19EC4111: MICROWAVE AND RADAR ENGINEERING

B.Tech IV Year I Semester

L	T	P	C
3	-	-	**3**

Prerequisite: Antennas and Propagation

Course Objectives:

- To get familiarized with microwave frequency bands, their applications and to understand thelimitations and losses of conventional tubes at these frequencies.
- To distinguish between different types of microwave tubes, their structures and principles of microwave power generation.
- To impart the knowledge of Scattering Matrix, its formulation and utility, and establish the S-Matrix for various types of microwave junctions.
- To explore the concepts of radar and its frequency bands.
- To understand Doppler Effect and get acquainted with the working principles of CW radar, FM-CW radar.

Course Outcomes: Upon completing this course, the student will be able to

- Know the limitations of conventional Tubes at Microwave Frequencies.
- Realize the need for microwave tubes and solid state microwave sources and understand the principles of solid statedevices.
- Understand the applications of S-parameters in microwave component design and learn themeasurement procedure of various microwave parameters.
- Derive the complete radar range equation.
- Understand the need and functioning of CW, and FM-CW radars

UNIT – I

Microwave Tubes: Limitations and Losses of conventional Tubes at Microwave Frequencies, Microwave Tubes – O Type and M Type Classifications, O-type Tubes: 2 Cavity Klystrons – Structure,Reentrant Cavities, Velocity Modulation Process and Applegate Diagram, Bunching Process and SmallSignal Theory – Expressions for O/P Power and Efficiency.

Reflex Klystrons – Structure, Velocity Modulation and Applegate Diagram, Mathematical Theory of Bunching, Power Output, Efficiency, Oscillating Modes and O/P Characteristics.

Helix TWTs: Types and Characteristics of Slow Wave Structures; Structure of TWT and Amplification Process (qualitative treatment), Suppression of Oscillations, Gain Considerations.

UNIT – II

M-Type Tubes: Introduction, Cross-field Effects, Magnetrons – Different Types, Cylindrical Traveling Wave Magnetron – Hull Cut-off and Hartree Conditions, Modes of Resonance And PI-Mode Operation, Separation of PI-Mode, o/p characteristics.

Microwave Solid State Devices: Introduction, Classification, Applications. TEDs Introduction, GunnDiodes – Principle, RWH Theory, Characteristics, Modes of Operation Gunn Oscillation Modes, Principle of operation of IMPATT and TRAPATT Devices.

UNIT – III

Rectangular Waveguides- Solution of Wave equations in rectangular coordinates, TE/TM Mode analysis, Expressions for Fields, Characteristic Equation and Cutoff Frequencies, Filter Characteristics, Dominant and Degenerate Modes, Sketches of TE and TM mode fields in the

Cross-section, Mode Characteristics Phase and Group Velocities, Wave lengths and Impedance Relations, Illustrative Problems

Waveguide Multiport Junctions and **Scattering matrix** - E plane and H plane and Magic Tees. Directional Couplers – 2 Holes, Bethe Hole

Ferrites– Composition and Characteristics, Faraday rotation, Ferrite Components – Gyrator, Isolator, Circulator

Microwave Measurements: Description of Microwave Bench – Different Blocks and their Features, Errors and Precautions

UNIT – IV

Radar: Radar Frequencies and Applications, Radar Block Diagram and Operation, Simple Form of Radar Equation, Prediction of Range Performance, Maximum Unambiguous Range, Minimum Detectable Signal, Receiver Noise, Modified Radar Range Equation.

Radar Equation: SNR, Envelope Detector – False Alarm Time and Probability, Integration of Radar Pulses, Radar Cross Section of Targets, Transmitter Power, PRF and Range Ambiguities, System Losses (qualitative treatment).

UNIT – V

CW Radar: Doppler Effect, CW Radar – Block Diagram, Isolation betweenTransmitter and Receiver, Non-zero IF Receiver, Receiver Bandwidth Requirements, Applications of CW Radar.

FM-CW Radar: Range and Doppler Measurement, Block Diagram and Characteristics, FM CWaltimeter.

TEXT BOOKS:

1. Microwave Devices and Circuits – Samuel Y. Liao, Pearson, 3rd Edition, 2003.
2. Introduction to Radar Systems – Merrill I. Skolnik, TMH Special Indian Edition, 2nd Ed. 2007.

REFERENCE BOOKS:

1. Radar: Principles, Technology, Applications – Byron Edde, Pearson Education, 2004.
2. Microwave Engineering - David M. Pozar, John Wiley & Sons (Asia) Pvt Ltd. 1989, 3r ed.2011Reprint.
3. Microwave Engineering - G.S. Raghuvanshi, Cengage Learning India Pvt. Ltd., 2012.
4. Electronic Communication System – George Kennedy, 6th Ed., McGrawHill.

