SCHEME OF EXAMINATION
B.TECH (FOUR YEAR) DEGREE COURSE
THIRD YEAR, ELECTRONICS & COMMUNICATION ENGINEERING
SCHOOL OF ENGINEERING & TECHNOLOGY, GGVV BILASPUR (CG) 495009
EFFECTIVE FROM SESSION 2020-21

SEMESTER V (THIRD YEAR)

Sr. No.	Course Code	Course Title	L	T	P	Periods/ week	Evaluation Scheme IA	ESE	Total	Credit
Theory										
1	EC05TPC08	Electromagnetic Waves	3	1	0	4	30	70	100	4
2	EC05TPC09	Computer Network	3	0	0	3	30	70	100	3
3	EC05TPC10	LIC and its Application	3	0	0	3	30	70	100	3
4	EC05TPC11	Control Systems	3	1	0	4	30	70	100	4
5	EC05TPE01 EC05TPE02 EC05TPE03 EC05TPE04	Program Elective – 1 • Information Theory & Coding • CMOS Design • Introduction to MEMS • Computer Architecture	3	0	0	3	30	70	100	3
6	EC05TOE01 EC05TOE02	Open Elective-1 • Data Structure & Algorithms • Operating Systems	3	0	0	3	30	70	100	3
Practical										
1	EC05PPC06	Electromagnetic Waves Lab	0	0	2	2	30	20	50	1
2	EC05PPC07	Computer Networks Lab	0	0	2	2	30	20	50	1
3	EC05PPC08	LIC and its Application Lab	0	0	2	2	30	20	50	1
									Total Credits	**23**

SEMESTER VI (THIRD YEAR)

Sr. No.	Course Code	Course Title	L	T	P	Periods/ week	Evaluation Scheme IA	ESE	Total	Credit
Theory										
1	EC06TPC12	Digital Signal Processing	3	1	0	4	30	70	100	4
2	EC06TPC13	Probability Theory and Stochastic Processes	3	0	0	3	30	70	100	3
3	EC06TPE05 EC06TPE06 EC06TPE07 EC06TPE08	Program Elective – 2 • Antenna & Wave Propagation • Power Electronics • High Speed Devices & Circuits • Nanoelectronics	3	1	0	4	30	70	100	4
4	EC06TOE03 EC06TOE04	Open Elective-2 • Cryptography & Network Security • Artificial Intelligence	3	0	0	3	30	70	100	3
5	EC06TBS07	Life Science	3	0	0	3	30	70	100	3
Practical										
1	EC06PPC09	Digital Signal Processing Lab	0	0	2	2	30	20	50	1
2	EC06PPC10	Electronic Measurement Lab	0	0	2	2	30	20	50	1
3	EC06PPC11	Mini Project/Electronic Design workshop	0	0	4	4	30	20	50	2
									Total Credits	**21**

L : LECTURE T: TUTORIAL P: PRACTICAL IA: INTERNAL ASSESSMENT ESE: END SEMESTER EXAM

B. TECH. III YEAR V SEMESTER SCHEME

Sub Code	L	T	P	Duration	IA	ESE	Credits
EC05TPC08	3	1	0	4 hours	30	70	4

ELECTROMAGNETIC WAVES

Course Objectives:

- To understand the concepts, working principles and laws of Electromagnetic Waves.
- To perform analysis of uniform plane wave and waveguides.
- To understand the basic concept of radiation and antenna.

Unit I: Transmission Lines- Equations of Voltage and Current on TX line, Propagation constant and characteristic impedance, reflection coefficient and VSWR, Impedance Transformation on Loss- less and Low loss Transmission line, Power transfer on TX line, Smitl. Chart, Admittance Smith Chart, Applications of transmission lines: Impedance Matching, use tran mission line sections as circuit elements.

Unit II: Maxwell's Equations- Basics of Vectors, Vector calculus, Basic laws of Electromagnetics, Maxwell's Equations, Boundary conditions at Media Interface.

Unit III: Uniform Plane Wave- Uniform plane wave, Propagation of wave, Wave polarization, Wave propagation in conducting medium, phase and group velocity, Power flow and Poynting vector, Surface current and power loss in a conductor, Plane Waves at a Media Interface- Plane wave in arbitrary direction, Reflection and refraction at dielectric interface, Total internal reflection, wave polarization at media interface, Reflection from a conducting boundary.

Unit IV: Wave propagation in parallel plane waveguide, Analysis of waveguide general approach, Rectangular waveguide, Modal propagation in rectangular waveguide, Surface currents on the waveguide walls, Field visualization, Attenuation in waveguide.

Unit V: Radiation: Solution for potential function, Radiation from the Hertz dipole, Power radiated by hertz dipole, Radiation Parameters of antenna, receiving antenna, Monopole and Dipole antenna

Text/Reference Books:

1. R.K. Shevgaonkar, Electromagnetic Waves, Tata McGraw Hill India, 2005
2. E.C. Jordan & K.G. Balmain, Electromagnetic waves & Radiating Systems, Prentice Hall, India
3. Narayana Rao, N: Engineering Electromagnetics, 3rd ed., Prentice Hall, 1997.
4. David Cheng, Electromagnetics, Prentice Hall

Course Outcomes:

At the end of this course students will demonstrate the ability to:

- Understand characteristics and wave propagation on high frequency transmission lines
- Carryout impedance transformation on TL
- Use sections of transmission line sections for realizing circuit elements
- Characterize uniform plane wave
- Calculate reflection and transmission of waves at media interface
- Analyze wave propagation on metallic waveguides in modal form
- Understand principle of radiation and radiation characteristics of an antenna

Sub Code	L	T	P	Duration	IA	ESE	Credits
EC05TPC09	3	0	0	3 hours	30	70	3

COMPUTER NETWORK

Course Objectives:

Student will try to learn to:

- Build an understanding of the fundamental concepts of computer networking.
- Familiarize the student with the basic taxonomy and terminology of the computer networking area.
- Introduce the student to advanced networking concepts, preparing the student for entry Advanced courses in computer networking.
- Develop an understanding of modern network architectures from a design and performance perspective.

Unit I: Introduction to computer networks and the Internet: Application layer: Principles of network applications, The Web and Hyper Text Transfer Protocol, File transfer, Electronic mail, Domain name system, Peer-to-Peer file sharing, Socket programming, Layering concepts.

Unit II: Switching in networks: Classification and requirements of switches, a generic switch, Circuit Switching, Time-division switching, Space-division switching, Crossbar switch and evaluation of blocking probability, 2-stage, 3-stage and n-stage networks, Packet switching, Blocking in packet switches, Three generations of packet switches, switch fabric, Buffering, Multicasting, Statistical.

Unit III: Multiplexing. Transport layer: Connectionless transport - User Datagram Protocol, Connection oriented transport – Transmission Control Protocol, Remote Procedure Call. Transport layer: Connectionless transport - User Datagram Protocol, Connection-oriented transport – Transmission Control Protocol, Remote Procedure Call. Congestion Control and Resource Allocation: Issues in Resource Allocation. Queuing Disciplines, TCP congestion Control, Congestion Avoidance Mechanisms and Quality of Service.

Unit IV: Network layer: Virtual circuit and Datagram networks, Router, Internet Protocol, Routing algorithms, Broadcast and Multicast routing

Unit V: Link layer: ALOHA, Multiple access protocols, IEEE 802 standards, Local Area Networks, addressing, Ethernet, Hubs, Switches.

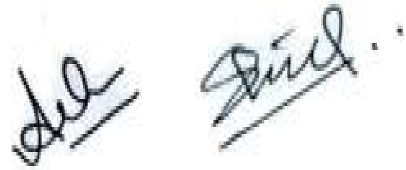
Text Reference books:

1. William Stallings, "Data and computer communications", Prentice Hall
2. B. A. Forouzan, "Data Communications and Networking", Tata McGraw Hill, 4th Edition
3. J.F. Kurose and K. W. Ross, "Computer Networking – A top down approach featuring the Internet", Pearson Education, 5th Edition
4. L. Peterson and B. Davie, "Computer Networks – A Systems Approach" Elsevier Morgan Kaufmann Publisher, 5th Edition.
5. T. Viswanathan, "Telecommunication Switching System and Networks", Prentice Hall
6. S. Keshav, "An Engineering Approach to Computer Networking" , Pearson Education
7. Andrew Tanenbaum, "Computer networks", Prentice Hall
8. D. Comer, "Computer Networks and Internet/TCP-IP", Prentice Hall

Course Outcomes:

At the end of this course students will demonstrate the ability to:

- Understand the concepts of networking thoroughly.
- Design a network for a particular application.
- Analyze the performance of the network.



