

B. Tech. (Electronics & Communication Engineering) Curriculum



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1 Introduction

This document describes the curriculum for the proposed undergraduate B. Tech. (Bachelor of Technology) program in ECE (Electronics and Communication Engineering). The document details the overall program structure, total credits with a semester-wise break-up of the credits and a break-up of the credits with reference to the various groups of core and elective courses.

Overall B. Tech. Programme Structure (minimum 150 credits)

Semester 1 (15 weeks)	18 credits <ul style="list-style-type: none">• 6 core courses
Semester 2 (15 weeks)	18 credits <ul style="list-style-type: none">• 5 core courses (1 of the core courses is 2-credit course)
Semester 3 (15 weeks)	22 credits <ul style="list-style-type: none">• 7 core courses (3 of the core courses are 2-credit course)
Semester 4 (15 weeks)	20 credits <ul style="list-style-type: none">• 5 core courses
Semester 5 (15 weeks)	20 credits <ul style="list-style-type: none">• 2 core courses• 3 electives
Semester 6 (15 weeks)	20 credits <ul style="list-style-type: none">• 5 electives
Semester 7 (15 weeks)	16 credits <ul style="list-style-type: none">• 4 electives
Semester 8 (15 weeks)	16 credits <ul style="list-style-type: none">• Project/Internship/Thesis

The course credits earned over 8 semesters are grouped into the following categories:

- Mathematics and Basic Sciences (MBS)
- Humanities and Social Sciences (HSS)
- ECE Core (CC)
- Systems (Sys)
- Programming (Prog)
- Branch Electives for ECE -- (BE)
- General Electives

- Bachelor's Thesis/Project/Internship

The break-up of credits under each category is in the table below. The courses under each category are in the tables that follow.

Electronics and Communication Engineering (ECE)	
Heads	Credits
Programming	12
Systems	20
ECE Core (ESE)	24
Humanities and Social Sciences (with 1 elective)	16
Mathematics and Basic Sciences	16
Branch Electives (6 ECE electives)	24
Other electives (5 Open electives)	20
Internship/Thesis/Project	16
Total	148

1.1 Programming

The list of courses under the programming category is given in the following table.

Course Name	Credits	L:T:P:C
Programming IA (C)	2	1:0:2:2
Programming IB (Python)	2	1:0:2:2
Data structures and Algorithms	6	3:1:4:6
OOP IA (C++)	2	1:0:2:2

Table 1: Programming

1.2 Systems

The following table contains the courses under the systems category.

Course Name	Credits	L:T:P:C
Digital Design	4	3:1:0:4
Signals and Systems	4	3:1:0:4
Computer Networks	4	3:1:0:4
Computer Architecture – Processor Design	2	3:1:0:2
Computer Architecture – Memory Design	2	3:1:0:2

Operating Systems	2	1.5:0:1:2
Advanced Operating Systems	2	1.5:0:1:2

Table 2: Systems

1.3 ECE Core

The following table contains the courses under the category of core courses exclusive to ECE.

ECE Core Course Name	Credits	L:T:P:C
Electronics Circuits and Network Analysis	2	2:0:0:2
Electronic Circuits Lab	2	0:0:4:2
Microcontroller Programming	2	1:0:2:2
Analog Circuits Theory & Lab	4	3:1:0:4
Signal Processing	4	3:2:0:4
Principles of Communication Systems Theory & Lab	4	3:0:2:4
Advanced Communication Technologies Theory & Lab	4	3:0:2:4

Table 3: ECE Core

1.4 Humanities and Social Sciences

The courses under this category are listed in the following table

Course Name	Credits	L:T:P:C
Technical Communication	2	2:0:0:2
English	2	2:0:0:2
Economics	4	3:1:0:4
Social Pathways to Information Technology	4	3:1:0:4
An elective in Humanities and Social Sciences	4	3:1:0:4

Table 4: HSS

1.5 Mathematics and Basic Sciences

The following table lists the courses under this category.

Course Name	Credits	L:T:P:C
Mathematics - 1	4	3:1:0:4
Mathematics - 2	4	3:1:0:4
Mathematics - 3	4	3:1:0:4
Physics for ECE	4	3:2:0:4

Table 1: Mathematics and Basic Sciences

1.6 Electives and Branch Electives

Apart from the courses specified in the previous sections, ECE students need to take **at least 12** elective courses, each carrying 4 credits. **Note that this includes the 1 elective from the Humanities and Social Science pool.** The students can plan their electives starting from the 5th semester to the 7th semester. The elective courses can be spanned across various departments.

While students are given the flexibility to choose their electives from various departments, out of the 12 electives, 6 electives will be considered as ECE branch electives (BE). Moreover, these branch electives compulsorily need to be from the VLSI Systems (VLSI) and Networking and Communication (NC) pool.

A list of candidate branch electives under the VLSI and NC pool is given in the following table. Note that this list is not permanent and may be changed every year, depending upon the availability of the courses.

<u>VLSI Branch Electives for ECE Branch</u>	<u>NC Branch Electives for ECE Branch</u>
System Design with FPGA	Mobile Computing
Digital CMOS VLSI Design	Software Defined Network
Analog CMOS VLSI Design	IoT
Embedded Systems Design	Fundamentals of Radar Sensing
VLSI Architecture Design	Adv Wireless Communication
Physical Design of ASICs	Mobile Computing
SoC Testing and Design for Testability	Information Theory
Electronic Systems Packaging	Wireless Access Networks
Functional Verification of SoCs	
Analog Power Integrated Circuits	

1.7 Project and Reading Electives

A project elective (PE) is a special type of 4-credit elective, where a student registers for a semester-long project under the supervision of a faculty member and is graded based on the project delivered. Similarly, a reading elective (RE) is a special type of 4-credit elective, where a student registers under a faculty

member for some advanced-level research topic. Typically the student will be provided some research material to read and present (for example, a set of research papers or some chapters from a research monogram) and the student is graded based on how well the student has understood and presented the material.

