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.)

OPEN ELECTIVE-1

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
EC206TOE01	1	1	-	2 hours	-	-	-	-

INTRODUCTION TO ELECTRONIC DEVICES & CIRCUITS

Course Objectives:

1. To develop basic concept of semiconductor materials and physics.
2. To develop an understanding of the PN junction diode and its behavior.
3. Tointroduce various types of special diodes and rectifier.
4. To develop the concept and analysis of transistor characteristics, Configuration and thermal stabilization.
5. To study the physics and construction of Field Effect transistors

UNIT-I: Semiconductor concept: Atomic structure, Bohr's atom model, Energy Band Theory of Crystals, Energy Band Structures in Metals, Semiconductors and Insulators, forbidden energy gap, Electrical properties of Ge and Si, Conductivity Equation, Mobility and Conductivity, Electron and holes in intrinsic and extrinsic semiconductors, P type and N type semiconductors– majority and minority carriers, Mass action Law, Hall effect, Carrier generation and recombination, Carrier transport: diffusion and drift process, Variation of semiconductor conductivity, resistance and bandgap with temperature and doping.

UNIT II: PN Junction Diode: Properties of P-N Junction, Open Circuited P-N Junction, Behaviour of P-N junction under forward and reverse bias, Current component of PN Diode, VI Characteristics, Temperature dependence of V-I Characteristics, Ideal diode, Breakdown phenomenon: Zener and avalanche breakdown, Diode resistance: Static and dynamic resistance, Diode Capacitance: Transition and Diffusion Capacitance, Switching Characteristics.

UNIT III: Special Purpose Diodes: Zener Diode, Varactor Diode, Tunnel Diode, Photodiode, Light Emitting Diodes- Construction, working and characteristics, Applications of Diodes: Half-Wave Diode Rectifier, Full-Wave Rectifier, Clippers and Clampers.

UNIT IV: Transistors: Definition, formation of transistor- PNP and NPN, symbols, working principle, Regions of operation, Transistor current components, Transistor construction, Common Base, Common Emitter & Common Collector configurations and their characteristics, Early Effect, Current Gains: α, β, and γ relation between them, simple problems, comparison of CB, CE and CC modes, Transistor as a switch, Transistor as an amplifier, Thermal runaway, Thermal stability.

UNIT-V: Field Effect Transistor: JFET Construction, Operation, VI characteristics, Transfer characteristics, Drain characteristics. FET as voltage variable resistor, Metal Oxide Semiconductor Field Effect Transistor (MOSFET): construction and working of enhancement and depletion modes, Drain and transfer characteristics, Application of MOSFET as a switch, Comparison of JFET & MOSFET.

Sub Code	L	T	P	Duration	IA	ESE	Credit
EC07TPC14	3	1	0	4	30	70	3

FIBER OPTICS COMMUNICATION

Course Objectives:

- To introduce the concept of optical communication system.
- Recognize and classify the structures of Optical fiber and types.
- Discuss the channel impairments like losses and dispersion.
- Measurement devices of optical fiber Communication system.
- To learn the Optical detector and optical transmitter.

Unit I:

Introduction to optical communication, principle of light transmission, propagation of light into fiber, mode theory of a cylindrical waveguide, Ray model.

Unit II:

Different types of optical fibers, Modal analysis of a step index fiber. Signal degradation on optical fiber due to dispersion and attenuation, Fabrication of fibers and measurement techniques like OTDR.

Unit III:

Optical sources-LEDs and Lasers, Photo-detectors - PIN-diodes, APDs, detector responsivity, noise, optical receivers, Optical link design - BER calculation, power penalties.

Unit IV:

Optical switches - coupled mode analysis of directional couplers, electro-optics switches, Optical amplifiers - EDFA, Raman amplifier, WDM and DWDM systems and Principles of WDM networks.

Unit V:

Nonlinear effects in fiber optic links, Concept of self-phase modulation, group velocity dispersion and Soliton based communication.

Text/Reference Books

1. J. Keiser, Fibre Optic communication, McGraw-Hill, 5thEd. 2013 (IndianEdition).
2. T. Tamir, Integrated optics, (Topics in Applied Physics Vol.7), Springer-Verlag, 1975.