Sub Code	L	T	P	Duration	IA	ESE	Credits
EC05TPC10	3	0	0	3 hours	30	70	3

LIC AND IT'S APPLICATIONS

Course objective:

The students will be able to learn:

- To understand the concepts, working principles and key applications of linear integrated circuits.
- To perform analysis of circuits based on linear integrated circuits
- To design circuits and systems for particular applications using linear integrated circuits.

UNIT I Basic Building Blocks for ICs & OPAMP: Basic Differential Amplifiers & Analysis, Introduction to OPAMP, Ideal OPAMP Characteristics, OPAMP ICs:741Pin Diagram and Pin Function, Inverting Amplifier, Non-Inverting Amplifier, Definition of OPAMP Parameters, Frequency Response of OPAMP, Open Loop & Closed Loop Configuration of OPAMP and its Comparisons, Voltage Comparator, Zero Crossing Detector, Level Detector.

UNIT II Applications of OPAMP: Introduction, Adder, Substractor/Difference Amplifier, Voltage Follower, Integrator, Differentiator, Comparator IC such as LM339, Window detector, Current to Voltage and Voltage to Current Converter, Instrumentation Amplifier, Precision Half Wave Rectifier, Precision Full Wave Rectifier, Log & antilog amplifier, Schmitt Trigger, Bridge Amplifier, Peak Detectors/Peak follower, Sampleand- Hold Amplifiers, Square wave generator, Saw-tooth wave generator, Triangular wave generator, Astable multivibrator, Monostable multivibrator, Dead Zone circuit- with positive output, with negative output, Precision clipper circuit, Generalized Impedance Converter (GIC) and its application.

Frequency response of OPAMP: Open loop voltage gain as a function of frequency, Unity gain Bandwidth, Close loop frequency response, Slew Rate.

UNIT III Active filters & PLL: - Introduction to Filters, Merits & Demerits of active filters of over Passive Filter, Classification of filters, Response characteristics of Filter, First Order and Second Order active high pass, Low pass, Band pass and band reject Butterworth filters.

Phase Lock Loop: Operating Principle of the PLL, Linear Model of Phase Lock Loop, Lock Range and Capture Range, Application of the PLL, Voltage Controlled Oscillator(VCO).

UNIT IV D/A and A/D converters & Analog Multiplier: D/A converter - Ladder, R-2R, A/D converters Ramp, Continuous conversion, Flash ADC, Dual slope ADC, Successive Approximation, Voltage to Time converters, Timing and circuits comparisons, DAC/ADC specifications.

Analog Multiplier: Basic Analog Multiplication Techniques, Applications of Multiplier- Frequency doubling, Phase-angle difference detection, Voltage dividing action, Square root of a signal, Function realization by Multiplier, Amplitude Modulator, Standard Modulator Circuit, Demodulation of AM signal.

UNIT V Timer & Regulators: Monolithic 555 Timer: Functional Diagram: Monostable and Astable operation using 555 Timer. Voltage Regulators: Basic Configurations Parameters for Voltage Regulators, Basic blocks of linear IC voltage regulators, Positive and negative voltage regulators, Positive and negative voltage regulators, General Purpose IC Regulater (723): Important features and Internal Structure, Switching regulators.

Text & Reference books:-

1. "Op - Amps and Linear Integrated Circuits", Ramakant A. Gayakwad, PHI
2. "Operational Amplifiers and Linear Integrated Circuits", Robert. F. Coughlin & Fred.F. Driscoll, PHI/Pearson.
3. "Linear Integrated Circuits", D. Roy Choudhury and Shail B. Jain, New Age International
4. " Integrated Circuits" by K. R. Botkar, Khanna Publications
5. "Design with Operational Amplifiers and Analog Integrated Circuits", Sergio Franco, TMH
6. Microelectronic Circuits: Theory and Applications (International Version), OXFORD University Press

Course Outcomes:

After the completion of this course student will

- Understand the fundamentals and areas of applications for the integrated circuits.
- Analyze important types of integrated circuits.
- Demonstrate the ability to design practical circuits that perform the desired operations.
- Understand the differences between theoretical, practical & simulated results in integrated circuits.
- Select the appropriate integrated circuit modules to build a given application

Sub Code	L	T	P	Duration	IA	ESE	Credits
EC05TPC11	3	1	0	4 hours	30	70	4

CONTROL SYSTEMS

Course Objectives:

The students will be able to learn:

- The type of System, dynamics of physical systems, classification of control system, analysis and design objective.
- How to represent system by transfer function and block diagram reduction method and Mason's gain formula.
- Time response analysis and demonstrate their knowledge to frequency response.
- Stability analysis of system using Root locus, bode plot, polar plot, and Nyquist plot.

Unit I: Introduction to control problem- Industrial Control examples. Transfer function. Block diagram and signal flow graph analysis. Open & Closed-loop systems, Control hardware and their models: potentiometers, synchros, LVDT, dc and ac servomotors, tacho-generators, electro hydraulic valves, hydraulic servomotors, electro pneumatic valves, pneumatic actuators.

Unit II: Time response of second-order systems, steady-state errors and error constants. Performance specifications in time-domain, proportional, integral and derivative systems. Feed forward and multi-loop control configurations,

Unit III: Feedback control systems- Stability, steady-state accuracy, transient accuracy, disturbance rejection, insensitivity and robustness. stability concept, relative stability, Routh stability criterion. Root locus method of design. Lead and lag compensation.

Unit IV: Frequency-response analysis- Polar plots, Bode plot, stability in frequency domain, Nyquist plots. Nyquist stability criterion. Performance specifications in frequency-domain. Frequency domain methods of design, Compensation & their realization in time & frequency domain. Lead and Lag compensation.

Unit V : State variable Analysis- Concepts of state, state variable, state model, state models for linear continuous time functions, diagonalization of transfer function, solution of state equations, concept controllability & observability. Introduction to Optimal control & Nonlinear control, Optimal Control problem, Regulator problem, Output regulator, tracking problem. Nonlinear system – Basic concept & analysis.

Text/Reference Books:

1. Gopal. M., "Control Systems: Principles and Design", Tata McGraw-Hill, 1997.
2. Kuo, B.C., "Automatic Control System", Prentice Hall, sixth edition, 1993.
3. Ogata, K., "Modern Control Engineering", Prentice Hall, second edition, 1991.
4. Nagrath & Gopal, "Modern Control Engineering", New Age International, New Delhi

Course Outcomes:

At the end of this course students will demonstrate the ability to:

- Characterize a system and find its study state behavior
- Investigate stability of a system using different tests
- Design various controllers
- Solve liner, non-liner and optimal control problem

Sub Code	L	T	P	Duration	IA	ESE	Credits
EC05TPE01	3	0	0	3 hours	30	70	3

INFORMATION THEORY & CODING

Course Objectives:

- Design the channel performance using Information theory.
- Comprehend various error control code properties.
- Apply linear block codes for error detection and correction.
- Apply convolution codes for performance analysis & cyclic codes for error detection and correction.
- Apply Turbo coding and decoding for error detection and correction.

Unit I: Source Coding: Introduction to Information Theory, Uncertainty and Information, Average Mutual Information and entropy, Information Measures for continuous Random Variables, Source Coding Theorem, Huffman coding.

Unit II: Channel Capacity Coding: Channel Models, Channel Capacity, Channel Coding, Information Capacity Theorem, Shannon Limit, Markov sources.

Unit III: Error Control Coding (Channel Coding) Linear Block Codes for Error Correction & Cyclic Codes: Introduction to Error Correcting Codes, Basic Definitions, Matrix Description of Linear Block Codes, Equivalent Codes, Parity Check Matrix, Decoding of a Linear Block Code, Syndrome Decoding, Hamming Codes. **Cyclic Codes:** Polynomials, The Division algorithm for Polynomials, A Method for Generating Cyclic codes, Matrix Description of cyclic codes, Burst Error Correction.

Unit IV: Convolution Codes: Introduction to Convolution Codes, Tree codes and Trellis Codes, Polynomial Description of Convolution Codes (analytical Representation), distance Notions for Convolution Codes, The Generating Function, Matrix Description of Convolution Codes, Viterbi Decoding, Distance Bounds for Convolution Codes.

