

**B. Tech.**

IN

**COMPUTER SCIENCE AND ENGINEERING**

**CURRICULUM**

**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING  
NATIONAL INSTITUTE OF TECHNOLOGY  
CALICUT 673601  
KERALA, INDIA**

## **The Program Educational Objectives (PEOs) of B. Tech. in Computer Science and Engineering**

<b>PEO1</b>	Graduates shall have sound knowledge regarding the fundamental principles and techniques in the discipline of Computer Science and Engineering.
<b>PEO2</b>	Graduates shall have the ability to specify, design, develop and maintain reliable and efficient software.
<b>PEO3</b>	Graduates shall have the necessary communication and management skills and ethical values to become competent professionals.

## The Programme Outcomes (POs) of B. Tech. in Computer Science and Engineering

<b>PO1 (Engineering Knowledge)</b>	Sound knowledge - theory and practical - in Computer Science and Engineering
<b>PO2 (Problem Analysis)</b>	Ability to analyze problems and solutions to assess the complexity.
<b>PO3 (Design and Development of Solutions)</b>	Ability to specify, design, develop, and maintain reliable and efficient software systems.
<b>PO4 (Investigation of Complex Problems)</b>	Ability to handle complex problems using abstraction and other software engineering methodologies.
<b>PO5 (Modern Tools and Usage)</b>	Knowledge of available tools and its use to develop systems by way of reuse for efficiency and reliability.
<b>PO6 (Engineer and Society)</b>	Ability to develop Information Technology solutions to the needs of the society.
<b>PO7 (Environment and Sustainability)</b>	Ability to develop Information Technology Solutions which are efficient and secure considering the environment.
<b>PO8 (Ethics)</b>	Awareness of ethics and its practice in the profession.
<b>PO9 (Individual and Teamwork)</b>	Ability to work in a team and ability to lead a team in a project.
<b>PO10 (Communication)</b>	Ability for clear and effective communication both oral and written.
<b>PO11 (Project Management and Finance)</b>	Management skills to lead a team for successful project implementation.
<b>PO12 (Lifelong Learning)</b>	Sound Knowledge in fundamental principles and techniques in the discipline of computing so as to learn and adapt to new technological advances.

## CURRICULUM

The total credits for completing the B. Tech. programme in Computer Science and Engineering is 160.

### MINIMUM CREDIT REQUIREMENT FOR THE VARIOUS COURSE CATEGORIES

The structure of B.Tech. programmes shall have the following Course categories :

Sl. No.	Course Category	Number of Courses	Minimum Credits
1.	Mathematics (MA)	4	12
2.	Science (BS)	5	10
3.	Humanities (HL)	3	9
4.	Basic Engineering (BE)	6	15
5.	Other Courses (OT)	4	6
6.	Professional Core (PC)	18	70
7.	Departmental Electives (DE)	9	32
8.	Open Electives (OE)	2	6
	TOTAL	51	160

## COURSE REQUIREMENTS

### 1. MATHEMATICS

Sl.No.	Course Code	Course Title	L	T	P	Credits
1.	MA1001D	Mathematics I	3	1	0	3
2.	MA1002D	Mathematics II	3	1	0	3
3.	MA2001D	Mathematics III	3	1	0	3
4.	MA2003D	Mathematics IV	3	1	0	3
<b>Total</b>			12	4	0	12

### 2. SCIENCE

Sl.No.	Course Code	Course Title	L	T	P	Credits
1.	PH1001D	Physics	3	0	0	3
2.	PH1091D	Physics Lab	0	0	2	1
3.	CY1001D	Chemistry	3	0	0	3
4.	CY1094D	Chemistry Lab	0	0	2	1
5.	BT1001D	Introduction to Life Science	2	0	0	2
<b>Total</b>			8	0	4	10

### 3. HUMANITIES

Sl.No.	Course Code	Course Title	L	T	P	Credits
1.	MS1001D	Professional Communication	3	0	0	3
2.	MS3001D	Engineering Economics	3	0	0	3
3.	ME3104D	Principles of Management	3	0	0	3
<b>Total</b>			9	0	0	9

#### 4. BASIC ENGINEERING

Sl.No.	Course Code	Course Title	L	T	P	Credits
1.	ZZ1001D	Engineering Mechanics	3	0	0	3
2.	ZZ1003D	Basic Electrical Sciences	3	0	0	3
3.	ZZ1002D	Engineering Graphics	1	0	3	3
4.	ZZ1004D	Computer Programming	2	0	0	2
5.	ZZ1091D	Workshop I	0	0	3	2
6.	ZZ1092D	Workshop II	0	0	3	2
<b>Total</b>			9	0	9	15