Sub Code	L	T	P	Duration	IA	ESE	Credit
EC07TPC15	3	1	0	4	30	70	3

EMBEDDED SYSTEMS

Course Objective:

Students will be able to:

- To introduce the Building Blocks of Embedded System
- To Educate in Various Embedded Development Strategies
- To Introduce Bus Communication in processors, Input/output interfacing.
- To impart knowledge in various processor scheduling algorithms
- To introduce Basics of Real time operating system.

Unit-I: Embedded system Introduction

Overview of microcomputer systems and their building blocks, Review of 8051 Microcontroller, Basic idea of system, Introduction of Embedded system, characteristic of Embedded system.

Unit-II: Components of Embedded system

Functional building blocks of Embedded systems, processor and controller, Interfacing of memory between analog and digital blocks, interfacing with external systems, user interfacing.

Unit-III: Layers of an Embedded system

Introduction, Need for Layering, The Middleware Layer, The Application Layer. Introduction to Real Time Operating Systems, Design tradeoffs due to process compatibility, thermal considerations.

Unit-IV: Networks for Embedded Systems

Serial Communication RS 232 model, I square Model, CAN and CAN Open, SPI and SCI, USB, HDLC, Parallel Communication Basics PCI interface and PCI X- interface, Device Driver Serial Port and Parallel Port.

Unit-V: Methodologies, Life cycle and Modeling

Software Life cycle, Embedded Life cycle Water Fall Model, Spiral Model, RAD Model and Modeling of Embedded system, Simulation and Emulation. Software aspects of embedded systems: real time programming languages and operating systems for embedded systems.

Text/Reference books:

1. J. W. Valvano, "Embedded Microcomputer System: Real Time Interfacing", Brooks/Cole, 2000.
2. Jack Ganssle, "The Art of Designing Embedded Systems", Newness, 1999.

Sub Code	L	T	P	Duration	IA	ESE	Credit
EC07TPC16	3	1	0	4	30	70	3

MOBILE COMMUNICATION & NETWORKS

Course Objectives:

Students will be able:

- To know the evolution of Mobile communication and cell concept
- To know the fading mechanism and types of fading and effect of fading on Mobile communication.
- To know the role of Equalization and diversity techniques in Mobile communication
- To know the various types of multiple access techniques.
- To know the higher generation cellular standards

Unit-I: Introduction to Mobile Communication

Evolution of mobile communications, Mobile radio around the world, Types of Wireless communication system. Second generation Cellular Networks, GSM, The Cellular Concept-System design Fundamentals: Cellular System, Hexagonal geometry cell and frequency reuse concept, channel assignment strategies, Distance to frequency reuse ratio, channel & Co-channel interference reduction factor, S/I ratio consideration and calculation for minimum Co-channel and adjacent interference, Handoff strategies, Umbrella Cell Concept, Improving Coverage & Capacity in cellular System : splitting, cell sectorization, Repeaters, Micro cell zone concept.

Unit-II : Mobile Radio Propagation

Free space propagation model, The three basic propagation Mechanism: reflection, diffraction, scattering, Practical link budget design, Outdoor Propagation models, Indoor propagation models, Small scale Multipath propagation, Impulse response model of a Multipath Channel, Small scale Multipath measurements, parameters of Mobile multipath channels, types of small scale fading, Time Delay Spread; Flat, Frequency selective, Doppler Spread; Fast and Slow fading Rayleigh and Ricean Distributions.

Unit-III: Receiver Structure

Diversity receivers- selection and MRC receivers, RAKE receiver, equalization: linear-ZFE and adaptive, DFE. Transmit diversity-Altamonte scheme. MIMO and space time signal processing, spatial multiplexing, diversity/multiplexing, trade-off. Performance measures-

Sub Code	L	T	P	Duration	IA	ESE	Credit
EC07TPE09	3	1	0	4	30	70	3

DIGITAL IMAGE PROCESSING

Course Objectives:

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

Unit I: Image Representation and Image Processing Paradigm

Image, Elements of Image perception, image sensing and acquisition, image sampling and quantization, basic relationships between pixels

Image Enhancements: Point operations, Arithmetic operations, Logical operation, Gray level transformations, histogram equalization, histogram specifications, pixel-domain smoothing filters, pixel-domain sharpening filters, two-dimensional DFT and its inverse, Cosine transform, Time-frequency localization, Wavelet transforms

Unit II: Image Filtering and restoration

Noise models, Restoration in the Presence of Noise only using Spatial Filtering and Frequency Domain Filtering, Linear Position-Invariant Degradations, Estimating the Degradation Function, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering, Constrained Least Squares Filtering.