Unit V: Turbo Codes: Turbo codes, Turbo decoding, Distance properties of turbo codes, Convergence of turbo codes

Text/Reference Books:

1. Simon Haykin, Digital Communications, Wiley India Edition, 2009
2. N. Abramson, Information and Coding, McGraw Hill, 1963.
3. M. Mansurpur, Introduction to Information Theory, McGraw Hill, 1987.
4. R.B. Ash, Information Theory, Prentice Hall, 1970.
5. Shu Lin and D.J. Costello Jr., Error Control Coding, Prentice Hall, 1983.
6. Todd K. Moon, "Error Correction Coding", 1st Edition, Wiley-Interscience, 2006.
7. F. J. MacWilliams, N. J. A. Sloane, "The Theory of Error-Correcting Codes", North-Holland, Amsterdam, 1977
8. R. E. Blahut, "Algebraic Codes for Data Transmission", 1st Edition, Cambridge University Press 2003.
9. Cary W. Huffman, Vera Pless, "Fundamentals of Error-Correcting Codes", 1st Edition, Cambridge University Press, 2003.
10. Rolf Johannesson and Kamil Sh. Zigangirov, ''Fundamentals of Convolutional Coding'', IEEE Press, 1999.

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

- Understand the concept of information and entropy
- Understand Shannon's theorem for coding
- Calculation of channel capacity
- Apply coding techniques

Sub Code	L	T	P	Duration	IA	ESE	Credits
EC05TPE02	3	0	0	3 hours	30	70	3

CMOS DESIGN

Course Objectives:

- Impart knowledge of MOS transistor theory and CMOS technologies.
- Impart knowledge on architectural choices and performance tradeoffs involved in designing and realizing the circuits in CMOS technology. study of VHDL language

Unit I: FUNDAMENTALS OF MOSFETS: Introduction to MOS transistor, basic operation, threshold voltage ,V-I characteristic ,Depletion MOSFET ,trans conductance, PMOS and its V-I characteristic, aspect ratio and its implication, channel length modulation, substrate bias effect, electrical parameters of MOSFETS.

Unit II: CMOS INVERTER: Introduction, ideal inverter, Logic level standards, VTC of inverter, Noise margin, Basic NMOS inverter. CMOS inverter, design technique, inverter switching characteristic, delay times, transient effects, power dissipation, introduction to bi-CMOS inverter

Unit III: STATIC AND DYNAMIC LOGIC CIRCUITS: Introduction, Various Static CMOS logic gate design ,Pseudo-nMOS gates ,pass transistor logic, transmission gates, tristate buffer, dynamic logic, Evaluate logic, Domino CMOS logic, Non ideal effects of dynamic logic circuits

Unit IV: SEQUENTIAL AND COMBINATIONAL CIRCUITS: Types of regenerative circuits, bi-stability principle, basics S-R flip flop, JK flip-flop, Master slave Flip Flop, D latch, Static Vs Dynamic latch ,memory system, types of semiconductor memory, Dynamic RAM, Static RAM.

Unit V: INTRODUCTION TO VHDL.: Introduction and use of VHDL, Entity and Architecture Declaration, Types of Models of Architecture, Data objects, Data types, Operators ,concurrent and sequential statements, process statements, case ,if, when statements ,Design of sequential and combinational circuits

Text/References books:

1. Douglas A. Pucknell & Kamran Eshraghian "Basic VLSI Design", PHI 3rd Edition.
2. Neil H.E. Weste, David Harris, Ayan Banerjee, "CMOS VLSI Design-A Circuits and Systems Perspective", Pearson Education 3rd Edition.
3. J Bhaskar, "A VHDL Primer", Pearson Publication.
4. Brow and Varsenic "Fundamentals of VLSI Design Techniques with VHDL" MGH Publication.
5. Angsuman Sarkar and Swapandip De, "VLSI design and EDA tools", SCITECH Publication.

Course outcomes:

At the end of this course, students will demonstrate the ability:

- To introduce the concept of VLSI.
- To introduce the concept of MOS fabrication, MOS design and different MOS circuits.
- To introduce the concept of VHDL.

Sub Code	L	T	P	Duration	IA	ESE	Credits
EC05TPE03	3	0	0	3 hours	30	70	[illegible]

INTRODUCTION TO MEMS

Course Objectives:

- To provide knowledge of semiconductors and solid mechanics to fabricate MEMS devices.
- To educate on the rudiments of Micro fabrication techniques.
- To introduce various sensors and actuators
- To introduce different materials used for MEMS
- To educate on the applications of MEMS to disciplines beyond Electrical and Mechanical engineering.

Unit I: Introduction : Intrinsic Characteristics of MEMS – Energy Domains and Transducers- Sensors and Actuators – Introduction to Micro fabrication – Silicon based MEMS processes – New Materials – Review of Electrical and Mechanical concepts in MEMS – Semiconductor devices – Stress and strain analysis – Flexural beam bending- Torsional deflection.

Unit II: Sensors and Actuators-I : Electrostatic sensors – Parallel plate capacitors – Applications – Interdigitated Finger capacitor – Comb drive devices – Micro Grippers – Micro Motors – Thermal Sensing and Actuation – Thermal expansion – Thermal couples – Thermal resistors – Thermal Bimorph – Applications – Magnetic Actuators – Micromagnetic components – Case studies of MEMS in magnetic actuators- Actuation using Shape Memory Alloys.

Unit III : Sensors And Actuators-II: Piezoresistive sensors – Piezoresistive sensor materials – Stress analysis of mechanical elements – Applications to Inertia, Pressure, Tactile and Flow sensors – Piezoelectric sensors and actuators – piezoelectric effects – piezoelectric materials – Applications to Inertia , Acoustic, Tactile and Flow sensors.

Unit IV: Micromachining: Silicon Anisotropic Etching-Anisotrophic Wet Etching-Dry Etching of Silicon – Plasma Etching – Deep Reaction Ion Etching (DRIE)-Isotropic Wet Etching-Gas Phase Etchants – Case studies -Basic surface micro machining processes-Structural and Sacrificial Materials – Acceleration of sacrificial Etch – Striction and Antistriction methods – LIGA Process - Assembly of 3D MEMS – Foundry process.

Unit V: Polymer and Optical MEMS: Polymers in MEMS– Polimide - SU-8 - Liquid Crystal Polymer (LCP) – PDMS – PMMA – Parylene – Fluorocarbon - Application to Acceleration, Pressure, Flow and Tactile sensors- Optical MEMS – Lenses and Mirrors – Actuators for Active Optical MEMS.

Text books:

1. Chang Liu, 'Foundations of MEMS', Pearson Education Inc., 2012.
2. Stephen D Senturia, 'Microsystem Design', Springer Publication, 2000.
3. Tai Ran Hsu, "MEMS & Micro systems Design and Manufacture" Tata McGraw Hill, New Delhi, 2002.

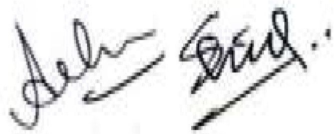
Reference books:

1. Nitaigour Premchand Mahalik "MEMS", The McGraw-Hill Companies, 2011.
2. Nadim Maluf," An Introduction to Micro Electro Mechanical System Design", Artech House, 2000.
3. Mohamed Gad-el-Hak, editor, " The MEMS Handbook", CRC press Baco Raton, 2001.
4. Julian w. Gardner, Vijay K. Varadan, Osama O.Awadelkarim, Micro Sensors MEMS and Smart Devices, John Wiley & Son LTD, 2002.
5. James J.Allen, Micro Electro Mechanical System Design, CRC Press Publisher, 2005.
6. Thomas M.Adams and Richard A.Layton, "Introduction MEMS, Fabrication and Application," Springer, 2010.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

- Understand the operation of micro devices, micro systems and their applications.
- Design the micro devices, micro systems using the MEMS fabrication process.



Sub Code	L	T	P	Duration	IA	ESE	Credits
EC05TPE04	3	0	0	3 hours	30	70	3

COMPUTER ARCHITECTURE

Course Objectives:

- To provide an introduction to concepts in computer architecture.
- Impart knowledge on design aspects, system resources such as memory technology and I/O subsystems needed to achieve increase in performance.
- Acquaint the students with current trends in computing architecture.

Unit I: Processor Basics: CPU Organization, Fundamental and features, Data Representation formats, Fixed and Floating point representation, Instruction Sets, Formats, Types and Programming Considerations.

Unit II: Data path Design: Fixed-Point Arithmetic, Combinational ALU and Sequential ALU, Floating point arithmetic and Advanced topics, Hardware Algorithm – Multiplication, Division.

Unit III: Control Design: Basic Concepts, Hardwired control, Microprogrammed Control, CPU control Unit and Multiplier control Unit, Pipeline Control.

