

B. Tech.
IN
ELECTRONICS AND COMMUNICATION ENGINEERING

CURRICULUM AND BRIEF SYLLABI OF COURSES
(I to VIII Semesters)
(Applicable to 2017 admission onwards)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

NATIONAL INSTITUTE OF TECHNOLOGY CALICUT
CALICUT 673601
KERALA, INDIA

**The Program Educational Objectives (PEOs) of
B. Tech. in ELECTRONICS AND COMMUNICATION ENGINEERING**

PEO1	Provide solid foundations in mathematical and engineering fundamentals required to solve engineering problems so that the graduates are able to apply their understanding of science and engineering principles creatively to the solve problems arising in whatever career path they choose, particularly in the domain of electronics and communication engineering.
PEO2	Make the graduates responsible and sensitive to social, environmental and economic issues in their profession and inculcate the sense of ethics and professionalism in their approach.
PEO3	Make the graduates capable to work in groups, lead teams engaged in system design and communicate their ideas clearly and precisely, both orally and in writing.
PEO4	Engage in lifelong learning of electronics and communication engineering and allied fields and face the challenges of the dynamic world by improving their skills through continuous learning.

The Programme Outcomes (POs) of B. Tech. in ELECTRONICS AND COMMUNICATION ENGINEERING

PO1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	Problem analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PO6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

**The Programme Specific Outcomes (PSOs) of
B. Tech. in ELECTRONICS AND COMMUNICATION ENGINEERING**

PSO1	Product development: Identify, formulate, and analyze real life problems that are solvable using techniques in electronics and communication engineering and develop innovative, reliable, economic and eco-friendly solutions to such problems.
PSO2	Research aptitude: Research on the current problems and advance the knowledge further in the fields of semiconductor devices and circuits, signal processing, telecommunication, data science etc. using scientific knowledge acquired from the programme and state of the art software and hardware tools available.

CURRICULUM

The minimum credits for completing the B. Tech. programme in Electronics and Communication Engineering is **160**

MINIMUM CREDIT REQUIREMENT FOR THE VARIOUS COURSE CATEGORIES

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

SI. No.	COURSE CATEGORY	Number of Courses	Credits
1.	Mathematics (MA)	4	12
2.	Science (BS)	5	10
3.	Humanities (HL)	3	9
4.	Basic Engineering(BE)	6	15
5.	Professional Core (PC)	27	81
6.	Open Electives (OE)	2	6
7.	Departmental Electives (DE)	7	21
8.	Other Courses (OT)	4	6
	TOTAL	58	160

COURSE REQUIREMENTS

1. MATHEMATICS (MA)

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.	MA2002D	Mathematics IV *	3	1	0	3
Total			12	4	0	12

* Mathematics IV will be branch specific.

2. SCIENCE (BS)

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
Total			8	0	4	10

3. HUMANITIES (HL)

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
Total			9	0	0	9

4. BASIC ENGINEERING (BE)

Sl.No.	Course Code	Course Title	L	T	P	Credits
1.	ZZ1001D	Engineering Mechanics	3	0	0	3
2.	ZZ1002D	Engineering Graphics	2	0	2	3
3.	ZZ1003D	Basic Electrical Sciences	3	0	0	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
Total			10	0	8	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.	EC3014D	Environmental Studies for Electronics Engineers	3	0	0	3
Total			3	0	6	6

6. PROFESSIONAL CORE (PC)

Sl.No.	Course Code	Course Title	Pre-requisites	L	T	P	Credits
1.	EC2011D	Electric Circuits and Network Theory	Nil	3	1	0	3
2.	EC2012D	Digital Circuits and Systems	Nil	3	1	0	3
3.	EC2013D	Solid State Devices	Nil	4	0	0	4

4.	EC2014D	Signals and Systems	Nil	4	0	0	4
5.	EC2021D	Electronic Circuits I	EC2011D & EC2013D	4	0	0	4
6.	EC2022D	Electromagnetic Field Theory	Nil	4	0	0	4
7.	EC2023D	Microprocessors and Microcontrollers	EC2012D	3	0	0	3
8.	EC2024D	Communication Theory and Systems I	EC2014D	4	0	0	4
9.	EC3011D	Electronic Circuits II	EC2021D	3	0	0	3
10.	EC3012D	Communication Theory and Systems II	EC2024D	4	0	0	4
11.	EC3013D	Digital Signal Processing	EC2014D	3	0	0	3
12.	EC3021D	Information Theory and Coding	EC3012D	4	0	0	4
13.	EC3022D	Computer Networks	EC2024D	3	0	0	3
14.	EC3023D	Control Systems	EC2014D	3	0	0	3
15.	EC4011D	Wireless Communication	EC3012D	3	0	0	3
16.	EC4012D	Radiation and Antenna Theory	EC2022D	3	0	0	3
17.	EC2091D	Devices and Networks Lab	Nil	0	0	3	2
18.	EC2092D	Digital Circuits and Systems Lab	Nil	0	0	3	2
19.	EC2093D	Electronic Circuits Lab I	Nil	0	0	3	2
20.	EC2094D	Microprocessors and Microcontrollers Lab	Nil	0	0	3	2
21.	EC3091D	Electronic Circuits Lab II	Nil	0	0	3	2
22.	EC3092D	Communication Engineering Lab I	EC2024D	0	0	3	2

23.	EC3093D	Digital Signal Processing Lab	EC3013D	0	0	3	2
24.	EC4091D	Communication Engineering Lab II	EC3021D & EC3022D	0	0	3	2
25.	EC4092D	Seminar	Nil	0	0	3	2
26.	EC4098D	Project: Part I	Nil	0	0	6	3
27.	EC4099D	Project: Part II	EC4098D	0	0	10	5
Total				55	2	43	81

7. DEPARTMENTAL ELECTIVES (DE)

Seven elective courses are to be credited as Departmental Electives from the list given below for B.Tech. programme in Electronics and Communication Engineering. Some of the departmental elective courses will also be offered as **open electives**.

Sl.No.	Course Code	Course Title	Pre-requisites	L	T	P	Credits
1.	EC3051D	Data Structures using C++	Nil	3	0	0	3
2.	EC3052D	Microelectronics Technology	EC2013D	3	0	0	3
3.	EC3053D	Semiconductor Device Modelling	EC2013D	3	0	0	3
4.	EC3054D	Compound Semiconductor Devices	EC2013D	3	0	0	3
5.	EC3055D	Power Semiconductor Devices	EC2013D	3	0	0	3
6.	EC3056D	MEMS	Nil	3	0	0	3
7.	EC3057D	Modelling and Testing of Digital Systems	EC2012D	3	0	0	3
8.	EC3058D	VLSI Circuits and Systems	EC2012D	3	0	0	3
9.	EC3059D	Active Network Synthesis	EC3011D	3	0	0	3
10.	EC3060D	Computer Organization and Architecture	EC2012D	3	0	0	3
11.	EC3061D	Embedded Systems	EC2023D	3	0	0	3

12.	EC3062D	Electronic Instrumentation	Nil	3	0	0	3
13.	EC3063D	Multi Rate Systems	EC3013D	3	0	0	3
14.	EC3064D	Digital Image Processing	EC3013D	3	0	0	3
15.	EC3065D	Statistical Signal Modelling and Processing	EC2014D	3	0	0	3
16.	EC4051D	Microwave Communication	EC2022D	3	0	0	3
17.	EC4052D	Radar Engineering	EC2022D	3	0	0	3
18.	EC4053D	Opto-electronic Communication Systems	EC2022D	3	0	0	3
19.	EC4054D	Communication Switching Systems	EC3022D	3	0	0	3
20.	EC4055D	Signal Estimation and Detection	EC2024D	3	0	0	3
21.	EC4056D	Multicarrier and MIMO Techniques	EC3012D	3	0	0	3
22.	EC4057D	Wireless Technologies and Systems	Nil	3	0	0	3
23.	EC4058D	Speech and Audio Processing	EC3013D	3	0	0	3
24.	EC4059D	Signal Compression	EC3021D	3	0	0	3
25.	EC4060D	Multimedia Systems and Applications	EC2014D	3	0	0	3
26.	EC4061D	Biomedical Signal Processing	EC3013D	3	0	0	3
27.	EC4062D	Wavelet Theory	EC3013D	3	0	0	3
28.	EC4063D	Compressed Sampling: Principles and Algorithms	EC3013D	3	0	0	3
29.	EC4064D	Cryptography: Theory and Practice	Nil	3	0	0	3
30.	EC4065D	Radio Frequency Circuits	EC2021D & EC2022D	3	0	0	3
31.	EC4066D	Nanoelectronics		3	0	0	3