Unit III: Color Image Processing

Color models, Color transformations, Color image smoothing and sharpening; Color Segmentation.

Unit IV: Image Compression

Redundancy–inter-pixel and psycho-visual, Lossless compression – predictive, entropy, Lossy compression- predictive and transform coding; Still image compression standards – JPEG and JPEG-2000.

Sub Code	L	T	P	Duration	IA	ESE	Credit
EC07TPE10	3	1	0	4	30	70	3

ANALOG AND DIGITAL VLSI DESIGN

Course Objective:

- Concepts and understanding of Importance of VLSI design in the field of Electronics and Telecommunication.
- Underlying methodologies for fundamental CMOS Analog and Digit signal Circuits.
- To study analog circuit and its limitations issues in the context of VLSI technology.
- To understand scaling technology
- To design and verify digital circuits by means of computer aided tools.
- To understand issues and tools related to ASIC

Unit I: Introduction to MOS and CMOS

General considerations, C-V characteristics, Short channel effect, Scaling of MOSFET, Constant field scaling and its effects, Constant Voltage Scaling and its effect, second order effect for calculation.

Unit II: MOSFET Models

Low frequency models and its analysis, High frequency models and its analysis, Frequency response, Basic concepts different types of amplifier.

Unit III: CMOS Fabrication Technology

VLSI design flow chart, Y-diagram, CMOS design flow, N-well, P-well, Twin-Tub, CMOS process enhancement, BI-CMOS technology and its application.

Unit IV

Hardware modeling with verilog HDL, Encapsulation, verilog models of propagation delay, net delay, path delay and simulation, Design examples in verilog.

UNIT V: Introduction to ASIC's

Programmable Logic Devices, Programmable Array Logic, concepts of FPGA, CPLD, Different design styles and its comparison.

REFERENCES:

1. Paul R. Gray, Paul. Hurst, Stephen H. Lewis, Robert G. Meyer, Analysis and Design

Sub Code	L	T	P	Duration	IA	ESE	Credit
EC07TPE11	3	1	0	4	30	70	3

ESTIMATION AND DETECTION THEORY

Course Objective:

- To teach students the basics of estimation and detection theory.
- To introduce the students to estimation bounds.
- To introduce classical and Bayesian estimators like ML, LS, and MMSE to students.
- To teach hypothesis testing and a number of detectors of signals in noise.
- 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

Maximum Likelihood 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.

Sub Code	L	T	P	Duration	IA	ESE	Credit
EC07TPE12	3	1	0	4	30	70	3

ADVANCED POWER ELECTRONICS

Course Objectives:

- To provide the students with deep insights of different rectifier configurations and their applications.
- To make the student, analyze the DC- DC converters for different mode
- To provide the students with a knowledge of resonant converters and multilevel inverters
- To make the students confident with the use of voltage source inverter and current source inverters.

Unit I: Phase Controlled Rectifiers

Principle of phase control, Single Phase Full wave controlled converters: Midpoint and bridge type, analysis of two pulse bridge converter with continuous current, single phase two pulse converters with discontinuous current

Unit II: DC to DC switch mode Regulators

Introduction, Review of linear power supply and basic dc-dc voltage regulator configurations, Buck converters, Boost converters, Buck-Boost converters and their analysis for continuous and discontinuous conduction mode, other converter configurations.

Unit III: Resonant Converters

Introduction, Need of resonant converters, Classification of resonant converters, Load resonant converters, resonant switch converters, Zero Voltage Switching DC-DC Converters, Zero Current Switching DC-DC Converters, Applications of Resonant Converters.

Unit IV: Multi-level converters

Need for multi-level inverters, Concept of multi-level, Topologies for multi-level: Diode Clamped, Cascaded H-bridge multilevel Converters configurations; Features and relative comparison of these configurations applications.