#### 5. OTHER COURSES (OT)

Sl.No.	Course Code	Course Title	L	T	P	Credits
1.	ZZ1093D	Physical Education	0	0	2	1
2.	ZZ1094D	Value Education	0	0	2	1
3.	ZZ1095D	NSS	0	0	2	1
4.	CS2007D	Environmental Studies	3	0	0	3
<b>Total</b>			3	0	6	6

**6. PROFESSIONAL CORE**

Sl.No.	Course Code	Course Title	Pre requisites	L	T	P	Credits
1	CS2001D	Logic Design	NIL	4	0	0	4
2	CS2002D	Program Design	ZZ1004D	4	0	0	4
3	CS2006D	Discrete Structures	NIL	4	0	0	4
4	CS2091D	Logic Design Laboratory	NIL	0	0	3	2
5	CS2092D	Programming Laboratory	NIL	1	0	3	3
6	CS2004D	Computer Organization	CS2001D	4	0	0	4
7	CS2005D	Data Structures and Algorithms	CS2002D, CS2006D	4	0	0	4
8	CS2093D	Hardware Laboratory	NIL	2	0	2	3
9	CS2094D	Data Structures Laboratory	CS2002D, CS2006D	1	0	3	3
10	CS3001D	Theory of Computation	NIL	4	0	0	4
11	CS3002D	Database Management Systems	NIL	3	0	2	4
12	CS3003D	Operating Systems	NIL	3	0	2	4
13	CS3004D	Software Engineering	CS2002D, CS2006D	3	0	2	4
14	CS3005D	Compiler Design	NIL	3	0	2	4
15	CS3006D	Computer Networks	CS2005D	3	0	2	4
16	CS4023D	Artificial Intelligence	NIL	3	0	2	4
17	CS4098D	Project: Part 1	NIL	0	0	6	3
18	CS4099D	Project: Part 2	CS4098D	0	0	16	8
<b>Total</b>				46	0	45	70

**7A. DEPARTMENT LABORATORY ELECTIVES**

Sl. No.	Course Code	Course Title	Pre requisites	L	T	P	Credits
1.	CS3091D	Compiler Laboratory	NIL	1	0	3	3
2.	CS3092D	Operating Systems Laboratory	NIL	1	0	3	3
3.	CS3093D	Networks Laboratory	NIL	1	0	3	3
4.	CS3094D	Systems Programming Laboratory	NIL	1	0	3	3
5.	CS3095D	Database Management Systems Laboratory	NIL	1	0	3	3
6.	CS4090D	Computer Security Laboratory	NIL	1	0	3	3
7.	CS4091D	Data Analytics Laboratory	NIL	1	0	3	3
8.	CS4092D	Machine Learning Laboratory	NIL	1	0	3	3
9.	CS4093D	Image Processing Laboratory	NIL	1	0	3	3
10.	CS4094D	Advanced Computer Networks Laboratory	NIL	1	0	3	3
11.	CS4096D	Software Engineering Laboratory	NIL	1	0	3	3
12.	CS4097D	Object Oriented Systems Laboratory	NIL	1	0	3	3
13	CS4088D	Advanced Hardware Laboratory	NIL	1	0	3	3

## 7B. DEPARTMENT ELECTIVES

Sl. No.	Course Code	Course Title	Pre requisites	L	T	P	Credits
1.	CS4021D	Number Theory and Cryptography	NIL	3	0	2	4
2.	CS4022D	Principles of Programming Languages	NIL	3	0	2	4
3.	CS4024D	Information Theory	NIL	3	0	0	3
4.	CS4025D	Randomized algorithms	NIL	3	0	2	4



5.	CS4026D	Combinatorial Algorithms	NIL	3	0	2	4
6.	CS4027D	Topics in Algorithms	NIL	3	0	2	4
7.	CS4028D	Quantum Computation	NIL	3	0	0	3
8.	CS4029D	Topics in Complexity	NIL	3	0	0	3
9.	CS4030D	Computational Complexity	NIL	4	0	0	4
10.	CS4031D	Computational Algebra	NIL	3	0	2	4
11.	CS4032D	Computer Architecture	NIL	3	0	2	4
12.	CS4033D	Distributed Computing	NIL	3	0	2	4
13.	CS4034D	Middleware Technologies	NIL	3	0	2	4
14.	CS4035D	Computer Security	CS4021D	3	0	2	4
15.	CS4036D	Advanced Database Management Systems	NIL	3	0	2	4
16.	CS4037D	Cloud Computing	NIL	3	0	2	4
17.	CS4038D	Data Mining	CS3002D	3	0	2	4
18.	CS4039D	Multi Agent Systems	NIL	3	0	2	4
19.	CS4040D	Bioinformatics	NIL	3	0	2	4
20.	CS4041D	Natural Language Processing	CS2005D	3	0	2	4
21.	CS4042D	Web Programming	NIL	3	0	2	4
22.	CS4043D	Image Processing	NIL	3	0	2	4
23.	CS4044D	Machine Learning	NIL	3	0	2	4
24.	CS4045D	Medical Image processing	NIL	3	0	2	4
25.	CS4046D	Computer Vision	NIL	3	0	2	4
26.	CS4047D	Computer Graphics	NIL	3	0	2	4