32.	EC4067D	Solid State Image Sensors	EC2013D	3	0	0	3
33.	EC4068D	Analog MOS Integrated Circuits	EC3011D	3	0	0	3
34.	EC4069D	Advanced VLSI Circuits	EC2012D	3	0	0	3
35.	EC4070D	Internet of Things	Nil	3	0	0	3
36.	EC4071D	Architecture of Advanced Processors	EC2023D	3	0	0	3
37.	EC4072D	Architectures for Digital Signal Processing	EC3013D	3	0	0	3
38.	EC4073D	Optimization Techniques	Nil	3	0	0	3
39.	EC4074D	Computer Vision: Algorithms and Applications	Nil	3	0	0	3
40.	EC4075D	Digital Video Processing	EC3013D	3	0	0	3
41.	EC4076D	Pattern Classification		3	0	0	3

8. OPEN ELECTIVES (OE)

Two elective courses are to be credited as Open Elective courses. One of the open electives shall be on any foreign language. [Any elective course offered by the same Department/Centre or any Core/ Elective course offered by other Departments/Centres is termed as Open Elective.]

Course 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
1	MA2001D	Mathematics III	3	1	0	3	MA
2	EC2011D	Electric Circuits and Network Theory	3	1	0	3	PC
3	EC2012D	Digital Circuits and Systems	3	1	0	3	PC
4	EC2013D	Solid State Devices	4	0	0	4	PC
5	EC2014D	Signals and Systems	4	0	0	4	PC
6	EC2091D	Devices and Networks Lab	0	0	3	2	PC
7	EC2092D	Digital Circuits and Systems Lab	0	0	3	2	PC
Total Credits			17	3	6	21	

Semester IV

Sl. No.	Course Code	Course Title	L	T	P	Credits	Category
1	MA2002D	Mathematics IV	3	1	0	3	MA
2	EC2021D	Electronic Circuits I	4	0	0	4	PC
3	EC2022D	Electromagnetic Field Theory	4	0	0	4	PC
4	EC2023D	Microprocessors and Microcontrollers	3	0	0	3	PC
5	EC2024D	Communication Theory and Systems I	4	0	0	4	PC
6	EC2093D	Electronic Circuits Lab I	0	0	3	2	PC
7	EC2094D	Microprocessors and Microcontrollers Lab	0	0	3	2	PC
Total Credits			18	1	6	22	

Semester V

Sl. No.	Course Code	Course Title	L	T	P	Credits	Category
1	MS3001D	Economics	3	0	0	3	HL
2	EC3011D	Electronic Circuits II	3	0	0	3	PC
3	EC3012D	Communication Theory and Systems II	4	0	0	4	PC
4	EC3013D	Digital Signal Processing	3	0	0	3	PC
5	EC3014D	Environmental Studies for Electronics Engineers	3	0	0	3	OT
6		Elective I	3	0	0	3	DE/OE
7	EC3091D	Electronic Circuits Lab II	0	0	3	2	PC
8	EC3092D	Communication Engineering Lab I	0	0	3	2	PC
Total Credits			19	0	6	23	

Semester VI

Sl. No.	Course Code	Course Title	L	T	P	Credits	Category
1	ME3104D	Principles of Management	3	0	0	3	HL
2	EC3021D	Information Theory and Coding	4	0	0	4	PC
3	EC3022D	Computer Networks	3	0	0	3	PC
4	EC3023D	Control Systems	3	0	0	3	PC
5		Elective II	3	0	0	3	DE/OE
6		Elective III	3	0	0	3	DE/OE
7	EC3093D	Digital Signal Processing Lab	0	0	3	2	PC
	Total Credits		19	0	3	21	

Semester VII

Sl. No.	Course Code	Course Title	L	T	P	Credits	Category
1	EC4011D	Wireless Communication	3	0	0	3	PC
2	EC4012D	Radiation and Antenna Theory	3	0	0	3	PC
3		Elective IV	3	0	0	3	DE/OE
4		Elective V	3	0	0	3	DE/OE
5		Elective VI	3	0	0	3	DE/OE
6	EC4091D	Communication Engineering Lab II	0	0	3	2	PC
7	EC4092D	Seminar	0	0	3	2	PC
8	EC4098D	Project: Part I	0	0	6	3	PC
	Total Credits		15	0	12	22	

Semester VIII

Sl. No.	Course Code	Course Title	L	T	P	Credits	Category
1	EC4099D	Project: Part II	0	0	10	5	PC
2		Elective VII	3	0	0	3	DE/OE
3		Elective VIII	3	0	0	3	DE/OE
4		Elective IX	3	0	0	3	DE/OE
	Total Credits		9	0	10	14	

Notes:

1. For the successful completion of B.Tech programme, a student must complete the minimum number of courses of each category specified in the curriculum of the specific programme. In addition to the above, the student must have acquired a total of 160 credits.
2. A student who completes all the course requirements (except the project) before the final semester may be permitted to undertake project at an institute/industry outside with the consent of the department.

MA1001D MATHEMATICS I

Pre-requisites: Nil

L	T	P	C
3	1	0	3

Total hours: 39

Brief Syllabus:

Limit, Continuity and Differentiability of functions of one variable and functions of several variables, Maxima and minima, Convergence of sequences and series, Multiple integrals and its applications, Parameterised curves in space, Vector differential calculus, Vector integral calculus and integral theorems.

MA1002D MATHEMATICS II

Pre-requisites: Nil

L	T	P	C
3	1	0	3

Total hours: 39

Brief Syllabus:

System of Linear equations, Vector spaces, Linear transformation, Orthogonalisation, Matrices and their properties, Diagonalisation, Quadratic forms, Ordinary Differential Equations, Applications to engineering problems, Gamma function, Beta function, Laplace transforms, Solution of differential equations and integral equations using Laplace transform.

PH1001D PHYSICS

Pre-requisites: Nil

L	T	P	C
3	0	0	3

Total hours: 39

Brief Syllabus:

Particle nature of radiation, properties of matter waves, uncertainty principle, Schrödinger equation and its applications, symmetry and anti-symmetry under exchange of particles, Pauli's exclusion principle, quantum model of a solid, Statistical Physics – classical and quantum distributions and applications.

CY1001D CHEMISTRY

Pre-requisites: Nil

L	T	P	C
3	0	0	3

Total hours: 39

Brief Syllabus:

Infrared and Electronic Spectroscopy, Gas Chromatography and High Performance Liquid Chromatography, Thermogravimetry, Differential Scanning Calorimetry and Differential Thermal Analysis, Corrosion mechanisms, control and prevention, Cyclic voltammetry, Potentiometry, Fuel cells, Liquid crystals, Homogeneous and heterogeneous catalysis, Organometallic compounds, Oxidative addition, Reductive elimination, insertion and Elimination reactions, Wilkinson's catalyst, Zeigler-Natta catalysis, Enzyme catalysis, Mechanisms, Turnover number, Co-enzymes and cofactors

MS1001D PROFESSIONAL COMMUNICATION

Pre-requisites: Nil.

L	T	P	C
3	0	0	3

Total hours: 39

Brief Syllabus:

Speaking skills, Fundamental Grammar, Dealing with the nuances of ambiguous constructions, Formal Writing, Effective non-verbal communication skills, Presentation Skills.

