS	Introduction to Bioengineering	2-0-2	4	-	3	
IH	HSS I	3-0-0	3		3	IS	Chemistry Lab	0-0-2	2	-	1	
IS	Physics Lab	0-0-2	2	-	1							
IS	Mathematics I	2-1-0	3	-	3	IS	Mathematics II	2-1-0	3	-	3	
IE	Engineering Drawing	0-0-2	2	-	1	IE	Engineering Workshop	0-0-2	1	-	1	
NE	Engineering Design I	0-0-2	2	1	-	NE	Engineering Design II	0-0-2	2	1	-	
NH	Communication Skills	0-0-2	2	1	-	IH	HSS II	3-0-0	3	-	3	
NH	Social Connect and responsibilities	0-0-1	1	0.5	-	NE	Introduction to Profession	0-0-2	2	1		
NH	Performing Arts /Sports	0-0-1	1	0.5	-						-	
<b>Total</b>					<b>18</b>	<b>Total</b>						<b>18</b>
<b>III Semester</b>						<b>IV Semester</b>						
PC	Basic Electronics Engineering	3-0-0	3	-	3	PC	Circuit Theory	3-0-0	3	-	3	
PC	Signals and Systems	3-1-0	4	-	4	PC	Engineering Electromagnetics	3-1-0	4	-	4	
PC	Data Structures and Algorithms (DSA)	3-0-0	3	-	3	PC	Digital Design	3-0-0	3	-	3	
PC	Probability, Statistics and Stochastic Processes	3-1-0	4	-	4	PC	Semiconductor Devices and Technology	3-0-0	3	-	3	
PC	Physics of Semiconductor Devices	3-0-0	3	-	3	PC	ECE Lab I	0-0-6	6	-	3	
IE	Environment and Sustainability	3-0-0			3							
<b>Total</b>					<b>20</b>	<b>Total</b>					-	<b>16</b>
<b>Summer Semester Internship (Minimum 45 days, Outside IIT Jodhpur)</b>												
<b>V Semester</b>						<b>VI Semester</b>						
PC	Analog Circuits	3-0-0	3	-	3	PC	Digital Systems Architecture	3-0-0	3	-	3	
PC	Communication Systems	3-0-0	3	-	3	PC	Digital Signal Processing	3-0-0	3	-	3	
PC	Microwave Engineering	3-0-0	3	-	3	PC	Data Communication and Networks	3-0-0	3	-	3	
PC	Control Systems	3-0-0	3	-	3	PC	Embedded Systems	3-0-0	3	-	3	
PC	VLSI Design	3-0-0	3	-	3	PC	ECE Lab III	0-0-6	6	-	3	
PC	ECE Lab II	0-0-6	6		3							
PE	Programme Elective	3-0-0	3	-	3	PE	Programme Elective	3-0-0	3		3	
NH	Professional Ethics I	1-0-0	1	1	-							
<b>Total</b>					<b>21</b>	<b>Total</b>						<b>18</b>
<b>Summer Semester Internship (Minimum 45 days, Outside IIT Jodhpur)</b>												
<b>VII Semester</b>						<b>VIII Semester</b>						
PP	BTech Project 1	0-0-3	-		3	PP	BTech Project 2	0-0-3	-		3	



PE/ OE	Programme/Open Electives				12	PE/ OE	Programme/Open Electives				12
<b>Total</b>					-	<b>Total</b>					-
											<b>141</b>
<b>Essential Audit</b>											<b>12</b>
<b>Grand Total</b>											<b>153</b>

