List of Courses Focus on Employability/ Entrepreneurship/ Skill Development

Department : *Electronics and Communication Engineering*

Programme Name : *B.Tech.*

Academic Year : 2021-22

List of Courses Focus on Employability/ Entrepreneurship/Skill Development

Sr. No.	Course Code	Name of the Course
01.	MA201TBS01	Mathematics-I
02.	PH201TBS02	Physics
03.	EC201TES01	Basic Electrical & Electronics Engineering
04.	IT201TES02	Introduction to Information Technologies
05.	EN201THS01	English Communication
06.	PH201PBS01	Physics Lab
07.	ME201PES01	Engineering Graphics
08.	ME201PES02	Workshop Technology & Practices
09.	EC201PES03	Basic Electrical Engineering Lab
10.	MA202TBS03	Mathematics-II
11	CY202TBS04	Chemistry
12	CE202TES03	Engineering Mechanics
13	CS202TES04	Computer Programming
14	CM202TES05	Basic Civil & Mechanical Engineering
15	CY202PBS02	Chemistry Lab
16	CE202PES04	Engineering Mechanics Lab
17	CS202PES05	Computer Programming Lab
18	EC203TPC01	Electronic Devices
19	EC203TPC02	Digital Logic Design
20	EC203TPC03	Network Theory
21	EC203TPC04	Signals and Systems
22	EC203TBS05	Mathematics-III
23	EC203THS02	Engineering Economics
24	EC203PPC01	Electronics Devices Lab
25	EC203PPC02	Digital Logic Design Lab
26	EC204TPC05	Analog Circuits

27	EC204TPC06	Analog Communication
28	EC204TPC07	Control System
29	EC204TES05	Data Structure with C++
30	EC204TBS06	Numerical Methods
31	EC204TMC02	Environmental Sciences
32	EC204PPC05	Analog Circuits Lab
33	EC204PES05	Data Structure with C++ Lab
34	EC205TPC08	LIC & its Application
35	EC205TPC09	Digital Communication
36	EC205TPC10	Digital Signal Processing
37	EC205TES06	Electromagnetic Waves
38	EC205THS03	Probability Theory & Random Process
39	EC205THS04	Effective Technical Communication
40	EC205PPC06	LIC Lab
41	EC205PPC07	Analog and Digital Communication Lab
42	EC205PPC08	Digital Signal Processing Lab
43	EC206TPC11	CMOS Digital VLSI Design
44	EC206TPC12	Data Communication & Computer Networks
45	EC206TPC13	Microprocessor & Microcontroller
46	EC206TES07	Electronic Measurements and Sensors
47	EC206TPE01	Information Theory & Coding
48	EC206TPE02	Advance Signal Processing
49	EC206TPE03	Renewable Energy Sources
50	EC206TPE04	Introduction to MEMS
51	EC206PPC09	CMOS Digital VLSI Design Lab
52	EC206PPC10	Data Communication & Computer Networks Lab
53	EC206PES06	Electronic Measurement and Sensors Lab
54	EC07TPC14	Fiber Optics Communication
55	EC07TPC15	Embedded Systems
56	EC07TPC16	Mobile Communication & Network
57	EC07TPE09	Digital Image Processing
58	EC07TPE10	Analog & Digital VLSI Design
59	EC07TPE11	Estimation and Detection Theory
60	EC07TPE12	Advanced Power Electronics
61	EC07TPE13	Microwave Theory & Techniques

62	EC07TPE14	Radar & Satellite Comm
63	EC07TPE15	Machine Learning
64	EC07PPC12	Fiber Optics Communication Lab
65	EC07PPC13	Design and Simulation Lab
66	EC07PPS01	Seminar on Industrial Training
67	EC07PPS02	Project - I
68	EC08TPC17	VLSI Fabrication Technology
69	EC08TPE16	Millimeter Wave Technology
70	EC08TPE17	Video Processing
71	EC08TPE18	Biomedical Electronics
72	EC08TPE19	Neural Network & Fuzzy logic
73	EC08TPE20	Next Gen. Comm. Technology
74	EC08TPE21	Wireless Sensor Networks
75	EC08TOE05	Intellectual Property Rights
76	EC08TOE06	Principles of Management
77	EC08TOE07	Introduction to IOT
78	EC08PPS03	Project - II
79	EC08PPS04	Comprehensive viva
80	ECPATT1	Linear Algebra
81	ECPATT2	Wireless Communication & Network
82	ECPATT3	Optoelectronic Devices
83	ECPATP1	ction to Signal Processing
84	ECPATP2	Introduction to Embedded & IOT System
85	ECPATP3	Microstrip Antenna
86	ECPATP4	Estimation & Detection Theory
87	ECPATP5	Digital Image Processing
88	ECPATP6	Network Security & Cryptography
89	ECPATP7	Modern Digital Communication
90	ECPATP8	Antenna for Modern wireless Communication
91	ECPBTT1	Advanced VLSI Fabrication
92	ECPBTT2	Millimeter Wave Technology
93	ECPBTP1	Machine Learning
94	ECPBTP2	Optical Communication System
95	ECPBTP3	Next Generation Communication Technologies
96	ECPBTP4	Advanced Digital Signal Processing

97	ECPBTP5	Computer Vision
98	ECPBTP6	Digital Communication Receiver
99	ECPBTP7	Optical Instrumentation
100	ECPBTP8	Satellite Communication
101	ECPCPT1	Dissertation Stage–I
102	ECPDPT1	Dissertation Stage–II

विभागाध्यक्ष (इलें. एव संचार अभियांत्रिकी)
H.O.D. (Elect. & Comm. Engineering)
प्रौद्योगिकी संस्थान
Institute of Technology
गु. घा. वि., बिलासपुर (छ.ग.)
G. G. V. Bilaspur (C.G.)