ZZ1001D ENGINEERING MECHANICS

Pre-requisites: Nil

L	T	P	C
3	0	0	3

Total hours: 39

Brief Syllabus:

Basic concepts of mechanics, important vector quantities, equivalent force systems, resultants of various force systems, equations of equilibrium, applications of equations equilibrium, properties of surfaces, method of virtual work, kinematics of a particle, dynamics of a particle, energy and momentum methods for a particle.

ZZ1002D ENGINEERING GRAPHICS

Pre-requisites: Nil

L	T	P	C
2	0	2	3

Total hours: 52

Brief Syllabus:

Introduction; Drawing instruments; Lines, lettering and dimensioning; Constructions of scales; Orthographic projection of points, lines, planes, and solids; Orthographic projection of solids in section; Development of surfaces of solids; Isometric projection of solids.

ZZ1003D BASIC ELECTRICAL SCIENCES

Pre-requisites: Nil

L	T	P	C
3	0	0	3

Total hours: 39

Brief Syllabus:

Analysis of resistive circuits - Node Voltage and Mesh Current Analysis, Circuit Theorems, Magnetic circuits, two terminal element relationships – Inductance, Capacitance, Single phase AC circuits – Phasor representation, analysis of ac circuits, power in ac circuits sensors and transducers, basics of signal amplification, operational amplifier basics, Digital Electronics- K maps, Combinational and sequential circuits, data converters.

ZZ1004D COMPUTER PROGRAMMING

Pre-requisites: Nil

L	T	P	C
2	0	0	2

Total hours: 26

Brief Syllabus:

Data types, operators, expressions, Control flow constructs, Functions and program structure, parameter passing, Arrays, multi-dimensional arrays, structures and unions.

BT1001D INTRODUCTION TO LIFE SCIENCE

Pre-requisites: Nil

L	T	P	C
2	0	0	2

Total hours: 26

Brief Syllabus:

Different hypotheses on the origin and evolution of life, Diversity of Life, Chemistry of life, structure and functions of biological macromolecules, structure and organization of cells, compartmentalization and its significance, cell division, energy transformation, Mendel's Law of inheritance, Ecosystems and restoration ecology.

PH1091D PHYSICS LAB

Pre-requisites: Nil

L	T	P	C
0	0	2	1

Total hours: 26

Brief Syllabus

Basic level experiments in optics, heat, semiconductors and modern physics. A total of 8 experiments to be done

CY1094D CHEMISTRY LAB

Pre-requisites: Nil

L	T	P	C
0	0	2	1

Total hours: 26

Brief Syllabus:

Polarimetry, Potentiometric titrations, Complexometric estimations, Conductometry, Determination of pH, Chromatographic separations, Viscometry, Colorimetric estimations, Synthesis of organic/inorganic compounds and their characterizations

ZZ1091D WORKSHOP I

Pre-requisites: Nil

L	T	P	C
0	0	3	2

Total hours: 39

Brief Syllabus:

Surveying- setting out and leveling exercise and introduction to total station with hands on sessions. Material testing – various tests on cements, tests on hardened concrete, hardness tests on metals, test on concrete and steel specimens. Masonry – hands on sessions on construction practices. Water supply and sanitation – basics. Various tests on driver’s characteristics. Familiarization of wiring tools and introduction to various types of wiring systems. Electric shock phenomenon - precautions, preventions, and earthing. Wiring – hands on sessions, domestic applications. Familiarization of various types of Fuses, MCBs, ELCBs. Estimation and costing of wiring.

ZZ1092D WORKSHOP II

Pre-requisites: Nil

L	T	P	C
0	0	3	2

Total hours: 39

Brief Syllabus:

The course is intended to expose the student to various manufacturing processes through hands on training in different sections of Central Workshop and make the student familiar with electronic components & circuits and perform troubleshooting of electronic boards of household appliances. During the course, the student learns the properties and selection of different materials and acquires the skill in using various tools and measuring devices. The students will also learn to prepare cost estimation and costing of PCB soldering and carry out the soldering.

ZZ1093D PHYSICAL EDUCATION

Pre-requisites: Nil

L	T	P	C
1	0	1	1

Total hours: 26

Brief Syllabus:

Introduction, definition, aims & objectives of Physical Education, Physical fitness and components. Health related Physical fitness and components, Physical exercise and its principles. Activities for developing physical fitness – walking, jogging, running, weight training, stretching, yogasanas. Athletic injuries and their management, Motivation and its importance in sports. Stress, anxiety, tension, aggression in sports, lifestyle diseases and its management, Olympic Values Education. Event & Crisis management.

ZZ1094D VALUE EDUCATION

Pre-requisites: Nil

L	T	P	C
1	0	1	1

Total hours: 26

Brief Syllabus:

Social Justice Definition –need-parameters of social justice –factors responsible for social injustice –caste and gender –contributions of social reformers. Human Rights and Marginalized People - Concept of Human

Rights-Principles of human rights-human rights and Indian Constitution, Social Issues and Communal Harmony, Social issues–causes and magnitude-alcoholism, drug addiction, poverty, unemployment etc.-communal harmony-concept-religion and its place in public in public domain, Media Education and Globalized World Scenario Mass media-functions-characteristics-need and purpose of media literacy-effects and influence –youth and children, Values and Ethics Personal values –family values-social values-cultural values- professional values-and overall ethics-duties and responsibilities

ZZ1095D NSS

Pre-requisites: Nil

L	T	P	C
0	0	3	1

Total hours: 39

Brief Syllabus:

Regular NSS Activities and Special Camping programme. Regular NSS Activity: NSS volunteers undertake various activities in adopted villages and slums for community service. Orientation of NSS volunteers, Campus Work, Community service, Institutional work, Rural Project, Urban Projects, National Days and Celebrations, Blood Donation Activities, Campus farming activities, Activities for social inclusion such as organizing programmes for differently – abled children. Special Camping Programme.

MA2001D MATHEMATICS III

Pre-requisites: Nil

L	T	P	C
3	1	0	3

Total hours: 39

Brief Syllabus:

Probability distributions, Random variables, Expectations, Mean, Variance and Moment generating function of a probability distribution, Chebyshev's theorem. Some important probability distributions, transformation of random variables, jointly distributed random variables. Introduction to statistical inference, sampling distributions, Maximum likelihood estimation, Point estimation and interval estimation of mean, variance and proportion, Hypothesis tests concerning one variance and two variances, one proportion and several proportions, Analysis of $r \times c$ contingency tables, chi – square test for goodness of fit. Analysis of variance, completely randomized designs, Randomized block design. Estimation of simple regression model and hypotheses tests concerning regression coefficients, Estimation of correlation coefficient, Hypothesis concerning correlation coefficient. Estimation of curvilinear regression models.

EC2011D ELECTRIC CIRCUITS AND NETWORK THEORY

Pre-requisites: Nil

L	T	P	C
3	1	0	3

Total hours: 39

Brief Syllabus:

Network theorems, Transients in linear circuits – time domain analysis of first and second order circuits, Steady state analysis, s-Domain Analysis of Circuits, Network functions – frequency response from Network functions, Ideal frequency selective filters, Two port networks and two port parameters - Image

impedance parameter description of a two port network, Introduction to Network Topology - Analysis of networks using tie-set and cut-set

EC2012D DIGITAL CIRCUITS AND SYSTEMS

Pre-requisites: Nil

L	T	P	C
3	1	0	3

Total hours: 39

Brief Syllabus

Number systems and Boolean algebra, Boolean functions, combinational digital circuits: Arithmetic Circuits, Comparators and parity generators, Expressing combinational digital circuits through HDL, Sequential circuits, design, synchronous circuits, asynchronous circuits, state diagrams, state reduction and optimization, Hazards and hazard free realizations, TTL and MOS gate families.