19EC4112: VLSI DESIGN

B. Tech IV Year I Semester

L	T	P	C
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Prerequisites - Electronic Devices and Circuits, Digital logic Design

Course Objectives: The objectives of the course are to:

- Give exposure to different steps involved in the fabrication of ICs and electrical properties using MOS Transistor analyze the behavior of inverters designed with various loads.
- Give exposure to the design rules to be followed to draw the layout of any logic circuit.
- Provide concept to design different types of logic gates using CMOS inverter and
- Provide design concepts to design building blocks of data path of any system using gates.
- Understand basic programmable logic devices and testing of CMOS circuits.

Course Outcomes: Upon completing this course, the student will be able to

- Acquire qualitative knowledge about the fabrication process of integrated circuitusing MOS transistors.
- Draw the layout of any logic circuit which helps to understand and estimate parasitic of any logic circuit
- Understand Gate level designs of different gates and driving capacitive Loads.
- Provide design concepts required to design building blocks of data path using gates and design of simple memories using MOS Transistors.
- Design simple logic circuit using PLA, PAL, FPGA and CPLD and Understand concept of CMOS Testing

UNIT – I

Introduction: Introduction to IC Technology – MOS, PMOS, NMOS, CMOS & BiCMOS

Basic Electrical Properties: Basic Electrical Properties of MOS and BiCMOS Circuits: Ids Vds relationships, MOS transistor threshold Voltage, gm, gds, Figure of merit ωo; Pas transistor, NMOS Inverter, Various pull ups, CMOS Inverter analysis and design, Bi-CMOS Inverters.

UNIT - II

VLSI Circuit Design Processes: VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layout, 2 μm CMOS Design rules for wires, Contacts and Transistors Layout Diagrams for NMOS and CMOS Inverters and Gates, Scaling of MOS circuits.

UNIT – III

Gate Level Design: Logic Gates and Other complex gates, Switch logic, Alternate gate circuits, Time delays, Driving large capacitive loads, Wiring capacitance, Fan – in, Fan – out, Choice of layers.

UNIT – IV

Data Path Subsystems: Subsystem Design, Shifters, Adders, ALUs, Multipliers, Parity generators, Comparators, Zero/One Detectors, Counters.

Array Subsystems: SRAM, DRAM, ROM, Serial Access Memories.

UNIT – V

Programmable Logic Devices: PLAs, FPGAs, CPLDs, Standard Cells, Programmable Array Logic, Design Approach, Parameters influencing low power design.

CMOS Testing: CMOS Testing, Need for testing, Test Principles, Design Strategies for test, Chip level Test Techniques.

TEXT BOOKS:

1. Essentials of VLSI circuits and systems – Kamran Eshraghian, Eshraghian Dougles and A. Pucknell, PHI, 2005 Edition
2. CMOS VLSI Design – A Circuits and Systems Perspective, Neil H. E Weste, David Harris, Ayan Banerjee, 3rd Ed, Pearson, 2009.

REFERENCE BOOKS:

1. CMOS logic circuit Design - John .P. Uyemura, Springer, 2007.
2. Modern VLSI Design - Wayne Wolf, Pearson Education, 3rd Edition, 1997.

19EC4171: CELLULAR AND MOBILE COMMUNICATIONS
(Professional Elective – III)

B.Tech IV Year I Semester

L	T	P	C
3	-	-	**3**

Prerequisite: Basic Communications

Course Objectives:
The course objectives are:

- To provide the student with an understanding of the Cellular concept, Frequency reuse, Hand-off strategies.
- To enable the student to analyze and understand wireless and mobile cellular communication systems over a stochastic fading channel
- To provide the student with an understanding of Co-channel and Non-Co-channel interferences
- To know the concepts of the cell coverage for signal and Traffic diversity techniques and mobile antennas.
- To know the concepts of the frequency management, Channel assignment and types of handoff.

Course Outcomes: Upon completing this course, the student will be able to

- Familiar with fundamental concepts of mobile cellular systems and its Generations, coverage and capacity in cellular systems.
- Understand impairments due to multipath fading channel and techniques to overcome.
- Understand the fundamental techniques to overcome the different fading effects.
- Understand Co-channel and Non-Co-channel interferences
- Understand frequency management, Channel assignment and types of handoff, Handoff Techniques.

UNIT -I:
Introduction to Cellular Mobile Radio Systems: Limitations of Conventional Mobile Telephone Systems, Basic Cellular Mobile System, First, Second, Third and Fourth Generation Cellular Wireless Systems, Uniqueness of Mobile Radio Environment- Fading Time Dispersion Parameters, Coherence Bandwidth, Doppler Spread and Coherence Time.
Fundamentals of Cellular Radio System Design: Concept of Frequency Reuse, Co Channel Interference, Co-Channel Interference Reduction Factor, Desired C/I From a Normal Case in a Omni Directional Antenna System, System Capacity, Trunking and Grade of Service, Improving Coverage and Capacity in Cellular Systems- Cell Splitting, Sectoring, Microcell Zone Concept.