27.	CS4048D	Mathematical Foundations of Machine Learning	NIL	3	0	0	3
28.	CS4049D	Advanced Computer Networks	NIL	3	0	2	4
29.	CS4050D	Design and Analysis of Algorithms	CS2005D	3	0	2	4
30.	CS4051D	Coding Theory	NIL	3	0	0	3
31.	CS4052D	Logic for Computer Science	NIL	3	0	2	4
32.	CS4053D	Topics in Logic	NIL	3	0	0	3
33.	CS4054D	Parameterized Algorithms	NIL	3	0	2	4
34.	CS4055D	Parameterized Complexity Theory	NIL	3	0	0	3
35.	CS4056D	Introduction to High Performance Computing	NIL	3	0	2	4
36.	CS4057D	Embedded Systems	NIL	3	0	2	4
37.	CS4058D	Computational Geometry	NIL	3	0	2	4
38.	CS4059D	Topics in Computational Geometry	NIL	3	0	0	3
39.	CS4060D	Introduction to Data Science	NIL	3	0	2	4
40.	CS4061D	Topics in Data Analytics	NIL	3	0	2	4
41.	CS4062D	Introduction to Information Security	NIL	3	0	0	3
42.	CS4063D	Topics in Cryptography	NIL	3	0	2	4
43.	CS4064D	Program Analysis	NIL	3	0	2	4
44.	CS4065D	Formal Semantics	NIL	3	0	2	4

45.	CS4066D	Algorithmic Decision Making	NIL	3	0	2	4
46.	CS4067D	Foundations of Programming	NIL	3	0	2	4
47.	CS4068D	DNA Computing Models	NIL	3	0	0	3
48.	CS4069D	Hashing Techniques for Big Data	NIL	3	0	0	3
49.	CS4070D	Topics in Computer Networks	NIL	3	0	0	3
50.	CS4071D	Network Analysis in Bioinformatics	NIL	3	0	0	3
51.	CS4089D	Term Paper	NIL	0	0	8	3
52.	CS3007D	Object Oriented Systems	NIL	3	0	2	4
53.	CS4072D	Advanced Programming and Data Structures for Engineers	NIL	3	0	0	3
54.	CS4073D	Computing Systems for Engineers	NIL	3	0	0	3
55.	MA6301	Real Analysis	NIL	4	0	0	4
56.	MA6302	Linear Algebra	NIL	4	0	0	4
57.	MA6323	Graph Theory	NIL	3	0	0	3
58.	MA6324	Abstract Algebra	NIL	4	0	0	4
59.	MA7365	Multivariable Calculus	NIL	3	0	0	3
60.	MA7369	Stochastic Processes	NIL	3	0	0	3

## 8. OPEN ELECTIVES

Two open elective courses to be credited from a pool of open electives during the third / fourth year.

## Programme Structure

### Semester I

Sl. No.	Course Code	Course Title	L	T	P	Credits	Category
1.	MA1001D	Mathematics I	3	1	0	3	MA
2.	PH1001D/ CY1001D	Physics/Chemistry	3	0	0	3	BS
3.	MS1001D/ ZZ1003D	Professional Communication/ Basic Electrical Sciences	3	0	0	3	HL/BE
4.	ZZ1001D/ ZZ1002D	Engineering Mechanics/ Engineering Graphics	3/2	0	0/2	3	BE
5.	ZZ1004D/ BT1001D	Computer Programming / Introduction to Life Science	2	0	0	2	BE/BS
6.	PH1091D/ CY1094D	Physics Lab/ Chemistry Lab	0	0	2	1	BS
7.	ZZ1091D/ ZZ1092D	Workshop I/Workshop II	0	0	3	2	BE
8.	ZZ1093D/ ZZ1094D/ ZZ1095D	Physical Education /Value Education/ NSS	-	-	-	3*	OT
Total Credits			14/13	1	5/7	17+3*	

\*Note: Three courses of 1 credit each has to be credited within the first four semesters.