Unit IV: Memory Organization: Memory device characteristics, RAM technology and Serial access memories technology, multilevel memory systems, Address translation and Memory allocation systems, Cache memory.

Unit V: System Organization: Programmed I/O, DMA, Interrupts and IO Processors, Processor-level Parallelism, Multiprocessor and Fault tolerance system.

Text /Reference Books:

1. V. Carl Hammacher, "Computer Organisation", Fifth Edition.
2. A.S.Tanenbum, "Structured Computer Organisation", PHI, Third edition
3. Y.Chu, "Computer Organization and Microprogramming", II, Englewood Chiffs, N.J., Prentice Hall Edition
4. M.M.Mano, "Computer System Architecture", Edition
5. C.W.Gear, "Computer Organization and Programming", McGraw Hill, N.V. Edition
6. Hayes J.P, "Computer Architecture and Organization", PHI, Second edition
7. Computer Organizations and Design- P. Pal Chaudhari, Prentice-Hall of India

Course Outcomes:

At the end of these course students will demonstrate the ability to

- Learn how computers work
- Know basic principles of computer's working
- Analyze the performance of computers
- Know how computers are designed and built
- Understand issues affecting modern processors (caches, pipelines etc.).

Sub Code	L	T	P	Duration	IA	ESE	Credits
EC05TOE01	3	0	0	3 hours	30	70	3

DATA STRUCTURE & ALGORITHMS

Course Objectives:

- Learn Basic Data Structures such as, Linked Lists, Stacks and Queues, Tree and Graph.
- Learn Algorithm for Solving Problems Like Sorting, Searching, Insertion and Deletion of Data
- Understand the Complexity of Various Algorithms.
- Introduce Various Techniques for Representation of the Data in in Memory.

Unit I: Algorithm Analysis and Complexity, Data Structure- Definition, Types of Data Structures Recursion: Definition, Linear and Binary Recursion, Searching Techniques, Linear Search, Binary Search.

Unit II: Sorting Techniques: Basic Concepts, Sorting Algorithms: Insertion (Insertion Sort), Selection (Heap Sort), Exchange (Bubble Sort, Quick Sort), Distribution (Radix Sort) and Merging (Merge Sort) Algorithms.

Unit III: Stacks and Queues: Stacks: Basic Stack Operations, Representation of a Stack Using Arrays, Stack Applications: Reversing List, Factorial Calculation, Infix to Postfix Transformation, Evaluating Arithmetic Expressions.

Queues: Basic Queue Operations, Representation of a Queue Using Array, Implementation of Queue Operations Using Stack. Circular Queues, Priority Queues. Applications of Queues-Round Robin Algorithm,

Unit IV: Linked Lists: Introduction, Single Linked List, Representation of a Linked List in Memory, Operations on a Single Linked List, Circular Linked List, Double Linked List, Advantages and Disadvantages of Linked List.

Unit V: Trees: Terms Related to Tree, Binary Tree, Binary Tree Traversals, Creation of Binary Tree from In-order, Pre-order and Post-Order Traversals. Threaded Binary Trees. Binary Search Tree, BST Operations: Insertion, Deletion.

Graphs: Basic Concepts, Representations of Graphs: Using Linked List and Adjacency Matrix, Graph Algorithms. Graph Traversals (BFS & DFS), Applications: Dijkstra's Shortest Path, Minimum Spanning Tree Using Prim's Algorithm, Warshall's Algorithm

Text books:

1. Fundamentals of Data Structures, Illustrated Edition by Ellis Horowitz, SartajSahni, Computer Science Press.
2. G. a. V. Pai, Data Structures and Algorithms-2008, TMH
3. Debasis,Samanta- Classic Data Structures- 2/E, PHI,2009

Reference books:

1. E. Horowitz, SartajSahni and Susan anderson, W. H. Freeman -Fundamentals of Data Structures in C
2. Schaum's Series- Introduction of Data Sructure-Prentice Hall of India

Course Outcomes:

At the end of this course, students will demonstrate the ability to

- Understand and Explain Basic Data Structures Such as, Linked Lists, Stacks and Queues, Treeand Graph.
- Select and Apply Appropriate Data Structures to define the particular Problem statement.
- Implement Operations Like Searching/Sorting, Insertion, and Deletion, Traversing on Various Data Structures.
- Determine and Analyze the Complexity of Given Algorithms

Sub Code	L	T	P	Duration	IA	ESE	Credits
EC05TOE02	3	0	0	3 hours	30	70	3

OPERATING SYSTEMS

Course Objectives:

- To Understand the Services Provided by Operating System
- To Understand the Working and Organization of Process and its Scheduling and Synchronization.
- To Understand the Concept of Deadlock.
- To Understand Different Approaches of Memory Management Techniques.
- To Understand the Structure and Organization of the File System.

Unit I: Definitions, Components and Types of Operating System, Operating System Services, System Calls, System Programs, Process Concepts, Process State & Process Control Block, Process Scheduling, Scheduling Criteria, Scheduling Algorithms, Multiple- Processor Scheduling, Real-Time Scheduling, Threads Introduction

Unit II: The Critical Sections Problem, Semaphores, Classical Problem of Synchronization, Deadlock Characterizations, Method for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock, Combined Approach to Deadlock

Unit III: Storage Management Logical Versus Physical Address Space, Swapping, Contiguous Allocating, Paging, Segmentation, Virtual Memory, Demand Paging, Performance of Demand Paging, Page Replacement, Page Replacement Algorithms, Thrashing, Demand Segmentation

Unit IV: Disk Structure, Disk Scheduling, Disk Management, Swap Space Management, Disk Reliability, Stable Storage Implementation, File Concepts, Directory Structure, Protecting, I/O Subsystem Overview, I/O Hardware, Application I/O Interface, Kernel I/O Subsystem

Unit V: Introduction to distributed systems: I/O Subsystem Principles of I/O Hardware: I/O devices, device controllers, direct memory access. Principles of I/O Software: Goals, interrupt handlers, device drivers, device independent I/O Software. User space I/O software, I/O protection. Distributed file systems: Design, Implementation, and trends. Performance Measurement: Important trends affecting performance issues, performance measures, evaluation techniques, bottlenecks and saturation feedback loops. Case study of UNIX, DOS and WINDOWS operating systems.

Text books:

1. Silberschatz, Galvin, Gagne-Operating System Concepts -Wiley Student Edition
2. Milan Milenkovic-Operating System Concepts & Design-TMH Publication
3. Andrew S. Tanenbaum-Modern Operating System-PHI

Reference books:

1. Operating System: A Design-oriented Approach, 1st Edition by Charles Crowley, IrwinPublishing
2. Operating Systems: A Modern Perspective, 2nd Edition by Gary J. Nutt, Addison-Wesley
3. Design of the Unix Operating Systems, 8th Edition by Maurice Bach, Prentice-Hallof India
4. Understanding the Linux Kernel, 3rd Edition, Daniel P. Bovet, Marco Cesati, O'Reillyand Associates

Course Outcomes:

At the end of the course, students will able to:

- Identify and describe the Services Provided by Operating Systems
- Understand and Solve Problems Involving Process Control, Mutual Exclusion, Synchronization and Deadlock.
- Implement Processor Scheduling, Synchronization and Disk Allocation Algorithms for a Given Scenario
- Apply Various Approaches of Memory Management Techniques
- Analyze Various Operating System Approaches in Linux and Windows

Sub Code	L	T	P	Duration	IA	ESE	Credits
EC05PPC06	0	0	2	2 Hours	30	20	1

ELECTROMAGNETIC WAVES LAB

Course Objectives:

- To understand the concepts and working principles of the devices used in propagation of Electromagnetic Waves
- Understand principle of radiation and radiation characteristics of an antenna

List of Experiments:

1. Design of Rectangular waveguide
2. Design of Circular Waveguide
3. Design and Analysis of Transmission line
4. Design of Transmission line as a circuit element
5. Analysis and use of smith chart for impedance calculation
6. Analysis and use of smith chart for admittance calculation
7. Field visualization in waveguide
8. Analysis of radiation pattern and various parameter of antenna
9. Design of Monopole Antenna
10. Design of dipole Antenna

Course Outcomes:

At the end of this course students will demonstrate the ability to

- Use sections of transmission line sections for realizing circuit elements
- Analyze wave propagation on metallic waveguides in modal form
- Understand principle of radiation and radiation characteristics of an antenna

Sub Code	L	T	P	Duration	IA	ESE	Credits
EC05PPC07	0	0	2	2 Hours	30	20	1

COMPUTER NETWORK LAB

Course Objectives:

Student will try to learn:

- To understand the working principle of various communication protocols.
- To analyze the various routing algorithms.
- To know the concept of data transfer between nodes.