Sub Code	L	T	P	Duration	IA	ESE	Credit
EC08TOE05	3	1	0	4	30	70	3

INTELLECTUAL PROPERTY RIGHTS

Course Objective:

Students will be able to:

- Introduce fundamental aspects of Intellectual property Rights.
- Understand rationale behind Patent System.
- Understand WTO, TRIPS and WIPO.
- To get insight about an overview of the IPR regime.

Unit-I: Overview on IPR and its classification

Introduction to IPRs, Basic concepts and need for Intellectual Property – Patents, Copyrights, Geographical Indications, IPR in India and Abroad – Genesis and Development – the way from WTO to WIPO –TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR

Unit-II: Patents

Patents - Elements of Patentability: Novelty , Non Obviousness (Inventive Steps), Industrial Application , Non Patentable Subject Matter ,Registration Procedure, Rights and Duties of Patentee, Assignment and licence , Restoration of lapsed Patents, Surrender and Revocation of Patents, Infringement, Remedies & Penalties - Patent office and Appellate Board

Unit-III: Registration of IPRs

Meaning and practical aspects of registration of Copy Rights, Trademarks, Geographical Indications, Trade Secrets, Plant Variety Protection and Industrial Design registration in India and Abroad.

Unit-IV: Agreement and legislation

International Treaties and Conventions on IPRs, TRIPS Agreement, PCT Agreement, intellectual Property - History of GATT & TRIPS Agreement , Berne convention, Madrid agreement Hague agreement concerning the International Deposit of Industrial Designs ,Lisbon Agreement Patent Act of India, Patent Amendment Act, Design Act, Trademark Act, Geographical Indication Act.

Sub Code	L	T	P	Duration	IA	ESE	Credit
EC08TOE06	3	1	0	4	30	70	3

PRINCIPLES OF MANAGEMENT

Course Objective:

Students will be able to:

- Help the students gain understanding of the functions and responsibilities of managers.
- Provide them tools and techniques to be used in the performance of the managerial job.
- Enable them to analyse and understand the environment of the organization.
- help the students to develop cognizance of the importance of management principles

Unit-I: Introduction

Definition of management, science or art, manager v/s entrepreneur, Types of managers managerial roles and skills, Evolution of management- scientific, human relations, system and contingency approaches, Types of Business Organizations, sole proprietorship, partnership, company, public and private enterprises, Organization culture and environment, Current trends and issues in management.

Unit-II: Planning

Nature and purpose of planning, types of planning, objectives, setting objectives, policies, Strategic Management, Planning Tools and Techniques, Decision making steps & processes

Unit-III: Organization

Nature and purpose of Organizing, formal and informal organization, organization structure, types, line and staff authority, departmentalization, delegation of authority, centralization and decentralization, job design, human resource management, HR planning, Recruitment selection, Training & Development, Performance Management, Career planning and Management.

Unit-IV: Direction and Leadership

Directing, individual and group behaviour, motivation, motivation theories, motivational techniques, job satisfaction, job enrichment, leadership, types & theories of leadership, effective communication

Sub Code	L	T	P	Duration	IA	ESE	Credit
EC08TOE07	3	1	0	4	30	70	3

INTRODUCTION TO IOT

Course Objective:

- It will enable student to understand the basics of Internet of things and protocols.
- It introduces some of the application areas where Internet of Things can be applied.
- Students will learn about the middleware for Internet of Things.
- It will enable to understand the concepts of Web of Things.

Unit I : Introduction to Internet of Things

Review of computer communication concepts (OSI layers, components, packet communication, Networks, TCP-IP, subnetting, IPV4 addressing and challenges). IPV6 addressing. IoT architecture reference layer. Characteristics IoT sensor nodes, Edge computer, cloud and peripheral cloud, single board computers, open source hardware, Examples of IoT infrastructure.

Unit II: IoT and M2M

Software defined networks, network function virtualization, difference between SDN and NFV for IoT, Basics of IoT System Management with NETCOZF, YANG- NETCONF, YANG, SNMP NETOPEER.

Unit III : IOT protocols and Communication Technologies

MQTT, UDP, MQTT brokers, publish subscribe modes, HTTP, COAP,XMPP and gateway protocols, IoT Communication Pattern, IoT Protocol Architecture, Selection of Wireless technologies (6LoWPAN, Zigbee, WIFI, BT, BLE,SIG,NFC, LORA, Lifi, Widi).