### Semester II

Sl. No.	Course Code	Course Title	L	T	P	Credits	Category
1.	MA1002D	Mathematics II	3	1	0	3	MA
2.	CY1001D/ PH1001D	Chemistry/ Physics	3	0	0	3	BS
3.	ZZ1003D/ MS1001D	Basic Electrical Sciences/ Professional Communication	3	0	0	3	BE/HL
4.	ZZ1002D/ ZZ1001D	Engineering Graphics/ Engineering Mechanics	2/3	0	2/0	3	BE
5.	BT1001D/ ZZ1004D	Introduction to Life Science./ Computer Programming	2	0	0	2	BS/BE
6.	CY1094D/ PH1091D	Chemistry Lab / Physics Lab	0	0	2	1	BS
7.	ZZ1092D/ ZZ1091D	Workshop II/ Workshop I	0	0	3	2	BE
Total Credits			13/ 14	1	7/5	17	

### Semester III

Sl. No.	Course Code	Course Title	L	T	P	Credits	Category
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1.	MA2001D	Mathematics III	3	1	0	3	MA
2.	CS2001D	Logic Design	4	0	0	4	PC
3.	CS2002D	Program Design	4	0	0	4	PC
4.	CS2006D	Discrete Structures	4	0	0	4	PC
5.	CS2091D	Logic Design Laboratory	0	0	3	2	PC
6.	CS2092D	Programming Laboratory	1	0	3	3	PC
Total Credits			16	1	6	20	

#### Semester IV

Sl. No.	Course Code	Course Title	L	T	P	Credits	Category
1.	MA2003D	Mathematics IV	3	1	0	3	MA
2.	CS2007D	Environmental Studies	3	0	0	3	OT
3.	CS2004D	Computer Organization	4	0	0	4	PC
4.	CS2005D	Data Structures and Algorithms	4	0	0	4	PC
5.	CS2093D	Hardware Laboratory	2	0	2	3	PC
6.	CS2094D	Data Structures Laboratory	1	0	3	3	PC
Total Credits			17	1	5	20	

#### Semester V

Sl. No	Course Code	Course Title	L	T	P	Credits	Category
1.	CS3001D	Theory of Computation	4	0	0	4	PC
2.	CS3002D	Database Management Systems	3	0	2	4	PC
3.	CS3003D	Operating Systems	3	0	2	4	PC
4.	MS3001D/ ME3104D	Engineering Economics / Principles of Management	3	0	0	3	HL
5.		Elective I				3/4	DE
6.		Laboratory Elective I	1	0	3	3	DE
Total Credits						21-22	

#### Semester VI

Sl. No.	Course Code	Course Title	L	T	P	Credits	Category
1.	CS3004D	Software Engineering	3	0	2	4	PC
2.	CS3005D	Compiler Design	3	0	2	4	PC
3.	CS3006D	Computer Networks	3	0	2	4	PC
4.	ME3104D/ MS3001D	Principles of Management / Engineering Economics	3	0	0	3	HL
5.		Elective II				3/4	DE
6.		Laboratory Elective II	1	0	3	3	DE
Total Credits						21-22	

#### Semester VII

Sl. No.	Course Code	Course Title	L	T	P	Credits	Category
1.	CS4098D	Project: Part 1	0	0	6	3	PC
2.	CS4023D	Artificial Intelligence	3	0	2	4	PC
3.		Elective III				3	OE
4.		Elective IV				4	DE
5.		Elective V				4	DE
6.		Elective VI				4	DE
	Total Credits					22	

**Semester VIII**

Sl. No.	Course Code	Course Title	L	T	P	Credits	Category
1.	CS4099D	Project: Part 2	0	0	16	8	PC
2.		Elective VII	3	0	0	3	OE
3.		Elective VIII				4	DE
4.		Elective IX				4	DE
	Total Credits					19	

**Notes:**

1. Since the credits for elective courses may vary, the total credits acquired in a semester can vary. However a student is required to complete all core courses and also the minimum number of elective courses stipulated in the curriculum under each category. **The total credits acquired must be at least 160 for the award of the B.Tech degree.**
2. Elective courses may be credited from the list of elective courses and laboratory elective courses. Laboratory electives will be treated as normal elective courses and hence may be credited as elective courses. However as laboratory electives, students are required to credit courses only from the list of courses specifically mentioned in the curriculum as laboratory electives. Two open electives may be credited in any elective slots in the curriculum.
3. Every student must credit two open elective courses from the open elective pool offered by the institute. If a student has opted for 4 credit Open Elective (OE) courses, he/she may be permitted to credit the corresponding number of 3 credit Department Elective (DE) courses.
4. A student who wishes to take up the final semester project work outside the institute may credit up to one extra elective course in the earlier semesters and may register only for Project: Part 2 in Semester 8.