List of Experiments:

1. Study of Local Area Network.
2. Study of Network Devices in Detail.
3. Program to calculate the channel capacity.
4. Program to calculate SINR (signal-to-noise-plus-interference ratio) using the channel capacity theorem.
5. Program to calculate Bandwidth using the channel capacity theorem.
6. Study of Ethernet.
7. Study of pure aloha protocol.
8. Study of slotted protocol.
9. Study of FTP (File transfer Protocol).
10. Study of Token Bus Protocol.
11. Study of Token Ring Protocol.
12. Study of Network Topologies.
13. Study of Selective Repeat protocol.
14. Study of CSMA-CD Protocol

Course Outcomes:

At the end of this course students will demonstrate the ability to:

- Identify and use various networking components
- Understand different transmission media and design cables for establishing a network.
- Implement device sharing on network
- Learn the major software and hardware technologies used on computer networks.

Sub Code	L	T	P	Duration	IA	ESE	Credits
EC05PPC08	0	0	2	2 Hours	30	20	1

LIC AND IT'S APPLICATIONS LAB

Course Objectives:

Student will try to learn:

- To design amplifier using transistor.
- To design amplifier using op-amp.
- To design oscillators.
- To design filters.

List of Experiments

1. To design a bistable multivibrator circuit and to draw its output waveform.
2. To design a monostable multivibrator circuit and to draw its output waveform.
3. To design a astable multivibrator circuit and to draw its output waveform.
4. To design an inverting amplifier using opamp (741) and study its frequency response.
5. To design a non-inverting amplifier using opamp (741) and study its frequency response.
6. To design a summing amplifier using opamp (741)
7. To design a differential amplifier using opamp (741) and find its CMRR.
8. To determine SVRR and slew rate of an opamp (741)
9. To design an astable multivirator using 555 timer
10. To design a monostable multivibrator using 555 timer.
11. To design and study a diode clamper circuit.
12. To design and study diode series and shunt clipper.
13. To measure the input impedance of an voltage follower using opamp (741)
14. To design and study comparator circuit using opamp (741)
15. To study the voltage regulation of 78xx and 79xx series of voltage regulators.

Course outcomes:

Upon successful completion of the course, students will be able to

- Design and test amplifiers using transistors and op-amps
- Analyze and test oscillators.
- Implement and design of analog active filters using op-amps.
- Design and test voltage regulated power supply.
- Implement and understand the voltage regulators.

B. TECH. III YEAR VI SEMESTER SCHEME

Sub.Code	L	T	P	Duration	IA	ESE	Credits
EC06TPC12	3	1	0	4 hours	30	70	4

DIGITAL SIGNAL PROCESSING

Course Objectives:

To provide an overview of topics in basic and advanced digital signal processing techniques with applications to speech and image processing.

Unit I: Introduction of discrete time signals, Representation of signals on orthogonal basis, Sampling and reconstruction of signals, Discrete systems attributes, Introduction of Z-Transform, Analysis of LSI systems, Frequency Analysis, Inverse Systems, Discrete Fourier Transform (DFT), Convolution, Correlation, Fast Fourier Transform Algorithm, Decimation –in-Time, Decimation –in-Frequency,

Unit II: Realization of Systems: Realization of digital linear system, Structures for realization of discrete time systems, Strucrures for IIR and FIR systems, **Realization of IIR filter:** Direct form-I, Direct form-II, Signal flow graph, Cascade form, Parallel structure, Lattice structure, Lattice-Ladder structure. **Realization of FIR filter:** Transversal structure, linear phase realization, Lattice structure.

Unit III: Infinite Impulse Response Filter design (IIR): Features of IIR filters, Design stages, Filter design by Approximation of Derivatives, Impulse invariance method, bilinear transformation method, Butterworth and Chebyshev Design Method, Frequency Transformations in Analog and Digital domain.

Unit-IV: Finite Impulse Response (FIR) Filter Design: Linear phase response- Symmetric and Antisymmetric, Design by Window method, Optimal method, Rectangular, Triangular, Hanning, Hamming, Blackman & Kaiser Window, Frequency sampling method, Design of FIR differentiators, Design of Hilbert transformer, Comparison of various design methods.

Unit V: Sampling Theorem and Multi-rate DSP: Introduction, Sampling Rate Conversion by rational factor, Decimation of Sampling rate by an Integer factor, Interpolation of sampling rate by an Integer Factor, Sampling rate alteration or conversion by a rational factor.

Applications of Digital Signal Processing: Introduction, Applications of DSP Digital Sinusoidal Oscillators, Digital Time Control Circuits, Digital Comb Filters. Applications in broader sense: Applications of DSP in Image Processing, Applications of DSP to Radar, Applications of DSP in speech processing.

Text/Reference Books:

1. S. K. Mitra, " Digital Signal Processing: A computer based approach", McGraw Hill, 2011.
2. A.V. Oppenheim and R. W. Schafer, "Discrete Time Signal Processing" , Prentice Hall, 1989.
3. J. G. Proakis and D.G. Manolakis, " Digital Signal Processing: Principles, Algorithms And Applications" , Prentice Hall, 1997.

4. L. R. Rabiner and B. Gold, "Theory and Application of Digital Signal Processing" , Prentice Hall, 1992.
5. J. R. Johnson, " Introduction to Digital Signal Processing" , Prentice Hall, 1992. D. J. DeFatta, J. G. Lucas and W. S. Hodgkiss, " Digital Signal Processing" , John Wiley & Sons , 1988

Course Outcomes:

At the end of this course, students will demonstrate the ability to

- Represent signals mathematically in continuous and discrete-time, and in the frequency domain.
- Understand the Discrete-Fourier Transform (DFT) and the FFT algorithms.
- Design digital filters for various applications.
- Apply digital signal processing for the analysis of real-life signals.

Sub Code	L	T	P	Duration	IA	ESE	Credits
EC06TPC13	3	0	0	3 hours	30	70	3

PROBABILITY THEORY AND STOCHASTIC PROCESSES

Course Objectives:

The main objective of this course is to provide students with the foundations of probabilistic and statistical analysis mostly used in varied applications in engineering and science like disease modelling, climate prediction and computer networks etc

Unit I: Introduction to Probability and random variables: Definitions, scope and history; limitation of classical and relative-frequency-base definitions, Sets, fields, sample space and events; axiomatic definition of probability. Combinatorics: Probability on finite sample spaces. Joint and conditional probabilities, independence, total probability; Bayes' rule and applications. The random variable concept, Distribution function, Density function, The Gaussian random variable, other distribution and density examples, Conditional distribution and density functions.

Unit II: Operation on One Random Variable – Expectation & Multiple Random Variables Expectation, Moments, Functions that give Moments, Transformations of a random variable, Computer generation of one random variable. Vector random variables, Joint distribution and its properties, Joint density and its properties, Conditional distribution and density, Statistical independence, Distribution and density of a sum of random variables, Central limit theorem.

Unit III: Random Processes-The random process concept, Stationarity and independence, Correlation functions, Measurement of correlation functions, Gaussian random processes, Poisson random process, Complex random processes

Unit IV: Spectral Characteristics of Random Processes-Power density spectrum and its properties, Relationship between power spectrum and autocorrelation function, Cross-Power density spectrum and its properties, Relationship between cross-power spectrum and cross-correlation function, Some noise definitions and other topics, power spectrum of complex processes.

Unit V: Queueing Theory Introduction markov sequences Queueing Systems, Birth-Death Process The M/M/1 Queueing System The M/M/s Queueing System The M/M/1/K Queueing System The M/M/s/K Queueing System.

Text books:

1. Peyton Z. Peebles"Probability, Random Variables & Random Signal Principles ", TMH, 4th Edition, 2001.
2. Donald Childers, Scott Miller "Probability and Random Processes", ,2Ed,Elsevier,2012

Reference Books:

1. Theory of probability and Stochastic Processes-Pradip Kumar Gosh, UniversityPress
2. Probability and Random Processes with Application to Signal Processing - Henry Stark and John W. Woods, Pearson Education, 3rd Edition.
3. Probability Methods of Signal and System Analysis- George R. Cooper, Clave D. MC Gillem, Oxford, 3rd Edition, 1999.

4. Statistical Theory of Communication -S.P. Eugene Xavier, New Age Publications 2003
5. Probability, Random Variables and Stochastic Processes Athanasios Papoulis and S.Unnikrishna Pillai, PHI, 4th Edition, 2002.