EC2013D SOLID STATE DEVICES

Pre-requisites: Nil

L	T	P	C
4	0	0	4

Total hours: 52

Brief Syllabus:

Semiconductor physics – junctions - homo and hetero junctions – p n junction diode – Schottky diode – LED solar cell and photo detector– MOS junction – MOSFET – large signal and small signal models of MOSFET and BJT.

EC2014D SIGNALS AND SYSTEMS

Pre-requisites: Nil

L	T	P	C
4	0	0	4

Total hours: 52

Brief Syllabus:

Functions and Continuous-time systems, Analysis of the linear time-invariant systems in the time domain: linear differential equation models, Analysis in the Laplace and Fourier domains; Discrete-time sequences and linear shift-invariant systems: linear difference equation models, Analysis in the time domain, and in the Z-domain, Fourier analysis of the discrete-time sequences.

EC2091D DEVICES AND NETWORKS LAB

Pre-requisites: Nil

L	T	P	C
0	0	3	2

Total hours: 39

Brief Syllabus:

Familiarization of electronic equipment and components – Passive filter and resonant circuits - Rectifier, filter and regulator circuits – Transistor characteristics

EC2092D DIGITAL CIRCUITS AND SYSTEMS LAB

Pre-requisites: Nil

L	T	P	C
0	0	3	2

Total hours: 39

Brief Syllabus:

Transfer Characteristics of TTL gates, Combinational Logic design, Arithmetic circuits, Flip flop circuit, synchronous and asynchronous Counters, Sequential Circuit designs, HDL representation of designs.

MA2002D MATHEMATICS IV

Pre-requisites: MA 1001 Mathematics I
MA 1002 Mathematics II

L	T	P	C
3	1	0	3

Total hours: 39

Brief Syllabus:

Series Solutions and Special Functions: Power series solutions of differential equations, Theory of power series method, Legendre Equation, Legendre Polynomials, Frobenius Method, Bessel's Equation, Bessel functions, Sturm- Liouville's Problems, Orthogonal eigenfunction expansions. Partial differential Equations: Cauchy's problem for first order equations, Linear Equations of the first order, Nonlinear Partial Differential Equations of the first order, Charpit's Method, Special Types of first order equations, Classification of second order partial differential equations, Wave equation, Heat equation, Laplace equation, Solution of a Partial Differential Equations by Laplace transforms. Complex functions, Derivative, Analytic function, Cauchy- Reimann equations, Laplace's equation, Geometry of Analytic functions: Conformal mapping, Linear fractional Transformations, Schwarz - Christoffel transformation, Transformation by other functions, Line integral in the Complex plane, Cauchy's Integral Theorem, Cauchy's Integral formula, Derivatives of analytic functions. Power series, Functions given by power series, Taylor series and Maclaurin's series. Laurent's series, Singularities and Zeros, Residue integration method, Evaluation of real Integrals.

EC 2021D ELECTRONIC CIRCUITS I

Pre-requisites: EC2011D Electric Circuits and Network Theory
EC2013D Solid State Devices

L	T	P	C
4	0	0	4

Total hours: 52

Brief Syllabus:

BJT and MOSFET controlled sources, output resistance, voltage amplification, amplifier transfer function, bandwidth, accurate gain, negative feedback, stability, frequency compensation, op amp properties, linear and nonlinear op amp circuits, op amp non-idealities, ADCs and DACs, linear regulators, DC-DC converters, first and second order active filters, filter approximations, frequency transformations, universal active filter, inductance emulation, switched capacitor filter, PLL and applications

EC2022D ELECTROMAGNETIC FIELD THEORY

Pre-requisites: Nil

L	T	P	C
4	0	0	4

Total hours: 52

Brief Syllabus:

Coulomb's law, Gauss's law, Poisson's equation, Laplace's equation, solutions to electrostatic boundary problems, permittivity and dielectric constant, Lorentz force, Biot-Savart law, Ampere's law, magnetic susceptibility and permeability, electromagnetic induction, continuity equation, displacement current, Maxwell's equations, Poynting's theorem, energy and momentum in electromagnetic field, monochromatic plane waves, group velocity, Lorentz gauge, normal and oblique incidence of electromagnetic waves at boundaries, transmission lines, Smith chart, waveguides, modes of operation, characteristics

EC2023D MICROPROCESSORS AND MICROCONTROLLERS

Pre-requisites: EC2012D Digital Circuits and Systems

L	T	P	C
3	0	0	3

Total hours: 39

Brief Syllabus:

Intel 8086 processor: The architecture of 8086 —Addressing modes-use of MASM - Programming concepts-hardware, address mapping, interrupts, 8051 microcontroller: architecture Instruction set-internal peripherals and external peripheral interfacing, Introduction to MSP 430-Architecture and peripherals

EC2024D COMMUNICATION THEORY AND SYSTEMS I

Pre-requisites: EC2014D Signals and Systems

L	T	P	C
4	0	0	4

Total hours: 52

Brief Syllabus:

Fundamentals of analog communication systems, Review of linear time invariant systems, Fourier series, Fourier Transforms, Energy/ Power Spectral Density and Bandwidth, Generation, transmission and reception of amplitude modulation (AM), frequency modulation (FM) and phase modulation (PM) signals. Statistical characteristics of discrete, continuous random variables and vectors, Correlation, covariance and power spectral density of stationary random processes, White Noise, Signal to Noise Ratio (SNR) performance of AM, FM and PM systems

EC2093D ELECTRONIC CIRCUITS LAB I

Pre-requisites: Nil

L	T	P	C
0	0	3	2

Total hours: 39

Brief Syllabus:

Amplifier design using transistor, Measurement of op amp parameters, Op-amp based circuits, Universal active filter, Characterization of ADC/DAC, simple data acquisition system, Voltage regulator, PLL applications, Introduction to circuit simulators

EC2094D MICROPROCESSORS AND MICROCONTROLLERS LAB

Pre-requisites: Nil

L	T	P	C
0	0	3	2

Total hours: 39

Brief Syllabus:

MASM programming for 8086- 8051 assembly language programming-interfacing different components with 8051 and programming using Embedded-C- Design of small electronic systems using MSP430

MS3001D ECONOMICS

Pre-requisites: Nil

L	T	P	C
3	0	0	3

Total hours: 39

Brief Syllabus:

Micro Economics, Demand and Supply Forces, Elasticity concepts, Short run and long run costs, Market Structure, Pricing in different markets, Game theory, Macro Economic Aggregates-Gross Domestic Product, Inflation , Fiscal and Monetary Policies ; Monetary system; Money Market, Capital market; Indian stock market; Break even analysis.

EC3011D ELECTRONIC CIRCUITS II

Pre-requisites: EC2021D Electronic Circuits I

L	T	P	C
3	0	0	3

Total hours: 39

Brief Syllabus:

Single stage amplifiers, biasing, current mirrors, controlled sources realization, differential amplifiers, frequency response of amplifiers, wide band amplifiers, Operational amplifiers, Comparators, Feedback amplifiers and oscillators, Output stages and Power amplifiers, Conversion efficiency of power amplifiers.

EC3012D COMMUNICATION THEORY AND SYSTEMS II

Pre-requisites: EC2024D Communication Theory and Systems I

L	T	P	C
4	0	0	4

Total hours: 52

Brief Syllabus:

Review of signals, systems, random variables and processes — Analog-to-digital conversion, Nyquist sampling theorem -, Pulse coded modulation- Signal space representation- Signal constellation- Line coding schemes -Pass band modulation schemes- Optimum waveform receiver in additive white Gaussian noise (AWGN) channels - Correlation receiver, Matched filter receiver and error probabilities- ML and MAP receivers- Coherent and non-coherent reception -- Probability of error performance of digital base band and pass band modulation schemes in AWGN channels – Comparison of bandwidth and error rate performance of digital modulation schemes- Communication over band limited channels- , Nyquist criterion for zero ISI - Optimum pulse shaping- Partial response signaling- Equalization Techniques

EC3013D DIGITAL SIGNAL PROCESSING

Pre-requisites: EC2014D Signals and Systems

Total hours: 39

L	T	P	C
3	0	0	3

Brief Syllabus:

Time domain and frequency domain representation of discrete time signals and systems. The DFT - Fast algorithms for DFT computation. Design of digital filters: FIR and IIR filter design using various methods - Filter implementation aspects: Structures for FIR and IIR filters - Finite word length effects in filter implementation.