Sub Code	L	T	P	Duration	IA	ESE	Credit
EC07TPE13	3	1	0	4	30	70	3

MICROWAVE THEORY AND TECHNIQUES

Course Objective:

- To understand the concepts of waveguides and various modes.
- To understand the basic concept of various types of Guiding Structure and Passive Components at Microwave.
- To understand the concepts and working principles of Microwave Active Components.
- To understand the concepts and working principles of Microwave System Design and Antenna
- To understand the applications and effect of microwave in various system

Unit I:

Introduction to Microwaves-History of Microwaves, Microwave Frequency bands; Applications of Microwaves, Mathematical Model of Microwave Transmission-Concept of Mode, Features of TEM, TE and TM Modes in Rectangular and Circular waveguide, Losses associated with microwave transmission, Concept of Impedance in Microwave transmission. Introduction of Microwave Systems.

Unit II:

Analysis of RF and Microwave Transmission Lines- Coaxial line, Strip line, Micro strip line. Microwave Network Analysis- Equivalent voltages and currents for non-TEM lines, Network parameters for microwave circuits, Scattering Parameters. Passive Microwave Devices- Microwave passive components: Directional Coupler, Power Divider, Magic Tee, Resonator.

Unit III:

Microwave active components: Microwave Semiconductor Devices: Gunn Diodes, IMPATT diodes, Schottky Barrier diodes, PIN diodes. Microwave Tubes: Klystron, Travelling Wave Tube Amplifier, Magnetron.

Unit IV:

Microwave Design Principles-Impedance transformation, Impedance Matching, Introduction of Microwave Filter Design, RF and Microwave Amplifier Design, Microwave Antennas

Sub Code	L	T	P	Duration	IA	ESE	Credit
EC07TPE14	3	1	0	4	30	70	3

RADAR AND SATELLITE COMMUNICATION

Course Objectives:

Students will be able:

- To know the evolution of Satellite communication and its concept
- To know the orbital mechanism and different satellite subsystems.
- To know the role of different factors affecting satellite and link budget equation.
- To know the types of multiple access techniques for satellite communication.
- To know the basics, types and working of RADAR.

Unit-I: Introduction to Satellite Communication

Principles and architecture of satellite Communication, Brief history of Satellite systems, advantages, disadvantages, applications and frequency bands used for satellite communication

Unit-II

Orbital Mechanics: Orbital equations, Kepler's laws, Apogee and Perigee for an elliptical orbit, evaluation of velocity, orbital period, angular velocity etc. of a satellite, concepts of Solar day and Sidereal day.

Satellite sub-systems: Study of Architecture and Roles of various sub-systems of a satellite system- Telemetry, tracking, command and monitoring (TTC & M), Attitude and orbit control system (AOCS), Communication sub-system, power sub-systems etc.

Unit-III: Typical Phenomena in Satellite Communication

Solar Eclipse on satellite, its effects, remedies for Eclipse, Sun Transit Outage phenomena, its effects and remedies, Doppler frequency shift phenomena and expression for Doppler shift. Satellite link budget Flux density and received signal power equations, Calculation of System noise temperature for satellite receiver, noise power calculation, Drafting of satellite link budget and C/N ratio calculations in clear air and rainy conditions.

Unit-IV: Modulation and Multiple Access Schemes

Various modulation schemes used in satellite communication, Meaning of Multiple Access, Multiple access schemes based on time, frequency, and code sharing namely TDMA, FDMA

Sub Code	L	T	P	Duration	IA	ESE	Credit
EC07TPE15	3	1	0	4	30	70	3

MACHINE LEARNING

Course Objectives:

- To review and strengthen important mathematical concepts required for ML.
- Introduce the concept of learning patterns from data.
- Introduce the linear regression technique and SVM .
- Introduce the basic neural network and provide background knowledge for deep learning.
- Introduce a few standard clustering techniques.

Unit I:

Review Artificial Intelligence and Mathematical foundations: Matrix Theory and Statistics for Machine Learning.

Introduction: Basic definition, Idea of Machines learning from data, Types of Learning, Classification of problem –Regression and Classification, Supervised and Unsupervised learning.

Unit II:

Linear Regression: Model representation for single variable, Single variable Cost, Function, Gradient Descent for Linear Regression, Gradient Descent in practice.

Unit III:

Logistic Regression: Classification, Hypothesis Representation, Decision Boundary, Cost function, Advanced Optimization, Multi-classification (One vs All), Problem of Over fitting. Support Vector Machine, Kernel function and kernel SVM.

Unit IV:

Discussion on clustering algorithms and use-cases cantered around clustering and classification, K-means, Adaptive hierarchical clustering, Gaussian mixture model.