Course Outcomes:

Students will be able to:

- Understand the axiomatic formulation of modern Probability Theory and think of random variables as an intrinsic need for the analysis of random phenomena.
- Characterize probability models and function of random variables based on single & multiples random variables.
- Evaluate and apply moments & characteristic functions and understand the concept of inequalities and probabilistic limits.
- Understand the concept of random processes and determine covariance and spectral density of stationary random processes.
- Demonstrate the specific applications to Poisson and Gaussian processes and representation of low pass and band pass noise models.

Sub Code	L	T	P	Duration	IA	ESE	Credits
EC06TPE05	3	1	0	4 hours	30	70	4

ANTENNA & WAVE PROPAGATION

Course Objectives:

- To understand the concepts of radiation from loop and wire antenna.
- To understand the basic concept of large gain and broadband antennas.
- To understand the concepts and working principle of currently popular antennas.
- To understand the working of smart antenna and beam forming to fulfill the requirement of latest technologies.

Unit I: Fundamental Concepts- Physical concept of radiation, Radiation pattern, near-and far-field regions, reciprocity, directivity and gain, effective aperture, polarization, input impedance, efficiency, Friis transmission equation, radiation integrals and auxiliary potential functions.

Unit II: Radiation from Wires and Loops- Infinitesimal dipole, finite-length dipole, linear elements near conductors, dipoles for mobile communication, small circular loop.

Unit III: Aperture and Reflector Antennas-Huygens' principle, radiation from rectangular and circular apertures, design considerations, Babinet's principle, Radiation from sectoral and pyramidal horns, design concepts, prime-focus parabolic reflector and cassegrain antennas. Broadband Antennas- Log-periodic and Yagi-Uda antennas, frequency independent antennas, broadcast antennas.

Unit IV: Micro strip Antennas- Basic characteristics of micro strip antennas, feeding methods, methods of analysis, design of rectangular and circular patch antennas, Dielectric Resonator Antenna, Antenna Arrays-Analysis of uniformly spaced arrays with uniform and non-uniform excitation amplitudes.

Unit-V: Planar arrays, synthesis of antenna arrays, Basic Concepts of Smart Antennas-Concept and benefits of smart antennas, fixed weight beam forming basics, Adaptive beam forming, Different modes of Radio Wave propagation used in current practice.

Text/Reference Books:

1. J.D. Kraus, "Antennas", McGraw Hill, 1988.
2. C.A. Balanis, "Antenna Theory - Analysis and Design", John Wiley, 1982.
3. R.E. Collin, "Antennas and Radio Wave Propagation", McGraw Hill, 1985.
4. R.C. Johnson and H. Jasik, "Antenna Engineering Handbook", McGraw ill, 1984.
5. I.J. Bahl and P. Bhartia, "Microstrip Antennas", Artech House, 1980.
6. R.K. Shevgaonkar, "Electromagnetic Waves", Tata McGraw Hill, 2005
7. R.E. Crompton, "Adaptive Antennas", John Wiley

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

- Understand the properties and various types of antennas.
- Analyze the properties of different types of antennas and their design.
- Operate antenna design software tools and come up with the design of the antenna of required specifications.

Sub Code	L	T	P	Duration	IA	ESE	Credits
EC06TPE06	3	1	0	4 hours	30	70	4

POWER ELECTRONICS

Course Objectives:

- To provide the students a deep insight in to the working of different switching devices with respect to their characteristics.
- To analyse different converters and control with their applications.
- To Learn to Analyse and design controlled rectifier, DC to DC converters, DC to AC inverters,
- To learn to Design SMPS.

Unit I: Characteristics of Semiconductor Power Devices: Thyristor, power MOSFET and IGBT-Treatment should consist of structure, Characteristics, operation, ratings, protections and thermal considerations. Brief introduction to power devices viz. TRIAC, MOS controlled thyristor (MCT), Power Integrated Circuit (PIC) (Smart Power), Triggering/Driver, commutation and snubber circuits for thyristor, power MOSFETs and IGBTs.

Unit II: Controlled Rectifiers: Single phase: Study of semi and full bridge converters for R, RL, RLE and Level loads. Analysis of load voltage and input current- Derivations of load form factor and ripple factor, Effect of source impedance, Input current Fourier series analysis of input current to derive input supply power factor, displacement factor and harmonic factor.

Unit III: Choppers: Quadrant operations of Type A, Type B, Type C, Type D and type E choppers, Control Techniques for choppers – TRC and CLC, Detailed analysis of Type A chopper. Step up chopper. Multiphase Chopper

Unit IV: Single-phase inverters: Principle of operation of full bridge square wave, quasi-square wave, PWM inverters and comparison of their performance. Driver circuits for above inverters and mathematical analysis of output (Fourier series) voltage and harmonic control at output of inverter (Fourier analysis of output voltage). Filters at the output of inverters.

Unit V: Switching Power Supplies: Analysis of fly back, forward converters for SMPS, **Applications:** Power line disturbances, EMI/EMC, power conditioners. Block diagram and configuration of UPS, salient features of UPS, selection of battery and charger ratings, sizing of UPS. Separately excited DC motor drive. P M Stepper motor Drive.

Text /Reference Books:

1. Muhammad H. Rashid, "Power electronics" Prentice Hall of India.
2. Ned Mohan, Robbins, "Power electronics", edition III, John Wiley and sons.
3. P.C. Sen., "Modern Power Electronics", edition II, Chand& Co.
4. V.R. Moorthi, "Power Electronics", Oxford University Press.
5. Cyril W., Lander," Power Electronics", edition III, McGraw Hill.
6. G K Dubey, S R Doradla,;Thyristorised Power Controllers", New Age International Publishers. SCR manual from GE, USA

Course Outcomes:

At the end of this course students will demonstrate the ability to:

- Build and test circuits using power devices such as SCR
- Analyse and design controlled rectifier, DC to DC converters, DC to AC inverters,
- Learn how to analyse these inverters and some basic applications.
- Design SMPS.

Sub Code	L	T	P	Duration	IA	ESE	Credits
EC06TPE07	3	1	0	4 hours	30	70	[illegible]

HIGH SPEED DEVICES & CIRCUITS

Course Objectives:

- To understand the Challenges and concepts of High Speed Electronics.
- To understand the Electronic Materials structure and working principles useful for high speed device.
- To understand the concept of MESFET and Hetero Junctions in High Speed Devices and Electronics.

Unit I: Introduction: Requirement of High speed devices, circuits in Electronics; Classification and Properties of Compound Semiconductors, Ternary Compound Semiconductors and their Applications.

Unit II: Crystal Structures of GaAs, Dopants and Impurities in GaAs and InP, Brief overview of GaAs technology for High speed transistors, Epitaxial techniques, Molecular Beam Epitaxy, Liquid Phase Epitaxy.

Unit III: Metal Semiconductor contacts for MESFET-details, Ohmic contacts on Semiconductors.

Unit IV: MESFET operation and I-V Characteristics, Shockley's Model, Velocity Saturation Effect, Drain Current Saturation, Self-aligned MESFET-SAINT.

Unit V: Hetero Junctions, High Electron Mobility Transistor(HEMT), Heterojunction Bipolar Transistor (HBT)

Text/Reference Books:

1. S K Ghandhi, VLSI Fabrication Principles, 2nd Edition, Wiley India Pvt Ltd
2. C Y Chang & F Kai, GaAs High Speed Devices: Physics, Technology and Circuit Applications, Wiley, NY, 1994
3. H Beneking, High Speed Semiconductor Devices: Circuit aspects and fundamental behavior, Chapman and Hall, London, 1994
4. S M Sze, High Speed Semiconductor Devices, Wiley, 1990
5. Michael Shur, GaAs Devices and Circuits, Springer

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

- Understand modern day electronic materials structures, properties required and concepts.
- Understand the VLSI Techniques and their Modifications required for High speed electronics.
- Understand the concept of Hetero-junction transistors

Sub Code	L	T	P	Duration	IA	ESE	Credits
EC06TPE08	3	1	0	4 hours	30	70	4

NANO ELECTRONICS

Course Objectives:

- To learn and understand basic and advance concepts of nanoelectronics.
- To introduce the Nanoelectronics & nano devices,
- To identify quantum mechanics behind nanoelectronics.
- To describe the principle and the operation of nanoelectronic
- To introduce basic theory of Metal Semiconductor Contacts, construction and operation of BJT and MOSFET and basic theory, operation and structure and scaling of MOS transistors.