**Table VIII. Semester-wise plan for BTech with Minor in Electronics Engineering**

Cat	Course	LTP	CH	NC	GC	Cat	Course	LTP	CH	NC	GC
<b>I-IV Semester</b>											
<i>(Same as Table VII with Programme Compulsory (PC) course offered by academic units other than Department of Electronics Engineering)</i>											
<b>Summer Semester Internship (Minimum 45 days, Outside IIT Jodhpur)</b>											
<b>V Semester</b>						<b>VI Semester</b>					
PC	<b>Programme Compulsory</b> <i>(offered by academic units other than Dept. of Electronics Engg.)</i>			-	16	PC	<b>Programme Compulsory</b> <i>(offered by academic units other than Dept. of Electronics Engg.)</i>			-	16
PE/ OE	Programme/Open Elective/Minor Compulsory courses#	3-0-0	3	-	3	PP					
NH	Professional Ethics I	1-0-0	1	1	-	PE/ SC	Program elective/Minor compulsory courses#	3-0-0			3
<b>Total</b>					19	<b>Total</b>					19
<b>Summer Semester Internship (Minimum 45 days, Outside IIT Jodhpur)</b>											
<b>VII Semester</b>						<b>VIII Semester</b>					
PP	<b>BTech Project</b>	0-0-3	-		3	PP	<b>BTech Project</b>	0-0-3	-		3
PE/ OE	Programme/Open Electives/Minor Compulsory Courses#	15-0-0	15	-	15	PE/ OE	Programme/Open Electives/Minor Compulsory Courses#	15-0-0		-	15
<b>Total</b>					18	<b>Total</b>					18
											<b>147</b>
<b>Essential Audit</b>											<b>12</b>
<b>Grand Total</b>											<b>159</b>

*#Note: Minor compulsory courses related to Department of Electronics Engineering are offered in Semester V to VIII. The course list for Minor is listed in Table V.*

## 12. Programme Core (PC) and Programme Elective (PE) Courses with Description

Category	Course Name	Description
PC	Basic Electronics Engineering	Course introduces the fundamental principles of electronic devices, circuits, covering diodes, transistors, amplifiers, and digital logic basics. It develops the ability to analyze, design, and troubleshoot basic analog and digital electronic circuits for engineering applications.



PC	Signals and Systems	Covers the representation and analysis of continuous-time and discrete-time signals and linear time-invariant (LTI) systems, including convolution, Fourier series, Fourier/Laplace/Z-transforms, system response, sampling and frequency-domain analysis.
PC	Data Structures and Algorithms (DSA)	Covers fundamental data structures, searching, sorting, recursion, and complexity analysis for efficient data processing. The course also includes algorithm design methods relevant to embedded systems, IoT, and electronics software applications.
PC	Probability, Statistics and Stochastic Processes	Course introduces the mathematical modeling of uncertainty using probability theory, random variables, distributions, and stochastic processes. The course covers noise, correlation, random signal analysis, and applications in communication, signal processing.
PC	Physics of Semiconductor Devices	Covers semiconductor physics, carrier transport, and PN junction fundamentals, along with the operating principles of diodes, BJTs, and MOSFETs. The course forms the foundation for understanding modern electronic and semiconductor devices.
PC	Circuit Theory	Course introduces the analysis of DC and AC electrical networks using circuit laws, network theorems, transient response, and two-port network models. The course builds a strong foundation for modeling and analysis of analog, digital, and electronic circuit systems.
PC	Engineering Electromagnetics	Provides understanding of wave propagation, transmission lines, electromagnetic boundary conditions, and guided-wave concepts. The course forms the foundation for antennas, microwave engineering, wireless communication, and RF system design.
PC	Semiconductor Devices and Technology	Builds understanding semiconductor device operation, fabrication processes, and technology aspects of diodes, transistors, and MOS devices. The course forms the foundation for VLSI, nanoelectronics, semiconductor manufacturing, and chip technology.
PC	Digital Design	The course covers digital logic fundamentals, including logic families, CMOS circuits, and key performance parameters. It covers HDL-based design and arithmetic circuits such as fast adders and multipliers. Combinational and sequential circuit design, including FSMs, counters, and shift registers, are emphasized. The course concludes with timing analysis and implementation using programmable logic devices like FPGA.
PC	ECE Lab I	i) <i>Basic Electronics Lab</i> : The lab covers hands-on experiments on diodes, transistors, amplifiers, and basic electronic circuits. It develops practical skills in circuit implementation, testing, and measurement. ii) <i>Digital Design Lab</i> : Experiments on Designing Arithmetic circuits, Universal Shift Registers, Frequency Divide and Timing circuits, ALU, UART, Serial Peripheral Interface, VGA, Control Applications: Vending Machine, Traffic Light Controllers, Game Circuits, Motor Control. iii) <i>DSA Lab</i> : Experiments include arrays, linked lists, stacks, queues, trees, graphs, sorting, searching, and algorithm analysis. Emphasis is placed on problem solving, and implementation of optimized algorithms.
PC	Analog Circuits	The course covers transistor biasing, small-signal models, single and multistage amplifiers, frequency response, and feedback