Unit IV : Data and Analytics for IoT

An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics, Securing IoT, A Brief History of IOT Security, Common Challenges in IOT Security, How IT and OT Security Practices and Systems Vary, Formal Risk Analysis Structures: OCTAVE and FAIR, The Phased Application of Security in an Operational Environment.

MTECH SYLLABUS
SEMESTER: I

LINEAR ALGEBRA

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
ECPATT1	3	0	0	3 hours	40	60	100	3

Course Objective:

The objectives of the course are to make the students:

1. Formulate, solve, apply, and interpret systems of linear equations in several variables
2. Compute with and classify matrices
3. Master the fundamental concepts of abstract vector spaces
4. Decompose linear transformations and analyze their spectra (eigenvectors and eigenvalues)
5. Utilize length and orthogonality in each of the above contexts
6. Apply orthogonal projection to optimization (least-squares) problems

UNIT-I

Introduction to Vectors: Vectors and Linear Combinations, Dot Products.

Solving linear Equations: Matrices and Linear Equations, Gaussian Elimination, Rules for Matrix Operations, Row-Reduced Echelon Form (RREF), Rank of a Matrix, Solution set of a Linear System, Inverse Matrices, Factorization: A=LUs.

UNIT-II

Vector Spaces and Subspaces: Properties, Rank, Nullspace, Solving $Ax= 0$, The Complete Solution $Ax= b$, Independence, Basis of a Vector Space, Dimension, Linear Span and Linear Independence, Dimensions of the Four Subspaces, Sums and Direct Sums.

Orthogonality: Orthogonality of the Four Subspaces, Projections and Least Square, Orthogonal Bases and Gram-Schmidt Process, QR Decomposition, The Fast Fourier Transform.

UNIT-III

Eigenvalues and Eigenvectors: The Characteristic Polynomial, Eigenvalues of a Square Matrices, Invariant Subspaces, Diagonalization, Applications to Differential Equations, Upper-Triangular Matrices, Symmetric Matrices, Spectrum of a Matrix. **Positive Definite Matrices:** Tests for Positive Definiteness, Similar Matrices, Singular Value Decomposition (SVD).

Complex Vector Spaces: Complex Vectors and Matrices: Hermitian and Unitary Matrices, Generalized Eigenvectors, Decomposition, Square Roots, The Minimal Polynomial, Jordan Form.

WIRELESS COMMUNICATION & NETWORK

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
ECPATT1	3	0	0	3 hours	40	60	100	3

Course Objective:

1. To know the evolution of wireless communication, its types and concept.
2. To know basics of recent wireless technologies.
3. To know the different multiple access techniques in wireless communication.
4. To know the details of Ad-hoc wireless network.
5. To know the basics and details of wireless personal local area network.

UNIT-I

Overview of wireless communication, cellular communication, different generations of Cellular communication system, satellite communication including wireless local loop cordless phone.

UNIT-II

Recent wireless technologies; multicarrier modulation, OFDM, MIMO system, diversity-multiplexing trade off; MIMO OFDM system; smart antenna; beam forming and MIMO, cognitive radio.

UNIT-III

Multiple access techniques in wireless communication: contention free multiple access Schemes {FDMA TDMA, CDMA, SDMA and Hybrid}, contention-based multiple access schemes (ALOHA and CSMA).

UNIT-IV

Wireless personal local area networks {Bluetooth, UWB and ZigBee), wireless local area network, IEEE 802.11, network architecture, medium access methods, WLAN standards

UNIT-V

Ad-Hoc wireless network: Design Challenges in Ad-hoc wireless networks, concept of cross layer design, security in wireless networks MANET and WSN, Wireless system protocols.

Text Books

1. Andrea Goldsmith, "Wireless Communications Cambridge University press, 2005.
2. Sanjay Kumar, "wireless communication the fundamental and advanced concepts, River publisher, Denmark ,2015 {Indian reprint}

OPTOELECTRONIC DEVICES

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
ECPATT3	3	0	0	3 hours	40	60	100	3

Course Objective:

1. To develop the basic concept of solid state physics and characteristics of light.
2. To develop the concept of luminescence, display devices, laser and their applications.
3. To learn the principle of optical detection mechanism in detection devices.
4. To learn different light modulation techniques and applications of optical switching
5. To develop the concept of opto electronic integrated circuits in transmitters and receivers.

UNIT I

WAVE NATURE OF LIGHT AND SOLID STATE PHYSICS

Wave nature of light, Polarization, Interference, Diffraction, Review of Semiconductor Physics and Junction Device.

UNIT II

DISPLAY DEVICES AND LASERS

Introduction, Photo Luminescence, LED, Plasma Display, Liquid Crystal Displays, Laser Emission, Absorption, Radiation, Optical Feedback, Threshold condition, Laser Modes, laser applications.

UNIT III

OPTICAL DETECTION DEVICES

Photon devices Photo emissive detectors, Photo conductive detectors, Photomultipliers (PMT), Photo diodes PIN & APD, photo transistors, Solar cells.

UNIT IV

OPTOELECTRONICS MODULATOR

Opto Electronic Modulators, Polarization, birefringence's, Electro optic effect, EO materials. Magneto Optic Modulators Faraday effect, Accusto Optic Modulators.