Unit V:

Neural network: Perceptron, multilayer network, back propagation, introduction to deep neural network.

Sub Code	L	T	P	Duration	IA	ESE	Credit
EC07PPC12	0	0	2	2	30	20	1

FIBER OPTICS COMMUNICATION LAB

Course Objectives:

- Align light waves into small optical components with high precision
- Calculate and simulate the attenuation and signal degradation due to intermodal and intramodal distortion.
- Calculate power coupling losses due to connectors, splices, source output pattern and fiber numerical aperture.
- Understand, compute and simulate the modes in step index fiber and graded index fiber.
- Understand the reliability issues of the highly delicate optical devices.

List of Experiments

1. Study of initial fiber end preparation and connecting plastic fiber to the connector.
2. Study of numerical aperture.
3. Setting up a fiber optic analog link and measurement of propagation loss in the fiber.
4. Study of effect of Lateral, Longitudinal and angular displacement.
5. Study of Time Division multiplexing.
6. Comparison of effect of EMI interference on Copper medium and on optical fiber.
7. Study of characteristics of fiber optic LED and Photo detector.
8. Setting up simple fiber optic Voice link.
9. Setting up fiber optic digital link.
10. Study of Pulse width modulation and demodulation over fiber optic Digital Link.
11. Study of frequency division multiplexing and demultiplexing.
12. Measurement of Bit Error rate.
13. V-I characteristics of LASER source.
14. Analog and digital signal transmission using LASER source.
15. Study of Chromatic dispersion.
16. Measurement of attenuation in attenuator.
17. Measurement of propagation delay time in fiber cable.

Sub Code	L	T	P	Duration	IA	ESE	Credit
EC07PPC13	0	0	2	2	30	20	1

DESIGN AND SIMULATION LAB

Course Objectives:

The idea to introduce Design and Simulation lab is:

- To make students familiar with different simulation software like Matlab, Octave, R, and Python.
- To teach basics of simulation and programming used.
- To design a simple system model and simulate their performance.
- The lab will help students in their project work.

Curriculum for the Lab:

- Introduction to different simulation tools like Matlab, Octave, R, and Python.
- Basic Operations on Matrices.
- Generation of Various Signals and Sequences (Periodic and Aperiodic), suchas Unit-impulse, Unit-step, Square, Sawtooth, Triangular, Sinusoidal, Ramp, and Sinc.
- Perform operations like addition, multiplication, scaling, shifting, and folding on signals.
- Dealing with complex signal/sequence.
- To perform convolution between signals and sequences.
- Find the Fourier transform of a given signal and plotting its magnitude andPhase spectrum.
- Computation of unit samples, unit step, and sinusoidal response of the givenLTI system and verifying its physical realizability and stability properties.
- Generation of Random number sequence.
- Plot the PDF and CDF for Gaussian, Rayleigh, Rician random variables.
- Plot the frequency histogram for the given data sample.
- Find the mean and variance ofthe given data sample.
- To perform autocorrelation and cross-correlation between signals and sequences.
- Introduction to Simulink.
- A simple control system simulink model.

Sub Code	L	T	P	Duration	IA	ESE	Credit
EC08TPC17	3	1	0	4	30	70	3

VLSI FABRICATION TECHNOLOGY

Course Objectives:

Students will be able:

- To introduce the brief concept of fabrication technology of both BJT & MOS.
- To learn difficulties in single crystal development.
- To learn different epitaxial growth techniques and their associated problems.
- To introduce the concept of Si atomic structure, atomic planes and structural defects.
- To learn different crystal refinement techniques and wafer design.

Unit I: Introduction to VLSI

Brief overview of processing steps of BJT & MOSFET fabrication, Concept of photolithography, Epitaxy, Self-aligned Technique, Polysilicon & its advantages etc.

Unit II: Silicon Crystal Structure

Basics of Crystal structure and its types and different formations, Hard sphere model of Diamond lattice and its Packing densities, Concept of misfit factor and its importance, Details of Crystal plane-Miller's indices, packing densities, interplane distances and angles between the planes, V-groove etching concept, Direction of line on Si-wafer.