		analysis. It also includes differential amplifiers, current mirrors, and operational amplifier circuits for analog signal processing.
PC	Communication Systems	The course covers analog and digital communication principles, modulation and demodulation techniques, noise analysis, and receiver design. It includes baseband and passband transmission, sampling, pulse modulation, and performance analysis of communication links. The course builds the foundation for wireless, optical, satellite, and modern digital communication systems
PC	Microwave Engineering	The course covers microwave transmission lines, waveguides, impedance matching, resonators, and microwave network analysis. It forms the foundation for RF systems, antennas, radar, satellite links, and high-frequency communication systems.
PC	Control Systems	The course covers mathematical modeling of dynamic systems, transfer functions, time and frequency response, stability analysis, and controller design. It provides the foundation for automation, embedded control, and intelligent electronic systems.
PC	VLSI Design	Course introduces CMOS logic design, combinational and sequential circuit implementation, timing analysis, layout concepts, and VLSI design flow. It builds the foundation for semiconductor chip design, ASICs, SoCs, and modern integrated electronic systems.
PC	ECE Lab II	i) <i>Analog Circuits Lab</i> : Design and analysis of single-stage amplifiers, differential amplifiers, op-amps with frequency compensation, and output stages. Covers gain, bandwidth, ICMR, CMRR, PSRR, slew rate via SPICE simulations, plus breadboard implementation of discrete components. ii) <i>Control Systems Lab</i> : MATLAB-based simulations of temperature and power control. Hands-on experiments: servo position, inverted pendulum, active suspension, magnetic levitation, and coupled tank. iii) <i>Microwave Lab</i> : The lab covers experiments on transmission lines, antenna characterization, and S-parameter measurements. It develops practical skills in RF characterization, and microwave measurements.
PC	Digital Systems Architecture	The course focuses on the design of processor-based digital systems, including instruction sets, addressing modes, and data types. It introduces ALP, processor microarchitecture, pipelining, and memory systems with caches. Key topics include input/output organization, interrupts, buses, DMA, and system-level design trade-offs.
PC	Digital Signal Processing (DSP)	The subject covers discrete-time signals and systems, Z-transform, DFT/FFT, digital filter design, and spectral analysis techniques. It forms the foundation for communication, audio, image, biomedical, and embedded signal processing applications.
PC	Data Communication and Networks	The subject covers data transmission, network architecture, routing, switching, and transport protocols. It forms the foundation for computer networks, IoT, and modern communication infrastructures.
PC	Embedded Systems	The subject covers microcontrollers, embedded programming, peripheral interfacing, real-time operation, communication protocols, and hardware-software co-design. It develops system-level design and implementation skills for modern embedded applications.