Unit I: INTRODUCTION TO NANO- ELECTRONICS: The "Top-Down" Approach, Lithography, The "Bottom- Up" Approach, Why Nano electronics? Nanotechnology Potential, MESO structures.

Unit II: QUANTUM MECHANICS OF ELECTRONS: General Postulates of Quantum Mechanics Operators: Eigen values and Eigen functions, Hermitian Operators, Operators for Quantum Mechanics, Measurement Probability, Time Independent Schrodinger equation: Boundary Conditions on the Wave function.

PARTICLE STATISTICS AND DENSITY OF STATES: Density of States, Density of States in Lower Dimensions, Density of States in a Semiconductor, Particle in a box Concepts, Degeneracy.

Unit III: ELECTRONS SUBJECT TO A PERIODIC POTENTIAL-BAND THEORY OF SOLIDS: Crystalline Materials, Electrons in a Periodic Potential, Kronig Penney Model of Band Structure: Effective Mass, Brillouin Zones, Band Theory of Solids, Doping in Semiconductors, Interacting Systems Model, The Effect of an Electric Field on Energy Bands, Band structures of Some Semiconductors, Electronic Band Transitions Interaction of Electromagnetic Energy and Materials, Carbon Nano tubes.

Unit IV: COULOMB BLOCKADE AND THE SINGLE-ELECTRON TRANSISTOR: Coulomb Blockade: Coulomb Blockade in a Nanocapacitor, Tunnel Junctions, Tunnel Junction Excited by a Current Source, Coulomb Blockade in a Quantum Dot Circuit, Resonant Tunneling Diode, The Single-Electron Transistor : Single-Electron Transistor Logic, Other SET and FET Structures : Carbon Nanotube Transistors (FETs and SETs), Semiconductor Nanowire FETs and SETs, Molecular SETs and Molecular Electronics, 2D semiconductors and electronic devices, Graphene, atomistic simulation.

Unit V: Shrink-down approaches of Transistors: Introduction, CMOS Scaling, The nanoscale MOSFET, FinFETs, Vertical MOSFETs, limits to scaling, system integration limits (interconnect issues etc.).

Text/ Reference Books:

1. G.W. Hanson, Fundamentals of Nanoelectronics, Pearson, 2009.
2. W. Ranier, Nanoelectronics and Information Technology (Advanced Electronic Material and Novel Devices), Wiley-VCH, 2003.
3. K.E. Drexler, Nanosystems, Wiley, 1992.
4. J.H. Davies, the Physics of Low-Dimensional Semiconductors, Cambridge University Press, 1998.
5. C.P. Poole, F. J. Owens, Introduction to Nanotechnology, Wiley, 2003

Course Outcomes:

At the end of this course, students will demonstrate the ability to

- Understand basic concepts of nanoelectronic devices
- Understand various aspects of nano-technology and the processes involved in making nano components and material.
- Leverage advantages of the nano-materials and appropriate use in solving practical problems.
- Understand various aspects of nano-technology and the processes involved in making nano components and material.
- Leverage advantages of the nano-materials and appropriate use in solving practical

Sub Code	L	T	P	Duration	IA	ESE	Credits
EC06TOE03	3	0	0	3 hours	30	70	3

CRYPTOGRAPHY AND NETWORK SECURITY

Course Objectives:

- To understand Cryptography Theories, Algorithms and Systems.
- To understand necessary Approaches and Techniques to build protection mechanisms in order to secure computer networks and system.

Unit I: Introduction to Cryptography and Block Ciphers: Introduction to security attacks - services and mechanism - introduction to cryptography - Conventional Encryption: Conventional encryption model - classical encryption techniques - substitution ciphers and transposition ciphers – cryptanalysis – steganography - stream and block ciphers - Modern Block Ciphers: Block ciphers principals - Shannon's theory of confusion and diffusion - fiestal structure - data encryption standard(DES) - strength of DES - differential and linear crypt analysis of DES - block cipher modes of operations - triple DES – AES.

Unit II: Confidentiality and Modular Arithmetic: Confidentiality using conventional encryption - traffic confidentiality - key distribution - random number generation - Introduction to graph - ring and field - prime and relative prime numbers - modular arithmetic - Fermat's and Euler's theorem - primality testing - Euclid's Algorithm - Chinese Remainder theorem - discrete algorithms.

Unit III: Public key cryptography and Authentication requirements: Principles of public key crypto systems - RSA algorithm - security of RSA - key management – Diffle-Hellman key exchange algorithm - introductory idea of Elliptic curve cryptography – Elgamel encryption - Message Authentication and Hash Function: Authentication requirements - authentication functions - message authentication code - hash functions - birthday attacks – security of hash functions and MACS.

Unit IV: Integrity checks and Authentication algorithms: MD5 message digest algorithm - Secure hash algorithm (SHA) Digital Signatures: Digital Signatures - authentication protocols - digital signature standards (DSS) - proof of digital signature algorithm - Authentication Applications: Kerberos and X.509 - directory authentication service - electronic mail security-pretty good privacy (PGP) - S/MIME.

Unit V: IP Security & Key Management and Web & System Security: IP Security: Architecture - Authentication header - Encapsulating security payloads - combining security associations - key management. Web Security: Secure socket layer and transport layer security - secure electronic transaction (SET) - System Security: Intruders - Viruses and related threads - firewall design principals – trusted systems.

Text Books:

1. William Stallings, "Crpyptography and Network security Principles and Practices", Pearson/PHI.
2. Wade Trappe, Lawrence C Washington, " Introduction to Cryptography with coding theory", Pearson.
3. Douglas Stinson, "Cryptography Theory and Practice", 2 nd Edition, Chapman & Hall/CRC.
4. B. A. Forouzan, "Cryptography & Network Security", Tata Mc Graw Hill.

Reference Books:

1. W. Mao, "Modern Cryptography – Theory and Practice", Pearson Education.
2. Charles P. Pfleeger, Shari Lawrence Pfleeger – Security in computing – Prentice Hall of India.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

- Identify computer and network security threats, classify the threats and develop a security model to prevent, detect and recover from the attacks.
- Develop SSL or Firewall based solutions against security threats, employ access control techniques to the existing computer platforms such as Unix and Windows NT.
- Identify factors driving the need for information security

Sub Code	L	T	P	Duration	IA	ESE	Credits
EC06TOE04	3	0	0	3 hours	30	70	3

ARTIFICIAL INTELLIGENCE

Course Objectives:

- Students will develop a basic understanding of the building blocks of AI as presented in terms of intelligent agents.
- Students to understand the main approaches to artificial intelligence such as heuristic search, game search, logical inference, decision theory, planning, machine learning, neural networks and natural language processing.

Unit I: Introduction of Artificial Intelligence(AI), Difference between Intelligence and Artificial Intelligence, Definitions of AI, Strong AI and Weak AI, Application areas of AI, Comparison of Conventional and AI Computing, History of AI, Turing Test, Branches of AI, Intelligent Agents, State Space Representation, Production System, Heuristic Search, Search Methods (Uninformed Search and Informed Search), Breadth First Search, Depth First Search, Difference between Breadth First Search and Depth First Search, Hill Climbing, Best First Search.

Unit II: Role of Knowledge Representation in AI, Types of Knowledge, Properties of Knowledge Representation System, Categories of Knowledge Representation Scheme, First Order Predicate Calculus, Well Formed Formula in Predicate Logic, Conversion to Clausal Form, Resolution in Predicate Logic, Semantic Nets, Properties of Semantic Nets, Frames, Scripts, Advantages and Disadvantages of Scripts.

Unit III: Introduction of Expert System, Comparison between Human Expert and Expert System, Comparison between Expert System and Software System, Difference between Knowledgebase and Database, Basic Components of an Expert System, Characteristics of Expert System, Life Cycle Development of Expert System, Advantages of Expert System, Limitation of Expert System, Expert System Tools, Existing Expert Systems (DENDRAL and MYCIN).

Unit IV: Introduction to LISP : Syntax and Numeric Functions, Working with GNU CLISP, Basic Data Objects in GNU CLISP, Basic List Manipulation Functions in GNU CLISP (setq, car, cdr, cons, list, append, last, member, reverse), User Defined Functions in GNU CLISP, Predicates (atom, equal, evenp, numberp, oddp, zerop, >=, <=, listp, null) and Conditionals (cond and if) in GNU CLISP, Logical Functions (not, or, and) in GNU CLISP, Input / Output and Local Variables (read, print, princ, terpri, format, let, prog) in GNU CLISP, Recursion and Iteration(do) in GNU CLISP, Arrays in GNU CLISP.