Defects in Crystal structure: Point defects, Line defects, Area dislocation, Volume defects

Unit III: Crystal growth of Si

Carbothermic Reduction process, Bridgemann Technique and its problems, Czochralski technique, its thermodynamics and effect of Pull rate on wafer size.

Dopant incorporation in Si crystal: Segregation coefficient, O_2 incorporation and its removal.

Unit IV: Crystal refinement & wafer preparation

Zone refining technique and its advantages, Wafer preparation, Gettering process and Metallic contaminant removal.

Epitaxy: Types, 3 cardinal rules and their importance, Liquid phase epitaxy, Vapour Phase Epitaxy, Reactor configuration.

Unit V: Chemical Vapour Deposition for Si epitaxy

Silane route, Doping during epitaxy- auto doping, Molecular Beam epitaxy.

Sub Code	L	T	P	Duration	IA	ESE	Credit
EC08TPE16	3	1	0	4	30	70	3

MILLIMETER WAVE TECHNOLOGY

Course objective

Students will be able:

- To understand the Characteristics and requirement of Millimeter Wave Technology
- To understand the concepts and working principles of various guiding Structures at Millimeter Wave Technology.
- To design the Antenna for Millimeter Wave Applications.
- To perform analysis of passive Components at Millimeter Wave
- 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.

Unit-II: Guiding Structure

Transmission Lines, TEM, TE and TM modes, Surface Wave in Grounded Dielectric Slab, Parallel Plate Guide, Wave Guides, Rectangular Cavity Resonator, Microstrip Lines, High Frequency Limitation of Microstrip Lines, Microstrip Coupled Lines, Conductor Backed CPW, Substrate Integrated Waveguide (SIW), Design of SIW, Image Guide, Non radiative Dielectric Guide (NRD)

Unit-III: Antennas at Millimeter wave Frequency

Antenna 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.

Sub Code	L	T	P	Duration	IA	ESE	Credit
EC08TPE17	3	1	0	4	30	70	3

VIDEO PROCESSING

Course Objectives:

Students will be able:

- To acquire the fundamental knowledge on digital video processing.
- To develop the ability to understand and implement various digital video processing and estimation algorithms.
- To facilitate the students for analyze and implement various real time digital video processing applications.

Unit-I: Basic Steps of Video Processing

Video capture and display, Analog video, Digital Video, Time varying Image Formation models-3D motion models, Geometric Image formation, Photometric Image formation, sampling of video signals, filtering operations

Unit-II: Video Modelling

Camera Model-Pinhole Model, CAHV Model, Camera Motions. Object Model- Shape Model, Motion Model. Scene Model, Two-Dimensional Motion Models.

Unit-III: 2-D Motion Estimation

Optical flow, general methodologies, pixel based motion estimation, Block matching algorithm, multi resolution motion estimation, Application of Motion Estimation in Video Coding.

Unit-IV: Video Coding

Waveform based coding, Block based transform coding-Unitary Transform, Discrete Cosine Transform, Bit Allocation and Transform Coding Gain, DCT-Based Image Coders and the JPEG Standard, predictive coding, Video Coding Using Temporal Prediction and Transform Coding.

Unit-V: Video Compression

H.261, H.263, MPEG-1, MPEG-2, and MPEG-4.

Text/Reference Books:-

1. The Essential Guide to Video Processing, Al Bovik (Alan C Bovik), Academic Press, Second Edition, 2009

Sub Code	L	T	P	Duration	IA	ESE	Credit
EC08TPE18	3	1	0	4	30	70	3

BIO-MEDICAL ELECTRONICS

Course Objectives:

Students will be able to:

- To introduce the concept of Biomedical Electronics and instrument system.
- To introduce the concept of Physiological system of human Body.
- To learn different Biomedical transducers.
- To learn the Radiology, X-Ray and Angiography.
- To learn the Biotelemetry system and their different Application in patient care.

Unit-I

Concept of Biomedical Electronics, Biomedical Engineering, Biometrics, Components of man instrument system, Data Acquisition techniques.

Unit-II

Brief introduction to human physiology, Physiological system of the Body, cells & their structure, Resting & Action, Bioelectric Potential, The heart & cardiovascular system, Physiological system & Mechanical activity of Heart, Electrocardiographic lead system, Electrocardiogram, Electrocardiography, other Physiological systems.