EC3014D ENVIRONMENTAL STUDIES FOR ELECTRONICS ENGINEERS

Pre-requisites: Nil

Total hours: 39

L	T	P	C
3	0	0	3

Brief Syllabus:

Renewable and non-renewable resources - Role of individual in conservation - Growing energy needs, use of alternate energy sources, energy consumption in electronic systems- Eco systems – Food chains- - Biodiversity and conservation - Environmental pollution - methods of prevention - waste management - disaster management - environmental ethics - sustainable development models - water conservation - climate change and global warming - consumerism and waste products - Electronic product life cycle, recycling electronics, Design for Environment (DFE), Human Population and the Environment– Family Welfare Programme, environment and human health, biological impact of materials used in electronic products and manufacturing process.

EC3091D ELECTRONIC CIRCUITS LAB II

Pre-requisites: Nil

Total hours: 39

L	T	P	C
0	0	3	2

Brief Syllabus:

Biasing schemes, Current source and current mirror, Amplifier – frequency and phase response, Power amplifiers, Feedback amplifiers, Oscillator circuits

EC3092D COMMUNICATION ENGINEERING LAB I

Pre-requisites: EC2024D Communication Theory and Systems I

L	T	P	C
0	0	3	2

Total hours: 39

Brief Syllabus:

Hardware design, implementation and testing of analog modulation schemes such as AM, DSBSC, FM and the corresponding demodulation schemes – Realization of various blocks in AM/FM radio super heterodyne receivers- Hardware implementation of a simple wired analog communication system

ME3104D PRINCIPLES OF MANAGEMENT

Pre-requisites: Nil

L	T	P	C
3	0	0	3

Total hours: 39

Brief Syllabus:

Introduction to management, classical, neo-classical and modern management theories, Levels of managers and skill required. Management process – planning – mission – objectives – goals – strategy – policies – programmes – procedures. Organizing, principles of organizing, organization structures, Directing, leadership, motivation, Controlling. Decision making process, decision making under certainty, risk and uncertainty, decision trees, models of decision making. Introduction to functional areas of management, Operations management, Human resources management, Marketing management, Financial management, entrepreneurship, business plans, corporate social responsibility, patents and Intellectual property rights.

EC3021D INFORMATION THEORY AND CODING

Pre-requisites: EC3012D Communication Theory and Systems II

L	T	P	C
4	0	0	4

Total hours: 52

Brief Syllabus:

Representation of Information bearing messages - Entropy and Differential entropy – Source coding theorem – Construction of lossless source codes- Channel Coding theorem – Construction of Channel codes – Finite field algebra – linear and convolutional codes – Encoding and decoding strategies of channel codes – performance analysis of channel coding schemes.

EC3022D COMPUTER NETWORKS

Pre-requisites: EC3012D Communication Theory and Systems II

L	T	P	C
3	0	0	3

Total hours: 39

Brief Syllabus:

Layering and protocols - OSI architecture - Internet architecture —Circuit switching - packet switching - Datagram Networks - Virtual Circuit networks - Reliable transmission - Multiple access protocols - Ethernet (IEEE 802.3) - wireless LAN (IEEE 802.11) - IPv4 - ARP - Routing- distance vector (RIP) - Link state (OSPF) - subnetting – CIDR - inter-domain routing (BGP) - IPv6 - UDP – TCP - congestion control - Broadband services and QoS issues - Integrated service architecture- Weighted Fair Queuing- Random Early Detection- Differentiated Services -RSVP- Multi protocol Label switching- Real Time transport protocol

EC3023D CONTROL SYSTEMS

Pre-requisites: Nil

L	T	P	C
3	0	0	3

Total hours: 39

Brief Syllabus:

Introduction to control systems – Mathematical Modelling – Transient and Steady state response – Stability Analysis- Root Locus-Compensation Techniques- Polar plots-Bode plot-PID Controller-State Space Analysis – Introduction to Digital Control Systems

EC3093D DIGITAL SIGNAL PROCESSING LAB

Pre-requisites: EC3013D Digital Signal Processing

L	T	P	C
0	0	3	2

Total hours: 39

Brief Syllabus:

Experiments using programming languages/dedicated software/hardware illustrating the time domain and the frequency domain representation of discrete time signals and systems. Implementation of DFT, and filtering in time and frequency domains, FIR and IIR filter designs and implementations. Application of DSP algorithms to speech/music and image processing and a course project

EC4011D WIRELESS COMMUNICATION

Pre-requisite: EC3012D Communication Theory and Systems II

L	T	P	C
3	0	0	3

Total hours: 39

Brief Syllabus:

Cellular Mobile Architecture – Interference Aspects - Handoff Mechanisms – Wireless Channel Characterisation – Frequency and Time Characterisation – Communicating through Fading Channels – Diversity Techniques – multiple antennas and space time communications - Spread Spectrum Systems – multiuser systems – multiple access - capacity analysis

EC4012D RADIATION AND ANTENNA THEORY

Pre-requisites: EC2022D Electromagnetic Field Theory

L	T	P	C
3	0	0	3

Total hours: 39

Brief Syllabus:

Basic antenna parameters, radiation resistance, retarded field, principles of reciprocity, measurement of radiation pattern, gain, directivity and impedance of antenna, antenna array, properties and design of broadside, endfire and binomial arrays, types of antennas: design, characteristics and applications, propagation of radio waves, sky wave propagation, MUF, skip distance, space wave propagation, duct propagation, tropospheric scatter propagation, fading and diversity techniques.

EC4091D COMMUNICATION ENGINEERING LAB II

Pre-requisites: EC3012D Communication Theory and Systems II

EC3021D Information Theory and Coding

L	T	P	C
0	0	3	2

Total hours: 39

Brief Syllabus:

Hardware design, implementation and testing of digital modulation schemes such as PCM, DPCM, BPSK, QPSK, BFSK, DPSK- Hardware realization of encoders and decoders for linear block codes and cyclic codes- Simulation and performance evaluation of digital modulation and channel coding schemes over AWGN channels

EC4092D SEMINAR

Pre-requisites: Nil

L	T	P	C
0	0	3	2

Total hours: 39

Brief Syllabus:

The objective of the seminar is to impart training to the students in collecting materials on a specific topic in the broad domain of Engineering/Science from books, journals and other sources, compressing and organizing them in a logical sequence, and presenting the matter effectively both orally and as a technical report.

EC4098D PROJECT: PART I

Pre-requisites: Nil

L	T	P	C
0	0	6	3

Total hours: 78

Brief Syllabus

Final year major projects represent the culmination of study towards the Bachelor of Technology (B. Tech.) degree. The major projects offer the opportunity to apply and extend knowledge acquired throughout the B. Tech. program. The major project can be analytical work, simulation, hardware design or a combination of these in the emerging areas of Electronics and Communication Engineering under the supervision of a faculty from the ECE Department.

EC4099D PROJECT: PART II

Pre-requisites: successful completion of EC4098D PROJECT I

L	T	P	C
0	0	10	5

Total hours: 130

Brief Syllabus

EC4099D Project II is a continuation of EC4098 Project I started in the seventh semester. Students should complete the work planned in the seventh semester and prepare the project report on the complete work done in the two semesters.

