



## **Regulations for B.Tech. in Electronics and Communications Engineering (ECE)**

### **1. Preamble**

IIIT Delhi aims to encourage research and innovation in Information Technology (IT) and allied areas. The objective of the B.Tech. program in Electronics and Communications Engineering (ECE) is to prepare students to undertake careers involving innovation and problem solving using suitable techniques and hardware and software technologies, or to undertake advanced studies for research careers.

In order to give due importance to apply as well as theoretical aspects of ECE, the curriculum for the B.Tech. (ECE) program covers most of the foundational aspects and also develops in students the engineering skills for problem solving. Towards this, the B.Tech. (ECE) program at IIIT-Delhi starts with computing and Electronics courses first, and allows the possibility of doing science courses later. Besides being better suited for developing engineering capabilities, it also enables the possibility of students seeing newer applications and possibilities of using computing and electronics in these subjects.

The first year of the ECE program is common with CSE - this allows flexibility to students in moving from one program to the other. The second year program is relatively fixed, comprising mostly of core courses for the program. 3<sup>rd</sup> year onwards the program can be mostly flexible comprising of electives, which may be organized as streams, including in Computer Science as well as domain areas.

This document specifies the specific regulations for the B.Tech. (ECE) program – the general regulations for the B.Tech. program are given in a separate document. These regulations are in addition to the general regulations of the B.Tech. program.

### **2. Program Structure**

2.1 The set of core courses are shown in the table below (courses mentioned in [ ] are electives and actual courses for these slots are as defined from semester to semester.)

For students of 2019 batch onwards

SEMESTER 1	SEMESTER 2	SEMESTER 3	SEMESTER 4	SEMESTER 5
Introduction to Programming	Data Structures and Algorithms	Circuit theory and Devices	Fields & Waves	[Digital Communication Systems – core elect]
Digital Circuits	Basic Electronics	Embedded Logic Design	Integrated Electronics	[Digital Signal Processing – core elect]

Prototyping Interactive Systems	Computer Organization	Signals and Systems	Principles of Communication Systems	
Maths I (Linear Algebra)	Maths II (Probability and Statistics)	Maths III (Multivariate Calculus)	Maths IV (ODE/PDE)	
Communication Skills	[SSH]	[SSH/Advanced Programming]	[Science/BIO/..]	Technical Communication + Environmental Sciences

For students of 2018-2015 batches

SEMESTER 1	SEMESTER 2	SEMESTER 3	SEMESTER 4	SEMESTER 5
Introduction to Programming	Data Structures and Algorithms	Circuit theory and Devices	Fields & Waves	[Digital Communication Systems – core elect]
Digital Circuits	Basic Electronics	Embedded Logic Design	Integrated Electronics	[Digital Signal Processing – core elect]
System Management	Introduction to Engineering Design	Signals and Systems	Principles of Communication Systems	
Maths I (Linear Algebra)	Maths II (Probability and Statistics)	Maths III (Multivariate Calculus)	Maths IV (ODE/PDE)	
Communication Skills	[SSH]	[SSH/Advanced Programming]	[Science/BIO/..]	Technical Communication + Environmental Sciences

2.2 First semester courses are common across all the B.Tech. programs. All students do one course each in Maths, Software, Hardware, Systems/practice, and Comm. All courses, except SSH, are core courses.

2.3 List of technical and non-technical courses of first year

Semester	Technical Courses	Non-Technical Courses
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<b>Semester 1</b>	Introduction to Programming Digital Circuits Maths I Prototyping Interactive Systems	Communication Skills
<b>Semester 2</b>	Data Structures and Algorithms Basic Electronics Probability and Statistics Computer Organization	SSH Elective

2.4 The semester mentioned for the core courses is indicative and suggested, and they can be done later/earlier also. However, the pre-requisite requirements must be kept in mind by a student, if he/she wishes to do a core course in some other semester.