UNIT V

OPTOELECTRONICS INTEGRATED CIRCUITS

Introduction, hybrid and Monolithic Integration, Application of Opto Electronic Integrated Circuits, Integrated transmitters and Receivers, Guided wave devices.

Text Books

INTRODUCTION TO SIGNAL PROCESSING

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
ECPATP1	3	0	0	3 hours	40	60	100	3

Course Objective:

The objectives of the course are to make the students:

1. Review of signal and system, Fourier transforms, the Z-transform
2. To impart knowledge of mathematical concept involved in signal processing.
3. To introduce mathematical modeling for Statistical Signals processing.
4. To apply optimization techniques for signal processing applications.

Unit-I

Discrete and Continuous time signals and systems, LTI systems, Convolution, Difference equations, z-transforms, Fourier transform and its properties.

Unit -II

Sampling and reconstruction, Review of vector spaces, Eigenvectors and Eigen-values. Hilbert transforms, matched filtering, equalization. Coherent and Non-coherent detection.

Unit-III

Probability theory review, Random variables, statistical averages, Random processes, Transmission of random process through an LTI system.

Unit-IV

Statistical Signal Processing: Power Spectrum Estimation Parametric and Maximum Entropy Methods, Wiener, Kalman Filtering, and the Poisson process, Levinson Durbin Algorithms Least Square Method.

Unit -V

Optimization techniques for linear and nonlinear problems, Applications in various areas of signal processing.

Text/Reference Books:

1. Proakis, John G. - Digital signal processing: principles algorithms and applications, PHI.
2. Oppenheim, Alan V - Discrete-time signal processing, Pearson Education India.
3. Vaidyanathan, Parishwad P - Multirate systems and filter banks, Pearson Education India.
4. Monson H. Hayes, "Statistical Digital Signal Processing And Modeling", 1st Edition, Wiley India Pvt Ltd, 2008.
5. Vaidyanathan, Palghat P- The theory of linear prediction, Morgan and Claypool Publishers.
6. Haykin, Simon S. - Adaptive filter theory, Pearson Education India.
7. Henry Stark and John W. Woods, "Probability and Random Processes with Applications to Signal Processing", Prentice Hall, 3rd Edition 2001

INTRODUCTION TO EMBEDDED & IOT SYSTEM

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
ECPATP2	3	0	0	3 hours	40	60	100	3

Course Objective:

This course will enable student to:

1. To introduce the Building Blocks of Embedded System
2. To understand the life cycle and applications of embedded system.
3. To understand the fundamentals about IoT, IoT Access technologies and IOT case studies.
4. To understand the design methodology and different IoT hardware platforms.
5. To study the basics of IoT Data Analytics and supporting services.

UNIT-I

Introduction and functioning: Review of Microcontroller concept. Functional block diagram of 8051 microcontroller. Introduction to Embedded system, characteristic of Embedded system. Functional building blocks of embedded systems, processor and controller.

UNIT-II

Life cycles and Applications: Interfacing of memory between analog and digital blocks, interfacing with external systems, Temperature control, stepper motor and keyboard interface. user interfacing, Embedded Life cycle, Water Fall Model , Spiral Model, RAD Model.

UNIT-III:

Introduction to IOT: Definition and characteristics of IOT, Physical design of IOT, Logical design of IOT, IoT Protocols, IoT communication models, IoT Communication APIs, IOT enabling technologies: Wireless Sensor Networks, Cloud Computing, Embedded Systems, IoT Levels and Templates, Domain Specific IoTs – Home, City, Environment, Energy, Agriculture,Industry, and health and life style.

UNIT IV:

IoT and M2M- Software defined networks, network function virtualization, difference between SDNand NFV for IoT, Basics of IoT System Management with NETCOZF, YANG- NETCONF, YANG, SNMP NETOPEER.

Design Methodology, Embedded computing logic, Microcontroller, System on Chips, IoT system building blocks IoT Platform overview: Overview of IoT supported Hardware platforms such as: Raspberry pi, Arduino Board details.

UNIT V:

MICROSTRIP ANTENNA

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
ECPATP3	3	0	0	3 hours	40	60	100	3

Course Objective:

1. To introduce the basic concept of Rectangular Microstrip Antenna
2. To introduce different Microstrip Antenna feeding techniques
3. To learn different parameters of Rectangular Microstrip Antenna
4. To learn the effect of various parameters on performance of Rectangular Microstrip Antenna
5. To develop the concept of antenna design to control different Antenna characteristics

Unit-1:

Rectangular Microstrip Antenna- Concept, Various Designs, Advantages, Problems, Applications

Unit-2:

Microstrip Antenna feeding techniques- Coaxial feed, Microstrip Line feed, EM Coupled feed, Aperture coupled feed

Unit-3:

Rectangular Microstrip Antenna- Resonance Frequency, Characterization, Design Equations, Design Examples

Unit-4:

Effect of various parameters on performance of Rectangular Microstrip Antenna – Feed point location, Effect of width, Effect of thickness, Effect of probe diameter, Effect of Loss tangent, Effect of Dielectric constant