EC3051D DATA STRUCTURES USING C++

Pre-requisites: Nil

L	T	P	C
3	0	0	3

Total hours: 39

Brief Syllabus

General concepts of object oriented programming C++ Class overview-Complexity analysis, Asymptotic notation, Recursion. Sorting algorithms: Selection Sort, Quick sort, Merge Sort. Implementation of sorting, searching, linked lists, stack and queues using C++. Binary tree - in-order, pre-order and post-order traversals-Binary Search trees - insertion, deletion and search- Prefix, Infix ,and Post fix representation and conversions,-Heaps and heap sort-Graph representation-Depth First Search (DFS)-Breadth First Search(BFS), Minimum spanning tree problem-Implementation of graph algorithms using C++and the Standard Template library -Hashing

EC3052D MICROELECTRONICS TECHNOLOGY

Pre-requisites: EC2013D Solid State Devices

L	T	P	C
3	0	0	3

Total hours: 39

Brief Syllabus:

Material properties, crystal structure, Crystal growth techniques, wafer cleaning, Epitaxy, Clean room and safety requirements, Oxidation-Kinetics, Deal-Grove model and Improvements in Deal-Grove method for thin and ultra thin oxide layers, , Diffusion and Ion Implantation, Deposition & Growth, Growth of High k and low k dielectrics, Etch and Cleaning, Photolithography, Planarization Techniques, Chemical Mechanical Polishing, Copper damascene process, Metal interconnects; Multi-level metallization schemes, Process integration

EC3053D SEMICONDUCTOR DEVICE MODELING

Pre-requisites: EC2013D Solid State Devices

L	T	P	C
3	0	0	3

Total hours: 39

Brief Syllabus:

Review of semiconductor physics – Introduction to modeling - physical modeling – modeling of semiconductor device physics - mobility models – modeling of I-V characteristics of solid state devices-MOSFET modeling

EC3054D COMPOUND SEMICONDUCTOR DEVICES

Pre-requisites: EC2013D Solid State Devices

L	T	P	C
3	0	0	3

Total hours: 39

Brief Syllabus:

Basics of compound semiconductor materials and devices – Advantages and disadvantages compared to Si – Compound semiconductor processing – metal semiconductor contacts and MOS systems – MESFET, HEMT and HBT.

EC3055D POWER SEMICONDUCTOR DEVICES

Pre-requisites: EC2013D Solid State Devices

L	T	P	C
3	0	0	3

Total hours: 39

Brief Syllabus:

Planar power diodes – breakdown voltage and on resistance – Edge Termination structures – Power Metal Oxide Semiconductor Field Effect Transistor (MOSFET), Power Bipolar Junction Transistor (BJT) and Insulated Gate Bipolar Junction Transistor (IGBT) – device physics – Characteristics – design considerations - wide band gap materials - Silicon Carbide (SiC)/Gallium Nitride (GaN) devices

EC3056D MEMS

Pre-requisites: Nil

L	T	P	C
3	0	0	3

Total hours: 39

Brief Syllabus:

Introduction to Microelectronics and Microsystems: Classical scaling in CMOS, Moore's law- Clean room concept, Microelectronic technologies for MEMS, MEMS Materials. Microsensors and applications- MEMS Simulators and different FEA tools, Micro machined Micro sensors for Mechanical, Inertial, Biological, Chemical, RF Applications etc- Bonding & Packaging of MEMS

EC3057D MODELING AND TESTING OF DIGITAL SYSTEMS

Pre-requisites: EC2012D Digital Circuits and Systems

L	T	P	C
3	0	0	3

Total hours: 39

Brief Syllabus:

Structural Models of Combinational Logic, Behavioural Modeling, Continuous-Assignment Models - Dataflow/RTL Models - Algorithm Based Models, Blocking and Nonblocking Assignments, Test benches, FSM, Propagation Delay Modeling, Intellectual Property Reuse and Parameterized Models - Clock Generators, Tasks and Functions, Logic Synthesis - RTL Synthesis - High-Level Synthesis, Synthesis of Combinational and Sequential Logic, FPGA architectures, Digital Testing - Test Pattern Generation - Fault Equivalence, Fault Dominance, DFT methods

EC3058D VLSI CIRCUITS AND SYSTEMS

Pre-requisites: EC2012D Digital Circuits and Systems

L	T	P	C
3	0	0	3

Total hours: 39

Brief Syllabus:

Review of MOS transistors - MOSFET capacitances - CMOS inverters-DC and Transient analysis-Area, power and noise margin considerations, Simulation analysis of CMOS Inverter using CAD tools, Multiple input static CMOS logic circuits - Pass transistor, Complementary pass transistor and transmission gate logic styles, Sizing for optimal delay - Logical Effort, Dynamic circuits, C2MOS, TSPC registers, Designing sequential circuits, Cell based design, Standard cells and Data path cells, Logic and circuit design of arithmetic circuits, 6T SRAM and DRAM cell design

EC3059D ACTIVE NETWORK SYNTHESIS

Pre-requisites: EC3011D Electronic Circuits II

L	T	P	C
3	0	0	3

Total hours: 39

Brief Syllabus:

Filter transfer functions and frequency transformations – active building blocks like opamps, OTAs, CC etc – realization of 2nd and higher order filters – design of high frequency integrated filters

EC3060D COMPUTER ORGANIZATION AND ARCHITECTURE

Pre-requisites: EC2012D Digital Circuits and Systems

L	T	P	C
3	0	0	3

Total hours: 39

Brief Syllabus:

Introduction to Computer Abstractions and Technology – Performance –Instructions –Logical Operations – Supporting Procedures in Computer Hardware– ARM Addressing for 32-Bit Immediates and Addressing Modes – Synchronization–Computer Arithmetics – Associativity –Processors– Logic Design – Implementation Scheme – Pipelining – Data Hazards– Control Hazards –Level Parallelism- Memory Hierarchy – The Basics of Caches –Virtual Memory – Storage and I/O –Disk Storage – Flash Storage – Connecting Processors, Memory and I/O Devices – Interfacing I/O Devices to Processor, Memory and Operating System – I/O Performance Measures – I/O System Designing

EC3061D EMBEDDED SYSTEMS

Pre-requisites: EC2023D Microprocessors and Microcontrollers

L	T	P	C
3	0	0	3

Total hours: 39

Brief Syllabus:

Introduction to Embedded Systems, Hardware , inside an MCU, Software Development, Buses and Protocols, The ARM processor, core and interfaces Assembly and C programming , Operating System scheduling and synchronizing, Real time operating system ,Design and development of an embedded product in industry

EC3062D ELECTRONIC INSTRUMENTATION

Pre-requisites: Nil

L	T	P	C
3	0	0	3

Total hours: 39

Brief Syllabus:

Introduction to control systems – Mathematical Modelling – Transient and Steady state response – Stability Analysis- Root Locus-Compensation Techniques- Polar plots-Bode plot-PID Controller-State Space Analysis – Introduction to Digital Control Systems.

EC3063D MULTIRATE SYSTEMS

Pre-requisites: EC3013D Digital Signal Processing

L	T	P	C
3	0	0	3

Total hours: 39

Brief Syllabus:

Multirate System Fundamentals, Multirate Filter Banks, up sampling and down Aliasing and imaging, Interpolator and decimator design, Identities of multi-rate operations, poly-phase representation. M-channel Filter Banks, Errors in filter banks, Prefect reconstruction and Near perfect reconstruction filter banks, Quantization effects, Applications of filter banks.

EC3064D DIGITAL IMAGE PROCESSING

Pre-requisites: EC3013D Digital Signal Processing

L	T	P	C
3	0	0	3

Total hours: 39

Brief Syllabus:

Introduction, Image Digitization, Pixel Relationships, Transformations, Pixel Relationships, Image Interpolation, Image Transformation, Fourier Transformation, Discrete Cosine Transform, K-L Transform, Image Enhancement, Image Restoration, Image Registration, Color Image Processing, Mathematical Morphology, Image Segmentation.