2.5 Program structure in 3<sup>rd</sup> and 4<sup>th</sup> Years.

2.6 Most courses in Semester 5-8 are electives (an elective course is one which is not compulsory, and a student may have choices from which to select the courses he/she wants to do). Core Electives mentioned in Semester 5 are the highly recommended electives, however are not compulsory (core) courses.

2.7 Some of the electives may be organized as *streams*, where a stream is a sequence of courses in an area providing a limited specialization in that area. Streams allow the student to focus on some area of ECE – as ECE is too diverse it is not possible for a student to gain a decent mastery in all. Streams allow the student to focus on a chosen area to gain a level of depth, and gain some understanding of other areas by doing some courses from other streams.

2.8 Besides electives and streams for specialized areas, streams and electives from domain areas (e.g. health, life sciences, finance, economics, E-Governance, sciences, etc.) may also be offered. A student may also be able to take CSE courses.

Note: Streams in the UG programs will not be shown on the transcript. However, the students may be guided about the courses belonging to a certain area during the course counseling session conducted at the beginning of the semester. Guidance on streams may also be put up on the website for information of the students.

2.9 There will also be a set of Social Sciences and Humanities (SSH) courses offered.

2.10 List of courses, and further information about the courses is available on the website: <https://www.iiitd.ac.in/academics/courses>

### 3 Requirements for Graduation

For a B.Tech. (ECE) degree, a student must satisfy all the following requirements:

1. Earn a total of 156 (inclusive of 2 credits each of SG and CW credits) credits (equivalent to 39 full courses – 21 courses in the first two years, and 18 courses in the last two years.)
2. Successfully complete all the core courses.
3. Complete at least 12 credits of Social Science and Humanities (SSH) Courses.
4. Do 2 credits of Community Work and Self Growth each. These are pass/fail credits, which are required to be completed, and will count for fulfilling the credit requirements.
5. A student may take Online Courses. No more than 8 of these credits can count towards satisfying the credit requirements of the degree.
6. In the last four semesters, a student must at least 32 credits (8 full courses) of ECE courses. B.Tech. Project /Independent Project/Independent Study/Undergraduate Research will not count towards this requirement. UGC may approve some other relevant courses (e.g. from Maths, CSE, Computational Biology, etc.) to be counted as ECE courses for this purpose. Online courses of the respective discipline (i.e. online courses with ECE course code), if done in last four semesters will count towards this requirement.
7. A B.Tech. Project (BTP) is optional. A student opting for BTP may take a total of 8 to 12 credits of BTP spread over minimum 2 semesters. A student not completing BTP credits will have to forgo the partial BTP credits earned earlier done and those will not be counted towards the credit requirement of 156 credits.
8. A student may take “Independent Project” or “Independent Study” or “Undergraduate Research” courses for 1, 2, or 4 credits. No more than 8 of these credits can count towards satisfying the credit requirements of the degree. Only students with satisfactory CGPA (at least 7.5) or with a strong interest in some area (the faculty advisor to determine this) and CGPA of at least 7.0 can take these courses.
9. A student can take maximum 2, 2xx level courses in 3rd and 4th year.

#### **4 Honors Program**

The B.Tech. (ECE) program has the Honors option, requirements for which are same as specified in the regulations for the B.Tech. program. Namely;

1. The student must earn an additional 12 discipline credits (i.e. must complete at least 168 credits)
2. The student’s program must include a B.Tech. Project
3. At graduation time, the student must have a CGPA of 8.0 or more

## 5 Suggested “Streams” for ECE

Streams will evolve over time – based on trends as well as faculty interests. Some common streams that are possible are given below. Then nature of streams will evolve with time depending on the interests of faculty as well as relevance/importance of the areas.

1. Signal and Image Processing
2. RF and Communication Engineering
3. Circuits and VLSI
4. Controls and Embedded Systems

The courses in the streams will be of two types to serve dual purpose. On one hand there will be courses to train students in the fundamentals of the specific streams whereas on the other hand there will be advanced courses to train the students on the latest developments in those specific streams.

The suggested courses for some of the streams are given below. These courses can be added/deleted based on their relevance after taking feedback from industry and academia.