PC	ECE Lab III	<p>i) <u>Communication &amp; DSP System Lab</u>: Design, implement and test modulator and demodulator for different types of communication schemes. Implement end-to-end digital communication systems over wireless links. Develops practical skills in signal analysis.</p> <p>ii) <u>Data Communication &amp; Networks Lab</u>: Hands-on experiments on network protocols and traffic modeling. Covers link-level, system-level, and packet-level simulation, plus SW/HW-in-the-loop. Develops practical skills in protocol validation.</p> <p>iii) <u>Embedded Systems Lab</u>: Hands-on experiments on microcontroller programming and peripheral interfacing. Develops practical skills in embedded implementation and system integration.</p>
<b>PE courses for the area of 'Communication &amp; Networks'</b>		
PE	Machine Learning for Communications (700)	The subject covers machine learning techniques for channel estimation, signal detection, resource allocation, modulation recognition, and adaptive communication system optimization. It develops intelligent data-driven methods for modern wireless, MIMO, and 6G communication networks
PE	Multi-rate Digital Signal Processing (400)	The course covers principles and techniques of multi-rate signal processing and sampling rate conversion. Topics include decimation, interpolation, polyphase structures, multistage filter design, filter banks, and efficient implementation of digital systems. Applications in audio, speech, image, and communication signal processing are also discussed.
PE	Satellite Communications (400)	The course introduces satellite orbits, link design, propagation effects, modulation, multiple access, and transponder architectures for space-based communication systems. It provides the foundation for satellite broadband, navigation, remote sensing, and non-terrestrial communication networks.
PE	Information Theory and Coding (400)	Provides understanding of channel coding, channel capacity, and error control coding for efficient and reliable communication. The course supports advanced studies in digital communication, wireless systems, and data storage technologies.
PE	Wireless Communications (700)	The course covers wireless channel modeling, digital modulation over fading channels, and diversity techniques for reliable communication. Topics include AWGN and fading channels, time, frequency, and antenna diversity, channel capacity, outage and ergodic capacity, water-filling algorithms, opportunistic communication, and multiuser communication techniques.
PE	Design & Analysis of Communication Networks (700)	The course covers probabilistic modeling and simulation of communication systems and networks. Topics include random processes, channel and mobility models, multiple access techniques, queuing networks, statistical analysis and visualization, graph theory, and discrete event and Monte Carlo simulation methods.
PE	Digital Image Processing (400)	The course introduces digital image processing and analysis. Topics include image sampling, enhancement, filtering, restoration, segmentation, feature extraction, image transforms, compression, and pattern recognition techniques. Applications in medical imaging, remote sensing, computer vision, and multimedia systems are also discussed.



<i>PE courses for the area of 'RF &amp; Photonics'</i>		
PE	RF system design for Communications (700)	The course covers wireless communication system fundamentals, radio channel requirements, gain, nonlinearities, and noise analysis in RF front-end circuits. It also includes receiver and transmitter architectures such as superheterodyne, direct conversion, and low-IF systems, along with contaminating signals, mixers, and intermodulation effects.
PE	Advanced Electromagnetics (700)	The course covers advanced topics in electromagnetics including waves in dispersive media, microstrip integrated circuits, quantum optics, remote sensing, scattering, Green's functions, integral equations, method of moments, and electromagnetic waves in periodic structures such as photonic crystals.
PE	Antenna Theory & Design (400)	The course covers radiation mechanisms, antenna parameters, wire and microstrip antennas, antenna arrays, and propagation characteristics. Emphasis is placed on antenna analysis, design, fabrication aspects, and performance evaluation using analytical and simulation techniques. The course also introduces modern RF and EM simulation tools for antenna modeling and characterization.
PE	Microwave Photonics (400)	The course introduces microwave photonics, an interdisciplinary field combining microwave and optical technologies. Topics include wave propagation in waveguides, optical and RF components, fiber-wireless links, microwave photonic signal processing, optoelectronic oscillators, and photonic integrated circuits. Applications in wireless communication, radar, beamforming, and signal generation are also discussed.
PE	Fiber Optic Devices and Components (700)	The course covers the principles and characteristics of optical fiber devices and components used in communication systems. Topics include optical fibers, couplers, modulators, detectors, optical amplifiers, filters, and fiber Bragg gratings. Emphasis is placed on device analysis, performance evaluation, and applications in optical communication and photonic systems.
PE	RFIC & MMIC (700)	The course covers RFIC and MMIC technology, including device modeling, foundry processes, and passive/active RF component design. It also focuses on on-chip RF building blocks such as LNAs, mixers, phase shifters, power amplifiers, and layout considerations, along with fabrication, testing, yield, and thermal management aspects.
PE	Optical Fiber Communication (400)	The course introduces the fundamentals of optical fiber communication systems. Topics include optical fibers, light sources, photodetectors, optical modulation, signal propagation, dispersion, attenuation, and optical communication links. Applications of fiber-optic communication in modern telecommunication systems are also discussed..
<i>PE courses for the area of 'Micro/Nano Electronics &amp; VLSI'</i>		
PE	Sensors and Actuators (400)	The course covers advanced material platforms for sensing such as nanostructured materials, metal oxides, quantum dots, and 2D materials, along with key performance parameters like sensitivity, selectivity, stability, and calibration. It covers modern industrial sensing applications and current real-world sensor technologies.