Unit-5:

Rectangular Microstrip Antenna patterns for different Dielectric constant, Dual Polarization, Effect of finite ground plane, Square and Circular Microstrip Antenna characteristics

Text/Reference Books:

1. Microstrip Antenna Design Handbook, Ramesh Garg, Prakash Bhartia, Inder J. Bahl, A. Ittipiboon
2. Broadband Microstrip Antennas, Girish Kumar, K.P. Ray
3. Microstrip and Printed Antennas: NEW TRENDS, TECHNIQUES AND APPLICATIONS by Debatosh Guha, Yahia M. M. Antar

ESTIMATION & DETECTION THEORY

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
ECPATP4	3	0	0	3 hours	40	60	100	3

Course Objective:

1. To teach students the basics of estimation and detection theory.
2. To introduce the students to estimation bounds.
3. To introduce classical and Bayesian estimators like ML, LS, and MMSE to students.
4. To teach hypothesis testing and a number of detectors of signals in noise.
5. To introduce the likelihood ratio test and GLRT. Exposing the students to applications of estimation and detection is another important goal.

UNIT-I

Recap of probability and linear algebra, Introduction of estimation in signal processing, Minimum variance unbiased estimation, Unbiased estimators, Minimum variance criterion,existence of minimum variance unbiased estimator, Cramer-Rao lower bound (CRLB), scalar parameters, Signal in white Gaussian noise.

UNIT-II

Linear models, General minimum variance unbiased estimation, Sufficient statistic, finding minimum variance unbiased estimators, Best linear unbiased estimators (BLUE),Finding the BLUE, Signal processing example.

UNIT-III

MaximumLikelihood Estimators(MLE), finding the MLE, Properties of the MLE, MLE for transformed parameters, Extension to a vector parameter, Introduction to Least Square (LS) Approach, Linear least square estimation, Geometrical interpretations of LS estimation, Some examples.

UNIT-IV

Bayesian estimators, Priors and Posteriors probabilities, Choosing a Prior PDF, General Bayesian estimators, Minimum mean square estimators (MMSE), Maximum A Posteriori (MAP) Estimators, Linear MMSE Estimation.

UNIT-V

Basics of statistical decision theory, Simple hypothesis testing, Likelihood ratio testing, Neyman-Pearson detectors, Detection of known signals in noise, Composite hypothesis testing, Generalized likelihood ratio tests (GLRTs), Deterministic signals with unknown parameters.

DIGITAL IMAGE PROCESSING

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
ECPATP5	3	0	0	3 hours	40	60	100	3

Course Objective: The objectives of the course are to make the students:

1. To provide the fundamental knowledge on digital image processing.
2. To develop the ability to understand and implement various digital image processing algorithms.
3. To facilitate the students for analyze and implement various real time digital image processing applications.

Unit-I

Image Representation and Image Processing Paradigm: Introduction and signal digitization, Pixel relationship, Camera models & imaging geometry.

Image Enhancements: Image operations, Image interpolation, Image transformation, histogram equalization and specifications.

Unit-II

Image Filtering and restoration: Noise models, Image Restoration Spatial and Frequency Domain Filtering, Estimation of Degradation Model and Restoration Techniques.

Unit-III

Color Image Processing: Color models, Color transformations, Color image smoothing and sharpening; Color Segmentation.

Wavelets and Multi-resolution image processing- Background of Wavelet transform, Multi-resolution expansions, wavelet transform in one and two dimensions.

Unit-IV

Image Compression:-Fundamentals and models of Image Compression; Lossless compression; Lossy compression, Image compression standards.

Unit-V

Image Segmentation: Detection of discontinuities, edge linking and boundary detection, thresholding, region-based segmentation, Segmentation Using Morphological Watersheds.

Text/Reference Books:

1. Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing, 3rd Edition, Pearson Education 2010
2. Anil Kumar Jain, Fundamentals of Digital Image Processing, Prentice Hall of India.2nd edition 2011
3. William K. Pratt, Digital Image Processing, 4th edition, John Wiley, 2007.
4. John C. Russ, The Image Processing Handbook, 6th edition, CRC Press,2011

NETWORK SECURITY & CRYPTOGRAPHY

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
ECPATP6	3	0	0	3 hours	40	60	100	3

Course Objectives:

This course will enable student to:

1. To provide deeper understanding into cryptography, its application to network security, threats/vulnerabilities to networks and countermeasures.
2. To explain various approaches to Encryption techniques, strengths of Traffic Confidentiality, Message Authentication Codes.
3. To familiarize Digital Signature Standard and provide solutions for their issues.
4. To familiarize with cryptographic techniques for secure communication of two parties over an public channel; verification of the authenticity of the source of a message.

UNIT –I:

INTRODUCTION: Security trends, The OSI Security Architecture, Security Attacks, Security Services and Security Mechanisms, A model for Network security. CLASSICAL ENCRYPTION TECHNIQUES: Symmetric Cipher Modes, Substitute Techniques, Transposition Techniques, Rotor Machines, Stenography.