EC3065D STATISTICAL SIGNAL MODELLING AND PROCESSING

Pre-requisites: EC2014D Signals and Systems

L	T	P	C
3	0	0	3

Total hours: 39

Brief Syllabus:

Signal models – AR, MA and ARMA – Spectral factorization –Wiener filtering – Error performance surface- Linear prediction and noise filtering – Levinson Durbin algorithm - Spectrum estimation – Adaptive filtering – Steepest descent method - LMS algorithm – Least squares and Recursive least squares – Kalman filtering- Applications

EC4051D MICROWAVE COMMUNICATION

Pre-requisites: EC2022D Electromagnetic Field Theory

L	T	P	C
3	0	0	3

Total hours: 39

Brief Syllabus:

Communication satellite subsystems, payload, orbital parameters, satellite trajectory, geostationary satellites, non-geostationary constellations, antenna and feed systems, satellite tracking system, fixed and mobile satellite service earth stations, terrestrial microwave links, communication link design, VSAT design issues, multiple access techniques.

EC4052D RADAR ENGINEERING

Pre-requisites: EC2022D Electromagnetic Field Theory

L	T	P	C
3	0	0	3

Total hours: 39

Brief Syllabus:

Radar Equation - Radar frequencies- Applications - Pulse Repetition Frequency and Range ambiguities – Antenna parameters. CW Radar-The Doppler Effect- FM-CW radar- MTI Radar- Non-coherent MTI-Pulse Doppler radar- Tacking Radar. Radar Transmitters - Modulators, Radar Antennas – Receivers - Displays. Detection of Radar signals in noise –Matched filter criterion-Extraction of information and waveform design– Radar clutter, Special purpose radars-HF and over the horizon radar- Height finder and 3D radars –Radar Beacons- Radar Jamming and electronic counters.

EC4053D OPTO-ELECTRONIC COMMUNICATION SYSTEMS

Pre-requisites: EC2022D Electromagnetic Field Theory

L	T	P	C
3	0	0	3

Total hours: 39

Brief Syllabus:

Wave propagation in optical fibers, fiber characteristics – optical sources & detectors - design of optical transmitters & receivers – optical amplifiers and their characteristics – multichannel optical systems – coherent system performance for typical signaling schemes

EC4054D COMMUNICATION SWITCHING SYSTEMS

Pre-requisites: EC3022D Computer Networks

L	T	P	C
3	0	0	3

Total hours: 39

Brief Syllabus:

Basics of a switching system - stored program control - space division switching – strict-sense non- blocking switches - re-arrangeable networks- multi-stage time and space switching- implementation complexity of the switches - blocking probability analysis of multistage switches - Fast packet switching – self routing switches – Banyan network – ATM switches. Traffic Analysis - lost calls cleared – Erlang-B formula, lost calls cleared model with finite sources, delay systems, Erlang-C formula , M/G/1 model, non-preemptive priority models.

EC4055D SIGNAL ESTIMATION AND DETECTION

Pre-requisites: EC2024D Communication Theory and Systems I

L	T	P	C
3	0	0	3

Total hours: 39

Brief Syllabus:

Role of Estimation in Signal Processing, Minimum variance unbiased (MVU) estimators, Cramer-Rao Lower Bound, Linear Modeling, Least Squares Estimation, Best Linear Unbiased Estimation Maximum Likelihood Estimation, Bayesian Philosophy, Minimum Mean Square Error (MMSE) Estimator, MAP Estimator, Linear MMSE Estimator, Wiener Filter. Fundamentals of Detection Theory: Hypothesis Testing, Binary Hypothesis Testing Problem, Bayes' Detection, MAP Detection, ML Detection, Minimum Probability of Error Criterion, Min-Max Criterion, Neyman-Pearson Criterion, Multiple Hypothesis Testing, Detection of Signals in White Gaussian Noise (WGN), M-ary Detection of Known Signals in WGN, Matched Filter Approach.

EC4056D MULTICARRIER AND MIMO TECHNIQUES

Pre-requisites: EC3012D Communication Theory and Systems II

L	T	P	C
3	0	0	3

Total hours: 39

Brief Syllabus:

Multicarrier communication – OFDM – OFDM implementation techniques – Synchronization and Channel estimation techniques for OFDM – PAPR issues and performance analysis of OFDM – Multiple access techniques with OFDM –OFDMA and SC-FDMA- MIMO communication systems - Capacity of MIMO Channels - Diversify of MIMO channels - MIMO diversity receivers - Space time block codes - Space time trellis codes.

EC4057D WIRELESS TECHNOLOGIES AND SYSTEMS

Pre-requisites: Nil

L	T	P	C
3	0	0	3

Total hours: 39

Brief Syllabus:

Fundamentals of Wireless Communications, Multipath Propagation, Basics of Digital Modulation Multiplexing and Multiple Access- Frequency/Time/Code, OFDM and OFDMA, ALOHA, TCP-IP Basics, Overview of 802.11 Wi-Fi, CSMA/CD and CSMA/CA, WLAN Architectures, Physical layer and MAC layer, WLAN Standards: IEEE 802.11a/g/n, Vehicular Adhoc Networks, Wireless Sensor networks, Wireless Personal Area Networks, Cellular architecture, 3GPP-LTE and LTE Advanced, Software defined radio, Cognitive radio, massive MIMO, Device to device communication, Internet of things (IoT)

EC4058D SPEECH AND AUDIO PROCESSING

Pre-requisites: EC3013D Digital Signal Processing

L	T	P	C
3	0	0	3

Total hours: 39

Brief Syllabus:

Discrete Time Modelling of Human Speech Production – Psychoacoustics – Speech and Audio Quality measurement – Linear Predictive Analysis of Speech – Cepstral Analysis of Speech – Time frequency analysis of speech and audio signals – speech coding techniques – perceptual audio coding – speech and audio enhancement techniques – computational auditory scene analysis (CASA) – automatic speech recognition – speaker recognition – music synthesizers.

EC4059D SIGNAL COMPRESSION

Pre-requisites: EC3021D Information Theory and Coding

L	T	P	C
3	0	0	3

Total hours: 39

Brief Syllabus:

Compression Techniques – Mathematical Preliminaries for Lossless Compression, Dictionary Techniques, Lossless Compression Standards (files, text, and images, faxes), Dynamic Markov Compression, Mathematical Preliminaries for Lossy Coding – Rate distortion theory, Converse source coding theorem (Converse of the Rate distortion theorem) - Design of Quantizers: Scalar Quantization, Vector Quantization, Mathematical Preliminaries for Transforms, Subbands, and Wavelets, Transform coding - Subband coding, Speech, Audio, Image and Video Compression Standards.

EC4060D MULTIMEDIA SYSTEMS AND APPLICATIONS

Pre-requisites: EC2014D Signals and Systems

L	T	P	C
3	0	0	3

Total hours: 39

Brief Syllabus:

Multimedia information system : Digital multimedia system, hardware, algorithm and standards, multimedia compression techniques and standards, multimedia communication and networking issues, synchronization, multimedia storage and retrieval, media I/O server and synchronization mechanism, multimedia data transfer service using internet express, conferencing, multimedia standards, tools and application.

EC4061D BIOMEDICAL SIGNAL PROCESSING

Pre-requisites: EC3013D Digital Signal Processing

L	T	P	C
3	0	0	3

Total hours: 39

Brief Syllabus:

Introduction to Biomedical Signals and Systems – Modeling of Biomedical Signals and Systems – Filtering – Artifact Removal – Enhancement – Event Detection – Analysis of ECG, EEG, EMG etc. – analysis of Biomedical images like MRI, PET etc. for enhancement, segmentation and registration – Spatial Filtering, Morphological processing, Image segmentation techniques.

EC4062D WAVELET THEORY

Pre-requisites: EC3013D Digital Signal Processing

L	T	P	C
3	0	0	3

Total hours: 39

Brief Syllabus:

Fourier and Sampling Theory, Generalized Fourier theory, Fourier transform, frames and windowed Fourier frames; Continuous wavelets and continuous wavelet transform; Discrete wavelets and discrete wavelet transform; Regularity, Construction of wavelets and fast algorithm for computing discrete wavelet transform and its inverse.