Note that PEs and REs are **optional**. A **maximum** of 1 PE and 1 RE will be considered in the Branch Elective requirements. This is encouraged so that students will gain necessary project or research experience working with ECE faculty.

2 Bachelor's Project / Thesis/ Internship

A student can do either a 16-credit B.Tech project or a 16-credit thesis under the supervision of a faculty member at IITB during their 8th semester. Alternatively, students also have an option to do a 16-credit internship during their 8th semester.

3 Other General Courses

Apart from the above courses, the students also need to compulsorily pass other general courses as specified in the following table

Course Name	Credits	L:T:P:C
Physical Education 1	0	0:4:0:0
Physical Education 2	0	0:4:0:0

4 Optional Specialization, Honors, and Minor

ECE students are encouraged to specialize in one of the following listed domains.

- VLSI (VLSI Systems)
- NC (Networking & Communication)

To get a specialization, a student must earn an additional 20 credits in that specific domain by doing **additional** elective courses offered in that domain. Note that a **maximum** of 1 PE and 1 RE is counted for getting a specialization. Moreover, these additional electives must be **different** from the branch electives.

Students completing a ECE specialization (non-minor) with a CGPA above or equal to 3.5 out of 4.0 will be graduating with a B.Tech. (ECE) Honors with specialization in the respective domain.

Additionally, an ECE student with a CGPA of more than 3.5 out of 4.0 by the end of 6th semester & recommended by faculty member for doing thesis of 28 credits (16+12) in the 7th and 8th semester will be awarded BTech (ECE) Honors. The student is expected to take two additional electives in VLSI or NC domain to complete the extra 20 credits requirements.

Alternatively, a ECE student can earn a minor in a non-ECE area by completing an **additional** 20 credits in the area chosen. The minor could be in one of the following listed areas.

- TCS (Theoretical Computer Science).
- SSY (Software Systems).
- AIML (Artificial Intelligence and Machine Learning)
- DT (Digital Society)

Note that a **maximum** of 1 PE and 1 RE can be counted for getting a minor.

The above lists of areas for specialization and minor are subject to change and refinements from time to time. Also, note that students can complete B.Tech. (ECE) programme **without** the requirement of earning a specialization or minor with extra credits.

5 Course Sequencing for BTech (ECE)

The course sequencing for the ECE branch is given in the following table.

Course Name	Credits	Course Category	Level
SEMESTER 1		18	
Mathematics - 1	4	Mathematics and Basic Sciences	Level 1
Programming IA (C)	2	Programming	Level 1
Programming IB (Python)	2	Programming	Level 1
Digital Design	4	Systems	Level 1
Physical Education 1	0	Others	Level 1
English	2	Humanities and Social Sciences	Level 1
Economics	4	Humanities and Social Sciences	Level 1
SEMESTER 2		18	
Mathematics - 2	4	Mathematics and Basic Sciences	Level 1
Computer Architecture – Processor Design	2	Systems	Level 1
Data Structures and Algorithms	4	Programming	Level 1
Data Structures and Algorithms Lab	2	Programming	Level 1
Computer Networks	4	Systems	Level 1
Technical Communication	2	Humanities and Social Sciences	Level 1
Physical Education 2	0	Others	Level 1
SEMESTER 3		22	
Mathematics - 3	4	Mathematics and Basic Sciences	Level 1
OOP IA (C++)	2	Programming	Level 1
Microcontroller Programming	2	ECE Core	Level 1

Course Name	Credits	Course Category	Level
Physics for ECE (Theory)	4	Mathematics and Basic Sciences	Level 1
Signals and Systems	4	Systems	Level 1
Electronic Circuits and Network Analysis	2	ECE Core	Level 1
Electronic Circuits Lab	2	ECE Core	Level 1
Computer Architecture – Memory Design	2	Systems	Level 1
SEMESTER 4	20		
Operating Systems (Theory & Lab)	2	Systems	Level 1
Advanced Operating Systems (Theory & Lab)	2	Systems	Level 2
Analog Circuits Theory & Lab	4	ECE Core	Level 2
Signal Processing	4	ECE Core	Level 1
Principles of Communication Systems (Theory & Lab)	4	ECE Core	Level 1
Social Pathways to Information Technology	4	Humanities and Social Sciences	Level 1
SEMESTER 5	20		
Control Theory	2	ECE Core	Level 2
Advanced Communication Technologies (Theory & Lab)	4	ECE Core	Level 2
Elective-1	4	Elective	Level 1
Elective-2	4	Elective	Level 1
Elective-3	4	Elective	Level 1
SEMESTER 6	20		
Elective-4	4	Elective	Level 2
Elective-5	4	Elective	Level 2
Elective-6	4	Elective	Level 2
Elective-7	4	Elective	Level 2
Elective-8	4	Elective	Level 2
SEMESTER 7	16		
Elective-9	4	Elective	Level 2 / Level 3
Elective – 10	4	Elective	Level 2 / Level 3
Elective – 11	4	Elective	Level 2 / Level 3
Elective – 12	4	Elective	Level 2 / Level 3
SEMESTER 8	16		
B.Tech. Project / Thesis / Internship	16	Project/Thesis/Internship	Bachelor's Project/Thesis/Internship

Table 10: Course Sequencing for B.Tech (ECE)

(1 Humanities and Social Science Elective course needs to be completed by the student in any semester starting from the 5th semester to the 7th semester as a graduation requirement)