UNIT –II:

BLOCK CIPHER AND DATA ENCRYPTION STANDARDS: Block Cipher Principles, Data Encryption Standards, the Strength of DES, Differential and Linear Crypt Analysis, Block Cipher Design Principles.

ADVANCED ENCRYPTION STANDARDS: Evaluation Criteria for AES, the AES Cipher. MORE ON SYMMETRIC CIPHERS: Multiple Encryption, Triple DES, Block Cipher Modes of Operation, Stream Cipher and RC4.

INTRODUCTION TO NUMBER THEORY: Prime Numbers, Fermat's and Euler's Theorem, Testing for Primality, The Chinese Remainder Theorem, Discrete logarithms.

UNIT –III:

PUBLIC KEY CRYPTOGRAPHY AND RSA: Principles Public key crypto Systems, Diffie Hellman Key Exchange, the RSA algorithm, Key Management, , Elliptic Curve Arithmetic, Elliptic Curve Cryptography.

MESSAGE AUTHENTICATION AND HASH FUNCTIONS: Authentication Requirement, Authentication Function, Message Authentication Code, Hash Function, Security of Hash Function and MACs.

MODERN DIGITAL COMMUNICATION

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
ECPATP7	3	0	0	3 hours	40	60	100	3

Course Objective:

This course will enable student to:

1. Understand and appreciate the need of various modulation and spread spectrum techniques.
2. Analyze the properties of basic Modulation techniques and apply them to Digital Communication
3. Apply different types of coding techniques to design the optimum receiver for channels with ISI and AWGN.
4. Design and develop the different types of modulation techniques, equalizer to improve the performance under fading channels for various applications.

UNIT I

Baseband Modulation: Line coding - types, criterions for choosing a line code, power spectra. Matched filter – maximization of output SNR, properties, RF and baseband design, integrate and dump filter. Signal space representation, Gram-Schmidt orthogonalization, correlation receiver, equivalence of matched filter and correlation receiver. Baseband transmission of digital signal, eye pattern, inter-symbol interference, Nyquist criterion for zero ISI. Pulse Shaping - raised cosine filtering. Correlative coding – duobinary coding, modified duobinary coding, generalized partial response signaling.

UNIT II

Optimum receivers:channels with ISI and AWGN, linear equalization and decision feed back equalization, adaptive linear and adaptive decision feedback equalizer.

UNIT III

Passband Transmission: Signal space and mathematical representation, transmitter, receiver (coherent and non coherent detection), Carrier modulation – Linear modulation schemes: M-ary ASK, PSK, QAM, FSK etc. Nonlinear Modulation schemes: CPFSK, MSK, GMSK . Non coherent modulations schemes: DPSK Spectral properties of various modulation schemes and their comparison. probability of error for various modulation schemes in AWGN channel. Clock and carrier recovery, synchronization issues.

UNIT IV

Error Control Codes: Examples of the use of error control codes, basic notions, Characterization of Error control codes performance of error control codes, comparison of uncoded and coded systems. Linear Block Codes, Cyclic Codes. Convolution Coding,

ANTENNA FOR MODERN WIRELESS COMMUNICATION

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
ECPATP8	3	0	0	3 hours	40	60	100	3

Course Objective:

1. To understand the concept of radiation and characterizing parameters of Antenna
2. To get the knowledge of working principles of modern Antennas
3. Design the array of Antenna for modern communication
4. To perform analysis of MIMO key technology of 4G/5G System
5. To get the knowledge and design of Antennas for modern wireless system.

Unit I:

Concepts of Radiation and Antenna Fundamentals: Fundamental parameters of antennas, Near and Far Field regions, S Parameters, Antenna Measurements: Radiation pattern, Gain, directivity and polarization measurement.

Unit II:

Printed Antenna: Microstrip Antennas & Dielectric Resonator Antenna: Radiation mechanism - parameters and applications - feeding methods.

Unit-III:

Array of Antennas: Linear and planar array fundamentals, Mutual Coupling in Arrays, Multidimensional Arrays, Phased Arrays, Array Feeding Techniques, Array optimization techniques.

Unit-IV

MIIMO System: Concept of Diversity, Introduction of MIMO, Types of MIMO Systems, Design parameters of MIMO system.

UNIT V:

Antennas for Modern Wireless System: Antennas for space applications, Antennas for 5G System, Reconfigurable Antenna:Reconfigurable methodologies, Design Considerations for Reconfigurable systems, Concept of Smart Antenna.