Unit-III

Biomedical transducers: Displacement, Velocity, Force, Acceleration, Flow, Temperature, Potential, dissolved ions and gases. Bio-electrodes and bio-potential amplifiers for ECG, EMG, EEG, etc.

Unit-IV

Radiology Introduction, Generation of ionizing Radiation, X-Ray System, Radiography, X-Ray Diagnostic, Special techniques in X-Ray, Angiography

Unit-V

Biotelemetry-Introduction, Physiological parameters, Biotelemetry system, Radio telemetry system, Problems in implant telemetry, Application of telemetry in patient care, EEG measurements, EMG measurement, Working Principle of PACE MAKERS.

Sub Code	L	T	P	Duration	IA	ESE	Credit
EC08TPE19	3	1	0	4	30	70	3

NEURAL NETWORKS AND FUZZY LOGIC

Course Objectives:

Students will be able:

- To introduce the origin, terminology and basic structure of the Neural Network.
- To introduce the back-propagation as supervised learning.
- To introduce the unsupervised learning based Neural Network.
- To introduce the basic level Fuzzy logic theory and its system.
- To introduce popular applications of Neural Network and Fuzzy based processing.

Unit-I

Biological neurons and McCulloch and Pitts models of neuron, Types of activation functions, Neural networks architectures, Linearly separable and linearly non-separable systems, Features and advantages of neural networks over statistical techniques, Knowledge representation, learning process, error-correction learning, concepts of supervised learning, and unsupervised learning.

Unit-II: Supervised Learning Neural Networks

Single layer perceptron and multilayer perceptron neural networks, their architecture, Error back propagation algorithm, generalized delta rule, learning factors, step learning, Momentum learning, Concept of training, testing and cross-validation data sets for design and validation of the networks.

Unit-III: Unsupervised Learning Neural Networks

Competitive learning networks, kohonen self-organizing networks, K-means and LMS algorithms, Radial Basis Function (RBF) Neural Network, its structure and Hybrid training algorithm for RBF neural networks, Comparison of RBF and MLP networks Learning, Vector Quantization neural network architecture and its training algorithm, Hebbian learning, Hopfield networks, Network, Self-organizing Feature Map, counter-propagation neural network, recurrent neural network, deep learning (Introductory).

Unit-IV: Fuzzy logic & System

Basic Fuzzy logic theory, sets and their properties, Operations on fuzzy sets, Fuzzy relation

Sub Code	L	T	P	Duration	IA	ESE	Credit
EC08TPE20	3	1	0	4	30	70	3

NEXT GENERATION COMMUNICATION TECHNOLOGY

Course Objective:

- To learn the new communication technologies such as OFDM, MIMO, and massive
- MIMO used in Next Generation communication systems.
- 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, massive MIMO, Coherence Time, Coherence Bandwidth, Coherence Interval.TDD Coherence Interval structure, Coherence Interval in the context of OFDM modulation, Small-scale and Large-scale fading, 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, Channel hardening and favorable propagation,

Sub Code	L	T	P	Duration	IA	ESE	Credit
EC08TPE21	3	1	0	4	30	70	3

WIRELESS SENSOR NETWORKS

Course Objectives:

- To introduce and understand the concept of Wireless Sensor Network and its applications.
- To identify various network technologies and its challenges.
- To know about various protocols used in Wireless Sensor Networks
- To understand the networking concept in Wireless Sensor Networks
- To introduce operating system in field of Sensor Networks

Unit I:

Introduction to Sensor Networks, unique constraints and challenges, Advantage of Sensor Networks, Applications of Sensor Networks, Types of wireless sensor networks

Unit II:

Mobile Ad-hoc Networks (MANETs) and Wireless Sensor Networks, Enabling technologies for Wireless Sensor Networks. Issues and challenges in wireless sensor networks

Unit III: MAC protocols and Routing Protocols for Wireless Sensor Networks

Classification of MAC Protocols, S-MAC Protocol, B-MAC protocol, IEEE 802.15.4 standard and ZigBee, Dissemination protocol for large sensor network. Data dissemination, data gathering, and data fusion, Quality of a sensor network; Real-time traffic support and security protocols.

Unit IV:

Design Principles for WSNs, Gateway Concepts Need for gateway, and WSN to Internet Communication, and Internet to WSN Communication. Single-node architecture, Hardware components & design constraints

Unit V:

Operating systems and execution environments, Introduction to TinyOS and nesC.