**Signal and Image Processing Courses:** Digital Signal Processing, Image Analysis, Machine Learning, Statistical Signal Processing, Compressive Sensing, Transform Learning and Applications, Multirate Signal Processing, Computer Vision, Multimedia Compression, Multimedia Security

**RF and Communication Engineering Courses:** Digital Communication System, Antennas Theory and Design, RF Circuit Design, Radar systems, RF Transceiver Design, Wireless Networks, Wireless System Implementation, Green Information and Communication Technology, Optical Communication System, Mobile Communication

**Circuits and VLSI Courses:** Digital VLSI Design, Analog CMOS Circuit Design, System on Chip Design and Test, Low Power Design, Memory Design, Mixed Signal Design, VLSI Design and Test Flow, RF Circuit Design, RF Transceiver Design

**Controls and Embedded Systems Courses:** Introduction to Robotics, Advanced Embedded Logic Design, Control Theory, Optimal Control Systems, Stochastic Estimation and Control, Computer Architecture, Multi Agent Systems

### Change History

- **July 2013 release:** B.Tech.(ECE) regulation revised
- **July 2014 release:** Only a few minor changes done.
- **July 2015 release:**
  - (i) B.Tech. (ECE) program revised w.e.f. Academic year 2015-16 \*
  - (ii) BTP External discontinued

(iii) BTP credits towards fulfilment of degree requirements reduced to 12.

- **July 2016 release:**

- (i) Discontinuation of streams in UG program

- **July 2017 release**

\*For students of 2014 and earlier batches the set of core courses are shown in the tables below (courses mentioned in [ ] are electives and actual courses for these slots are as defined from semester to semester.)

First year courses are common for both ECE and CSE students. Each of the two semesters, all students do one course each in Maths, Software, Hardware, Systems/practice, and HSS/Comm. All courses, except HSS, are core courses.

	<b>Sem 1</b>	<b>Sem 2</b>
<b>Hardware</b>	Digital circuits	Basic Computer Organization
<b>Software</b>	Intro to Programming	Data structures and Algos
<b>Systems/Practice</b>	System Management	Intro to Engineering Design
<b>Maths</b>	Math 1 (Linear Algebra)	Math 2 (Probability and Statistics)
<b>Communication Skills / HSS</b>	Com 1	[HSS 1]

### Core Courses for ECE in 2<sup>nd</sup> Year

In 3<sup>rd</sup> and 4<sup>th</sup> semesters, the course load will be same as in CSE – 5 courses, including one HSS/. Communication Skills. These core courses are given below: These courses will become pre-requisites for advanced courses in some of the streams.

<b>Sem 3</b>	<b>Sem 4</b>
Linear Circuits	Principles of Communication Systems
Embedded Logic Design	Integrated Electronics
Signals & Systems	Fields and Waves
Math 3 (Complex Variables, Vector Calculus and ODEs)	Math 4 (Numerical Methods and Optimization)
[HSS 2]	Technical Communication (2 credits) Environment Studies (2 credits)

- **July 2019 release**

- (i) Counting of SG, CW credits in total credits. Applicable from 2017 batch onwards.
  - (ii) Total credits requirement for graduation and credit requirement for Honors students. Applicable from 2017 batch onwards.
  - (iii) Courses for Honors students. Applicable from 2017 batch onwards.
  - (iv) Discontinuation of BTP to IP conversion. Applicable from AY2019-20.

- (v) Technical Courses
- (vi) 2xx level courses

- **August 2019 release**

- (i) Program structure Pnt 2.1
- (ii) List of technical and non-technical courses in the first year. For students of 2018-2015 batches

<b>Semester</b>	<b>Technical Courses</b>	<b>Non-Technical Courses</b>
<b>Semester 1</b>	Introduction to Programming Digital Circuits Maths I System Management	Communication Skills
<b>Semester 2</b>	Data Structures and Algorithms Basic Electronics Probability and Statistics Introduction to Engineering Design	SSH Elective