Text/Reference Books:

1. Jordan E C and Balmain K G, "Electromagnetic Waves and Radiating Systems", 2nd Edition, Pearson Education, 2015.

RESEARCH METHODOLOGY & IPR

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
IPPATC1	3	0	0	3 hours	40	60	100	3

Syllabus Contents:

- **Introduction and Design of research**: Meaning, objectives and significance of research, types and parameters of research, research process, identification and definition of the research problem, definition of construct and variables, pure and applied research design, exploratory and descriptive design methodology, qualitative vs. quantitative research methodology, field studies, field experiments vs. laboratory experiments, research design in social and physical sciences.
- **Data and Methods of Data Collection**: Survey, assessment and analysis: data collection, primary and secondary sources of data, Collection of primary data through questionnaire and schedules. Collection of secondary data, processing and analysis of data. Sample survey, simple random sampling, stratified random sampling, systematic sampling, cluster sampling, area sampling and multistage sampling. Pilot survey, scaling techniques, validity & reliability.
- **Data Analysis:** Procedure for testing of hypothesis, the null hypothesis, determining levels of significance, type i and ii errors, grouped data distribution, measures of central tendency, measures of spread/dispersion, normal distribution, analysis of variance: one way, two way, chi square test and its application, students 'T' distribution, non-parametric statistical techniques, binomial test. Correlation and regression analysis – discriminate analysis – factor analysis – cluster analysis, measures of relationship
- Research report preparation and presentation: Review of literature: historical survey and its necessity, layout of research plan, meaning, techniques and precautions of interpretation, types of report: technical report, popular report, report writing – layout of research report, mechanics of writing a research report. Writing bibliography and references.
- Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

References:

- Research in education, By J W Best and J V Kahn, Pearson/ Allyn and Bacon.
- Research Methodology – Methods and Techniques, C K Kothari, New Age International.
- Design and Analysis of Experiments, D C Montgomery, Wiley.
- Applied Statistics & Probability for Engineers, D C Montgomery & G C Runger, Wiley.
- Management Research Methodology: Integration of Principles, Methods and Techniques, K N Krishnaswamy, A I Sivakumar and M Mathiranjan, Pearson Education.

MTECH SYLLABUS
SEMESTER: II

ADVANCED VLSI FABRICATION

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
ECPBTT1	3	0	0	3 hours	40	60	100	3

Course Objective:

1. To develop the basic concept of IC fabrication.
2. To develop the concept of detailed processes of Oxidation
3. To learn the detail techniques of Ion implantation
4. To learn different Lithography techniques
5. To learn the different techniques and challenges of final thin film integrated transistor devices

Unit-1: Introduction to BJT and MOSFET fabrication for IC, Crystal growth & Defects, Epitaxy Details of Doping during Epitaxy, VPE and MBE,

Unit-2: Oxidation-Kinetics, Rate Constants, Dopant redistribution, Oxide charges and Oxidation systems, Theory of diffusion and Fick's Law, Constant Impurity diffusion, Doping Profiles, Diffusion systems and comparison with Ion implantation,

Unit-3: Ion implantation process and stopping mechanisms, Damages during implantation, Annealing of created damages, Masking during implantation and characterization of doped layers,

Unit-4: Lithography-details, Wet chemical etching, Dry etching, Plasma etching systems, Metallization, Problems in Al metal contacts,

Unit-5: IC BJT-from junction isolation to LOCOS, Problems in LOCOS, Trnch isolation and selective epitaxy, Realization of p-n-p transistor, MOSFET-self aligned poly-gate, Tailoring of device parameter, CMOS Technology, Latch-up in CMOS, BiCMOS Technology

Text/Reference Books:

1. VLSI Fabrication Principles by S K Gandhi
2. Silicon VLSI Technology by J D Plummer, M Deal, P D Griffin
3. VLSI Technology by S M Sze,
4. VLSI Technology by B G Streetman

MILLIMETER WAVE TECHNOLOGY

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
ECPBTT2	3	0	0	3 hours	40	60	100	3

Course Objective:

1. To understand the Characteristics of Millimeter Wave Technology
2. To understand the concepts and working principles of various guiding Structures at Millimeter Wave Technology.
3. To design the Antenna for Millimeter Wave Applications.
4. To perform analysis of passive Components at Millimeter Wave
5. To understand the basic concept of Active Devices and Link Design at Millimeter Wave.

UNIT-I

Introduction to Millimeter wave Technology: Advantages and Challenges of Millimeter Wave Technology, Millimeter Wave Applications, Sources of losses at Millimeter wave; Dielectric Loss, Conduction Loss, Radiation Surface wave losses, Wave propagation, Phase and Group Velocity, Slow and Fast waves.TEM, TE and TM modes

UNIT-II

Guiding Structure: Transmission Lines, Surface Wave in Grounded Dielectric Slab, Parallel Plate Guide, Rectangular Wave Guide, Circular Waveguides, Microstrip Lines, High Frequency Limitation of Microstrip Lines, Microstrip Coupled Lines, Conductor Backed CPW, Substrate Integrated Waveguide (SIW), SIW Losses, Design of SIW

UNIT-III

Antennas at Millimeter wave Frequency: Antennas Parameters, Printed Millimeter Wave Antennas, Dipole and Slot Antenna, Loop Antennas, Printed Millimeter Wave Array Antennas, Waveguide Slot Arrays, On Chip Antennas: Design and Challenges.

UNIT-IV

Passive Components: Dielectric Resonators, Dielectric Resonators Antenna and its modes, filters, Different types of couplings, Power divider, Directional Coupler, Hybrid Coupler.

UNIT-V

Active Components: PIN Diode, Gunn Diode, IMPATT Diode, FET, MOSFET, HEMT, Comparison of Solid State Devices , Noise and Link Budget, Friss Transmission Equation, Millimeter Wave Systems, Noise Figure for Cascaded System Elements.