PE	Semiconductor Memory Technologies (400)	The course covers SRAM, DRAM, Flash memory, non-volatile memory technologies, memory cell design, read/write operations, memory organization, and reliability issues. It also introduces emerging memory technologies such as MRAM, ReRAM, and phase-change memory. Emphasis is placed on memory performance, power consumption, and integration of memory systems in modern VLSI architectures.
PE	Semiconductor Optoelectronics (700)	The course covers semiconductor optoelectronics with emphasis on compound semiconductor materials, band structure engineering, and photon-carrier interactions. It includes quantum wells, wires, and dots, along with photon emission and absorption mechanisms. The syllabus further introduces LEDs, semiconductor lasers, PIN/APD photodetectors, solar cells, and optical fiber communication systems.
PE	Mixed Signal Circuit Design (700)	The course covers the analysis and design of circuits that integrate analog and digital components on a single chip. Topics include data converters (ADC/DAC), clocking, signal integrity, noise coupling, and CMOS implementation techniques, with emphasis on performance, power, and layout considerations in VLSI systems.
PE	Signal and Power Integrity (700)	The course introduces the principles of signal and power integrity in high-speed electronic systems. Topics include transmission line effects, reflections, crosstalk, impedance matching, jitter, and electromagnetic interference (EMI). The course also covers power distribution networks, decoupling techniques, ground bounce, and power-supply noise analysis.
PE	Semiconductor Device Characterization (700)	The course introduces characterization techniques for semiconductor devices and materials. Topics include I-V and C-V measurements, carrier transport analysis, parameter extraction, and reliability evaluation of semiconductor devices. Emphasis is placed on experimental methods and interpretation of device performance.
<b><i>PE courses for the area of 'Intelligent and Embedded Computing'</i></b>		
PE	Hardware Design for Artificial Intelligence (700)	The course covers the fundamentals of AI hardware design, including computational, memory, and precision challenges. It introduces modern platforms such as CPUs, GPUs, FPGAs, and AI accelerators. It also covers DNN architecture, parallel computing, performance optimization, quantization, and compact embedded neural networks.
PE	In-memory Computing (700)	The course introduces principles, device technologies, and circuit architecture enabling computation-in-memory using emerging devices such as memristors, RRAM, and SRAM-based designs. It covers analog and digital IMC techniques, crossbar arrays, and their application in AI/ML acceleration, and edge computing.
PE	Formal Verification (700)	The course introduces the digital VLSI design and verification flow, covering functional, timing, and formal verification techniques. It includes equivalence checking, model checking, and verification using simulation and analytical methods. Students learn assertion-based verification, System Verilog testbenches, and mixed-signal verification concepts.
PE	Processor Design (400)	The course covers the design and implementation of modern digital processors and computing systems. Topics include instruction set architecture (ISA), processor data path and control design, arithmetic and logic units, pipelining, hazard handling, memory hierarchy, cache organization, interrupts, and input/output interfaces.



### 13. Guidelines for Curriculum Implementation

1. *BTech projects 1 and 2* will be done under the same supervisor. Each component will be evaluated in the respective semesters. Since BTPs are part of the PC, the supervisor should be from the department.
  2. *Compulsory Industry-Academia Internship*: The internship will be after the 4th and 6th semesters during the summer semester break. It is the students' responsibility to seek an internship. The internship should be for a minimum of 45 days. The students are expected to submit an internship completion certificate along with the report to the departments. The internship must be outside IIT Jodhpur.
  3. *BTech with Minor*: Each academic unit will fix the program core courses of 18 credits for the minor in its discipline. The departments will circulate the forms to the students at the end of the 2nd, 3rd, and 4th semesters for opting minor. Each department will decide the maximum intake for the minor. Open elective credits will be utilized for completing the minor requirements (12 credits). The students will do extra 6 credits to earn a minor in a discipline.
  4. *Courses with theory and lab components* should be separated as independent courses but taught in the same semester.
  5. *Humanities and Social Science (HSS) courses* will be offered through the School of Liberal Arts and the Department of Economics.
  6. *Design credit* will be done during the semesters.
-