EC4063D COMPRESSED SAMPLING: PRINCIPLES AND ALGORITHMS

Pre-requisites: EC3013D Digital Signal Processing

L	T	P	C
3	0	0	3

Total hours: 39

Brief Syllabus:

Fundamentals of sampling analog signals, and mathematical preliminaries; Signal spaces; Frames, basis and underdetermined representation; Compressed sampling paradigm, Sparse representation of signals, Sensing methods; Recovery algorithms and performance analysis.

EC4064D CRYPTOGRAPHY: THEORY AND PRACTICE

Pre-requisites: Nil

L	T	P	C
3	0	0	3

Total hours: 39

Brief Syllabus:

Security issues in communication - Basic cryptographic services- Mathematical fundamentals- Groups – Rings – Fields – Basic operations- Primality –Classic Ciphers- Private key and Public key cryptography- Block and stream ciphers- AES- RSA- Elliptic Curves- Hash and Message authentication codes – Digital Signatures – SHA – ECDSA – Design of cryptographic systems

EC4065D RADIO FREQUENCY CIRCUITS

Pre-requisites: EC2021D Electronic Circuits I
EC2022D Electromagnetic Field Theory

L	T	P	C
3	0	0	3

Total hours: 39

Brief Syllabus:

Basics of RF design like noise, linearity and performance of components at RF – Design of high frequency amplifiers, RF power amplifiers & low noise amplifiers – Analyses & design of mixers and oscillators – Analyses & design of PLL and frequency synthesizers

EC4066D NANO ELECTRONICS

Pre-requisites: Nil

L	T	P	C
3	0	0	3

Total hours: 39

Brief Syllabus:

Challenges going to sub-100 nm MOSFETs, fundamental limits for MOS operation, multiple gate MOSFETs, silicon-on-insulator, FDSOI, FinFETs, vertical MOSFETs, strained Si devices, Heterostructure based devices resonant tunneling devices, 2D materials and devices, carbon nanotubes based devices , spin-based devices.

EC4067D SOLID STATE IMAGE SENSORS

Pre-requisites: EC2013D Solid State Devices

L	T	P	C
3	0	0	3

Total hours: 39

Brief Syllabus:

Review of MOS capacitor and MOSFET, photon to electron conversion, photo current, charge collection, image sensor specifications, active and passive pixel configurations, fixed pattern noise, high dynamic range image sensors, data converters for imagers, readout architectures, application specific imagers, photon transfer curve (PTC), characterization of image sensors, PTC-inspired imagers.

EC4068D ANALOG MOS INTEGRATED CIRCUITS

Pre-requisites: EC3011D Electronic Circuits II

L	T	P	C
3	0	0	3

Total hours: 39

Brief Syllabus:

MOS Transistor, Low frequency and high frequency models, Noise models, capacitors and resistors in CMOS process, layout of components in CMOS process, current mirrors and sources, Biasing and voltage references, Single stage and multistage amplifiers, Operational amplifiers, comparator, multiplier, switched capacitor circuits.

EC4069D ADVANCED VLSI CIRCUITS

Pre-requisites: EC2012D Digital Circuits and Systems

L	T	P	C
3	0	0	3

Total hours: 39

Brief Syllabus:

Impact of technology scaling on circuit specification, process and temperature variation, circuit design in short channel regime, high speed design techniques, logical effort, power supply and clock tree design, I/O circuit design, low power circuit design techniques, leakage reduction, multiple supply and threshold voltage circuits, low power memory

EC4070D INTERNET OF THINGS

Pre-requisites: Nil

L	T	P	C
3	0	0	3

Total hours: 39

Brief Syllabus:

M2M to IoT – A Market Perspective–, An emerging industrial structure for IoT, M2M to IoT-An Architectural Overview– Building an architecture, M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Review of internet protocols – Processing platforms for IoT-Zigbee –BLE – 6LoWPAN, Applications for IoT-Smart home, city ,agricultureetc, - IoT services - Fog Computing, Architecture of Intel processors - Architecture of Cortex-M

EC4071D ARCHITECTURE OF ADVANCED PROCESSORS

Pre-requisites: EC2023D Microprocessors and Microcontrollers

L	T	P	C
3	0	0	3

Total hours: 39

Brief Syllabus:

Fundamentals: Technology trend -Performance measurement –Comparing and summarizing performance- Features of advanced Intel processors: Enhancements of 80386 and Pentium – processors beyond Pentium-Intel's embedded processor Atom-Instruction and thread level parallelism: Instruction level parallelism and concepts - Limitations of ILP- Pipelining: Issues and solutions- Instruction flow technique- Multicore technology

EC4072D ARCHITECTURES FOR DIGITAL SIGNAL PROCESSING

Pre-requisites: EC3013D Digital Signal Processing

L	T	P	C
3	0	0	3

Total hours: 39

Brief Syllabus:

DSP Algorithm representations- Basic and advanced DSP Filter structures- Fundamentals of DSP algorithm to architecture mapping- Transformations for improved DSP architectures Algorithmic simulations- DSP Algorithmic Strength Reduction- Parallel FIR Filter structures; Architecture transformation for fast DCT and inverse DCT- Fixed-point DSP design considerations- High performance arithmetic unit architectures- Distributed arithmetic- Canonic signed digit arithmetic- Introduction to redundant number system- Numerical Strength reduction

EC4073D OPTIMIZATION TECHNIQUES

Pre-requisites: Nil

L	T	P	C
3	0	0	3

Total hours: 39

Brief Syllabus:

Mathematical background in calculus and linear algebra, convex and quadratic functions, conditions of maxima and minima for unconstrained and constrained optimization problems, linear programming problems: simplex method, duality, dual simplex method, unconstrained optimization: One dimensional minimization, constrained optimization: Lagrangian method, sufficiency conditions, Kuhn-Tucker optimality conditions.

EC4074D COMPUTER VISION: ALGORITHMS AND APPLICATIONS

Pre-requisites: Nil

L	T	P	C
3	0	0	3

Total hours: 39

Brief Syllabus:

Image formation, geometric transformations, camera system, image filtering, 2D Frequency filters, Segmentation, Mean shift and mode finding, Normalized cuts, Graph cuts, Triangulation, motion from images, Photometric calibration, High dynamic range imaging, Super-resolution and blur removal, Image matting and compositing, Texture analysis and synthesis, Object detection, Face recognition, Instance recognition, Category recognition, Context and scene understanding, Linear discriminants, Bayes rule, maximum likelihood, MLP – back propagation, deep feed forward networks.

EC4075D DIGITAL VIDEO PROCESSING

Pre-requisites: EC3013D Digital Signal Processing

L	T	P	C
3	0	0	3

Total hours: 39

Brief Syllabus:

Introduction to Video formation models; Video Sampling and Interpolation; Motion Detection and Estimation; Interframe Subband/ Wavelet Scalable Video Coding; Digital Video Transcoding; Embedded Video Codecs; Basic Transform Video Coding; MPEG-1 and MPEG-2 Video Standards; MPEG-4 Visual and H.264/AVC, Standards for Modern Digital Video: HEVC; Video Quality Assessment; Video Enhancement and Restoration; Video Stabilization and Mosaicing; Video Segmentation; Motion Tracking in Video; Applications.

EC4076D PATTERN CLASSIFICATION

Pre-requisites: Nil

L	T	P	C
3	0	0	3

Total hours: 39

Brief Syllabus:

Features, feature vectors and classifiers, Classifiers based on Bayes Decision theory - discriminant functions and decision surfaces, Estimation of unknown probability density functions, Linear classifiers - Linear discriminant functions, perceptron algorithm, Non-Linear classifiers- Two layer and three layer perceptrons, Back propagation algorithm, Radial Basis function networks, Support Vector machines, HMM, Datasets, accuracy, Receiver Operating Characteristics (ROC) curve, Clustering- Cluster analysis