UNIT –II
Co-Channel Interference: Measurement Of Real Time Co-Channel Interference, Design of Antenna System, Antenna Parameters and Their Effects, Diversity Techniques-Space Diversity, Polarization Diversity, Frequency Diversity, Time Diversity.
Non-Co-Channel Interference: Adjacent Channel Interference, Near End Far End Interference, Cross Talk, Effects on Coverage and Interference by Power Decrease, Antenna Height Decrease, Effects of Cell Site Components.

UNIT -III:

Cell Coverage for Signal and Traffic: Signal Reflections in Flat and Hilly Terrain, Effect of Human Made Structures, Phase Difference between Direct and Reflected Paths, Constant Standard Deviation, Straight Line Path Loss Slope, General Formula for Mobile Propagation over Water And Flat Open Area, Near and Long Distance Propagation, Path Loss from a Point to Point Prediction Model in Different Conditions, Merits of Lee Model. **Cell Site and Mobile Antennas:** Space Diversity Antennas, Umbrella Pattern Antennas, Minimum Separation of Cell Site Antennas, Mobile Antennas.

UNIT -IV:

Frequency Management and Channel Assignment: Numbering and Grouping, Setup Access And Paging Channels, Channel Assignments to Cell Sites and Mobile Units, Channel Sharing and Borrowing, Sectorization, Overlaid Cells, Non Fixed Channel Assignment.

UNIT -V:

Handoffs and Dropped Calls: Handoff Initiation, Types of Handoff, Delaying Handoff, Advantages Of Handoff, Power Difference Handoff, Forced Handoff, Mobile Assisted and Soft Handoff, Intersystem Handoff, Introduction to Dropped Call Rates and their Evaluation.

TEXT BOOKS:

1. Mobile Cellular Telecommunications – W.C.Y. Lee, Mc Graw Hill, 2nd Edn. 1989.
2. Wireless Communications - Theodore. S. Rapport, Pearson Education, 2nd Edn. 2002.
3. Mobile Cellular Communication - Gottapu sashibhushana Rao, Pearson, 2012.

REFERENCE BOOKS:

1 Principles of Mobile Communications – Gordon L. Stuber, Springer International, 2nd Edn. 2001.

2 Modern Wireless Communications-Simon Haykin, Michael Moher, Pearson Education, 2005.

3 Wireless Communications Theory and Techniques, Asrar U. H.Sheikh, Springer, 2004.

4 Wireless Communications and Networking, Vijay Garg, Elsevier Publications, 2007.

5 Wireless Communications – Andrea Goldsmith, Cambridge University Press, 2005.

19EC4172: **DIGITAL IMAGE PROCESSING**
(Professional Elective – III)

B.Tech IV Year I Semester

L	T	P	C
3	-	-	**3**

Prerequisite: DSP

Course Objectives:

- To provide detailed approach of human visual system as according to machine perception and transforming to frequency domain
- To enhance image quality using generalized filters both in spatial and frequency domain
- To restore images from degraded phenomenon using filters
- To calculate and remove the amount of redundant information using coding techniques
- To decompose images using thresholding algorithms and getting the structure or pattern of an image using morphological operations

Course Outcomes: Upon completing this Course, the Student will be able to

- Understand the need for image transforms and their properties.
- Choose appropriate technique for image enhancement both in spatial and frequency domains
- Identify causes for image degradation and apply appropriate restoration technique
- Compare various image compression techniques both in spatial and frequency domains
- Analyze various segmentation techniques and morphological operations applied on images

UNIT – I

Digital Image Fundamentals: Image representation, types of images, image file formats, relationship Between pixels, distant measures, Sampling and Quantization, blocks and elements of image Processing.

Image Transforms: 2-D FFT, Walsh Transform, Hadamard Transform, Discrete Cosine Transform, Haar Transform, Slant Transform, Hotelling Transform, Properties of all Transforms.

UNIT – II

Image Enhancement (Spatial Domain): Introduction, Image Enhancement in Spatial Domain, Enhancement through Point Processing, Types of Point Processing, Histogram Manipulation, Linear And Non Linear Gray Level Transformation, Local or Neighborhood criterion, Median Filter, Spatial Domain High-Pass Filtering.