MACHINE LEARNING

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
ECPBTP1	3	0	0	3 hours	40	60	100	3

Course Objective:

The objectives of the course are to make the students:

1. To provide foundation for Machine learning.
2. Introduce the concept of learning patterns from data.
3. Introduce the linear regression technique and SVM
4. Introduce the basic neural network and concept behind deep learning.
5. Introduce a few standard clustering techniques.

Unit I:

Introduction, Basic definitions, types of learning, hypothesis space and inductive bias, evaluation, cross-validation. Linear regression, Decision trees, overfitting

Unit II:

Instance based learning, Feature reduction, Collaborative filtering based recommendation. Probability, Probability and Bayes learning.

Unit III:

Supervised Learning, Logistic Regression, Support Vector Machine(SVM), Kernel function.

Unit IV:

Neural network, Perceptron, multilayer network, backpropagation, introduction to deep neural network.

Unit V:

Computational learning theory, PAC, Sample complexity, VC Dimension, Ensemble learning. Clustering: k-means, adaptive hierarchical clustering, Gaussian mixture model.

Text Books/References:

1. "Machine Learning: A Probabilistic Perspective" Book by Kevin P. Murphy, The MIT Press, 2012.
2. "Pattern Recognition and Machine Learning " Book by Christopher M. Bishop, Springer, 2011
3. Tom Mitchell, Machine Learning, McGraw Hill, 2017.
4. T. Hastie, R. Tibshirani, J. Friedman. The Elements of Statistical Learning, 2e, 2011.

OPTICAL COMMUNICATION SYSTEM

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
ECPBTP2	3	0	0	3 hours	40	60	100	3

Course Objective:

1. To understand the transmission mechanism of optical fiber communication system .
2. To understand the working of light source.
3. •To introduce the concept of optical detector and various parameter associated with it.
4. •To get the concept of design of system link and its characteristics.
5. To introduce the concept of optical fiber cable and working principle of amplifier.

Unit 1

Introduction to Guided optical communication system: Review of Unguided optical communication system, Guided optical communication, Optical Fibres Types, Materials, Elements, Fabrication techniques. Signal degradation

Unit 2

Sources for communication: Review of LED, modulation circuits, Laser Diode, Optomechanical switches, Photonic & digital switches.

Unit 3

Detectors for communication: Noise Sources, Noise in Optical detector, Receiver noises preamplifiers, Low impedance, High impedance, Trans impedance amplifiers.

Unit 4

System design considerations: Multiplexing, regenerative repeaters, Link Power Budget Analysis, Line coding, Coherent systems homodyne and heterodyne detection.

Unit 5

Optical fiber cable componenets and amplifier. Optical Fiber Cables, Connectors, Joints, Splicers, Couplers, Fiber amplifiers, Raman Fiber Amplifier, Brillowin fiber Amplifier, Solitons Communication.

Text Books:

1. Optical Fiber Communication G Keiser (4th Ed, TMH)
2. Optical Fiber Communications J M Senior (Pearson Publication)

NEXT GENERATION COMMUNICATION TECHNOLOGIES

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
ECPBTP3	3	0	0	3 hours	40	60	100	3

Course Objective:

3. Tolearn the new communication technologies such as OFDM, MIMO, and massive MIMO used in Next Generation communication systems.
4. To analysis the performance such as capacity/spectral efficiency and energy efficiency of the MIMO and massive MIMO system.

UNIT – I

Introduction and Preliminaries: Introduction to point-to-point Multi-input Multi-output (MIMO), multiuser MIMO, massiveMIMO, Coherence Time, CoherenceBandwidth, Coherence Interval.TDD Coherence Interval structure, Coherence Interval in the context of OFDM modulation, Small-scale and Large-scalefading, Normalized signal model, and SNR.

UNIT –II

OFDM: Principle of Orthogonal Frequency Division Multiplexing (OFDM), Multiple access – OFDMA, Implementation of transceivers, Frequency-selective channels, Cyclic Prefix (CP), Performance in the frequency-selective channel, Pilot based channel estimation, Peak-to-average power ratio, Inter-carrier-interference, Parameter adaptation.

UNIT –III

MIMO Systems: Introduction to MIMO systems, Diversity in wireless channel, Introduction to fading distributions, Analytical MIMO channel models, Independent and identically distributed (uncorrelated) MIMO fading model, Fully correlated MIMO channel model, MIMO channel parallel decomposition.

UNIT –IV

MIMO Channel Capacity and Power Allocation: Power allocation in MIMO systems, Uniform power allocation, Adaptive power allocation, MIMO channel capacity, Capacity of i.i.d. Rayleigh fading MIMO channels, Capacity of separately correlated Rayleigh fading MIMO channel.

UNIT –V

Massive MIMO Systems: Definition of Massive MIMO, Correlated Rayleigh fading, Uplink, and downlink system model, Impact of Spatial channel correlation, Channelhardening and favorable propagation, Pilot transmission and channel estimation, Spectral Efficiency (SE), Transmit precoding and Receive decoding, Single-cell uplink and downlink SE expressions, Asymptotic analysis, Energy efficiency.