Unit V: Introduction to PROLOG, Term, Ground Term, Function, Predicate, Features of PROLOG, Program Clause, Unit Clause, Logic Program, Goal Clause, Empty Clause, Simple Query, Conjunctive Query, Structure of PROLOG Program, Working with SWI-Prolog General Syntax of PROLOG, Execution of a Query in Logic Program (Ground Query and Non-Ground Query), Law of Universal modus ponen, Ground Reduction, PROLOG Control Strategy, Search Tree and Proof Tree, Relational and Arithmetic Operators, Recursion in PROLOG, Lists manipulation in PROLOG, Iterative programming in PROLOG.

Text/Reference Books:

1. E, Rich and K. Knight, "Artificial Intelligence", Forty Sixth Edition, Tata Mc GrawHill, 2007.
2. D.W. Patterson, "Introduction to Artificial Intelligence and Expert Systems", Tenth Edition, Prentice Hall of India, 2001.
3. S. Kaushik, "Logic and Prolog Programming", New Age International Limited, 2006

Course Outcomes:

Upon completion of this course the students should able to:

- Recognize problems that can be solved using artificial intelligence.
- Implement artificial intelligence algorithms for real-time problems.
- Apply ontological engineering in state space search.
- Analyze various uncertain knowledge and reasoning techniques.
- Implement different types of learning methods.

Sub Code	L	T	P	Duration	IA	ESE	Credits
EC06TBS07	3	0	0	3 hours	30	70	3

LIFE SCIENCE

Course Objectives:

- Introduce the molecular basis of life.
- Provide the basis for classification of living organisms.
- Describe the transfer of genetic information.
- Introduce the techniques used for modification of living organisms.
- Describe the applications of biomaterials

Unit I: **Plant Physiology** covering, Transpiration; Mineral nutrition, **Ecology** covering, Ecosystems-Components, types, flow of matter and energy in an ecosystem; Community ecology-Characteristics, frequency, life forms, and biological spectrum; Ecosystem structure- Biotic and a-biotic factors, food chain, food web, ecological pyramids.

Unit II: **Population Dynamics** covering, Population ecology- Population characteristics, ecotypes; Population genetics- Concept of gene pool and genetic diversity in populations, polymorphism and heterogeneity; **Environmental Management** covering, Principles: Perspectives, concerns and management strategies; Policies and legal aspects- Environment Protection Acts and modification, International Treaties; Environmental Impact Assessment- Case studies (International Airport, thermal power plant)

Unit III: Molecular Genetics covering, Structures of DNA and RNA; Concept of Gene, Gene regulation, e.g., Operon concept; **Biotechnology** covering, Basic concepts: Totipotency and Cell manipulation; Plant . Methods and uses in agriculture, medicine and health; Recombinant DNA Technology- Basic Techniques and applications.

Unit IV: Biostatistics covering, Introduction to Biostatistics:-Terms used, types of data; Measures of Central Tendencies- Mean, Median, Mode, Normal and Skewed distributions; Analysis of Data-Hypothesis testing and ANNOVA (single factor)

Unit V: Laboratory & Fieldwork Sessions covering, Comparison of stomatal index in different plants; Study of mineral crystals in plants; Determination of diversity indices in plant communities; To construct ecological pyramids of population sizes in an ecosystem; Determination of Importance Value Index of a species in a plant community; Seminar (with PPTs) on EIA of a Mega-Project (e.g., Airport, Thermal/Nuclear Power Plant/ Oil spill scenario); Preparation and extraction of genomic DNA and determination of yield by UV absorbance; Isolation of Plasmid DNA and its separation by Gel Electrophoresis; Data analysis using Bio-statistical tools.

Text/Reference Books:

1. Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M. L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd.
2. Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H. John Wiley and Sons.

3. Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman and Company.
4. Molecular Genetics (Second edition), Stent, G. S.; and Calender, R. W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher.
5. Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm. C. Brown Publishers.

Course Outcomes:

After studying the course, the student will be able to:

- explain the differences between biological organisms and manmade systems and classify organisms
- interpret the relationship between the structure and function of proteins, nucleic acid and summarize the industrial applications of biomolecules
- explain the mechanism of respiration
- demonstrate the mapping of genes, and explain the medical importance of gene disorders.
- apply thermodynamic and kinetic principles to biological systems

Sub Code	L	T	P	Duration	IA	ESE	Credits
EC06PPC09	0	0	4	4 hours	30	20	2

DIGITAL SIGNAL PROCESSING LAB

Course Objectives:

- To implement Linear and Circular Convolution.
- To implement FIR and IIR filters.

List of Experiments:

Introduction to MATLAB or equivalent software

1. Generation of digital signals and random sequences also determine their correlations.
2. To verify Linear and Circular convolutions.
3. To compute DFT of sequence and its Spectrum Analysis.
4. To implement 8-point FFT algorithm.
5. To design of FIR filters using rectangular window techniques.
6. To design of FIR filters using triangular window techniques.
7. To design of FIR filters using Kaiser Window.
8. To design of Butterworth IIR filter.
9. To design of Chebyshev IIR filter.
10. To generate the down sample (decimation) by an Integer factor,
11. To generate the up sample (interpolation) by an Integer factor

Course Outcomes:

Upon successful completion of the course, students will be able to

- Analyze Finite word length effect on DSP systems.
- Demonstrate the applications of FFT to DSP.
- Implement adaptive filters for various applications of DSP.

Sub Code	L	T	P	Duration	IA	ESE	Credits
EC06PPC10	0	0	2	2 hours	30	20	1

ELECTRONIC MEASUREMENT LAB

Course Objectives:

- To introduce students to monitor, analyze and control any physical system.
- To understand students how different types of meters work and their construction
- To introduce students a knowledge to use modern tools necessary for electrical projects

List of Experiments:

1. Measurement of unknown self-inductance using maxwell inductance bridge.
2. Measurement of unknown self-inductance of high quality factor using Hay's Bridge
3. Measurement of an unknown self -inductance using Anderson Bridge
4. Measurement of an unknown capacitance using De-Sauty's Bridge.
5. Measurement of an unknown capacitance using Wein's Series Resistance Bridge.
6. Measurement of an unknown capacitance using Schering's Bridge
7. To determine the sensitivity of LVDT and hence to show linear range of operation of LVDT.
8. To study the input /output characteristics of LVDT.
9. To study the characteristics of the Thermocouple.
10. To study Galvanometer.

Course Outcomes:

At the end of this course students will demonstrate the ability to:

- To use the techniques and skills for electrical projects.
- Design a system, component or process to meet desired needs in electrical engineering
- Ability to balance Bridges to find unknown values.
- Ability to measure frequency, phase with Oscilloscope.
- Ability to use Digital voltmeters

Sub Code	L	T	P	Duration	IA	ESE	Credits
EC06PPC11	0	0	4	4 hours	30	20	2

MINI PROJECT/ELECTRONIC DESIGN WORKSHOP

Course objectives:

- To provide students for knowledge of Electronics Components and soldering techniques and its package information for electronics circuit design.
- Knowledge for the assembling of electronics circuit with components on PCB (Printed Circuit Board) of circuit design.
- Design and development of Small electronic project based on hardware and software for electronics systems

Course Guidelines:

1. The mini-project is a team activity having 3-4 students in a team. This is electronic product design work with a focus on electronic circuit design.
2. The mini project may be a complete hardware or a combination of hardware and Software. The software part in mini project should be less than 50% of the total work.
3. Mini project should cater to a small system required in laboratory or real life.
4. It should encompass components, devices, analog or digital IC's, micro controller with which functional familiarity is introduced.
5. After interactions with course coordinator and based on comprehensive literature survey/ need analysis, the student shall identify the title and define the aim and objectives of Mini-project.
6. Student is expected to detail out specifications, methodology, resources required, critical Issues involved in design and implementation and submit the proposal within first week of the semester.
7. The student is expected to exert on design, development and testing of the proposed work as per the schedule.
8. Art work and layout should be made using cad based pcb simulation software. Due considerations should be given for power reqsirement of the system, mechanical aspects for enclosure and control panel design.
9. Completed mini project and documentation in the form of mini project report is to be submitted at the end of semester.
10. Students should follow the standard practice for electronic circuits/product design, converting the circuit design into a complete electronic product, PCB design using suitable simulation software, front panel design and mechanical aspects of the product, and guidelines for documentation /report writing.

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

- Conceive a problem statement either from rigorous literature survey or from the requirements raised from need analysis.

- Design, implement and test the prototype/algorithm in order to solve the conceived problem.
- Write comprehensive report on mini project work.