Image Enhancement (Frequency Domain): Filtering in Frequency Domain, Low Pass (Smoothing) and High Pass (Sharpening) Filters in Frequency Domain, Homomorphism filtering

UNIT – III

Image Restoration: Degradation Model, Algebraic Approach to Restoration, Inverse Filtering, Least Mean Square Filters, Constrained Least Squares Restoration, Interactive Restoration.

UNIT – IV

Image Compression: Redundancies and their Removal Methods, Fidelity Criteria, Image Compression Models, Huffman and Arithmetic Coding, Error Free Compression, Lossy Compression, Lossy and Lossless Predictive Coding, Transform Based Compression, JPEG

2000 Standards.

UNIT – V

Image Segmentation: Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region Oriented Segmentation.

Morphological Image Processing: Structuring Element Decomposition, Dilation, Erosion, Combining Dilation and Erosion, Opening and Closing, Hit or Miss Transformation.

TEXT BOOKS:

1. Digital Image Processing - Rafael C. Gonzalez, Richard E. Woods, 3rd Edition, Pearson, 2008.
2. Fundamentals of Digital Image Processing- Anil. K. Jain, Pearson Prentice Hall of India, 2002.
3. Digital Image Processing- S Jayaraman, S Esakkirajan, T Veerakumar Mc Graw Hill Education, 2010.

REFERENCE BOOKS:

1. Digital Image Processing and Analysis-Human and Computer Vision Application with using CVIP Tools - Scotte Umbaugh, 2nd Ed, CRC Press, 2011
2. Digital Image Processing using MATLAB – Rafael C. Gonzalez, Richard E Woods and Steven L. Eddings, 2nd Edition, Mc Graw Hill Education, 2010.
3. Digital Image Processing and Computer Vision – Somka, Hlavac, Boyle- Cengage Learning (Indian edition) 2008.
4. Introductory Computer Vision Imaging Techniques and Solutions- Adrian low, 2008, 2nd Edition

19EC4173: **ARTIFICIAL INTELLIGENCE**
(Professional Elective – III)

B.Tech IV Year I Semester

L	T	P	C
3	-	-	**3**

Prerequisite: PTSP

Course Objectives:

- To import knowledge about Artificial Intelligence.
- To learn the distinction between optimal reasoning Vs. human like reasoning
- To understand the concepts of state space representation, exhaustive search, heuristic search together with the time and space complexities.
- To give understanding of the main abstractions and reasoning for Intelligent systems.
- To enable students to understand the basic principles of Artificial Intelligence in various applications.

Course Outcomes: Upon completing this course, the students will be able to

- Formulate an efficient problem space for a problem expressed in natural language.
- Select a search algorithm for a problem and estimate its time and space complexities.
- Possess the skill for representing knowledge using the appropriate technique for a given problem.
- Apply AI techniques to solve problems of game playing, and machine learning.
- Select appropriate from a range of techniques when implementing intelligent systems.

UNIT – I

Problem Solving by Search-I: Introduction to AI, Intelligent Agents

Problem Solving by Search –II: Problem-Solving Agents, Searching for Solutions, Uninformed Search Strategies: Breadth-first search, Uniform cost search, Depth-first search, Iterative deepening Depth-first search, Bidirectional search, Informed (Heuristic) Search Strategies: Greedy best-first Search, A* search, Heuristic Functions, Beyond Classical Search: Hill-climbing search, Simulated Annealing search, Local Search in Continuous Spaces, Searching with Non-Deterministic Actions, Searching with Partial Observations, Online Search Agents and Unknown Environment.

UNIT – II

Problem Solving by Search-II and Propositional Logic

Adversarial Search: Games, Optimal Decisions in Games, Alpha–Beta Pruning, Imperfect Real-Time Decisions.

Constraint Satisfaction Problems: Defining Constraint Satisfaction Problems, Constraint Propagation, Backtracking Search for CSPs, Local Search for CSPs, the Structure of Problems.

Propositional Logic: Knowledge-Based Agents, the Wumpus World, Logic, Propositional Logic, Propositional Theorem Proving: Inference and proofs, Proof by resolution, Horn clauses and definite clauses, forward and backward chaining, Effective Propositional Model Checking, Agents Based on Propositional Logic.

UNIT – III

Logic and Knowledge Representation

First-Order Logic: Representation, Syntax and Semantics of First-Order Logic, Using First-

Order Logic, Knowledge Engineering in First-Order Logic.
Inference in First-Order Logic: Propositional vs. First-Order Inference, Unification and Lifting,Forward Chaining, Backward Chaining, Resolution.
Knowledge Representation: Ontological Engineering, Categories and Objects, Events. Mental Events and Mental Objects, Reasoning Systems for Categories, Reasoning with Default Information.

UNIT – IV
Classical Planning: Definition of Classical Planning, Algorithms for Planning with State-Space Search, Planning Graphs, other Classical Planning Approaches, Analysis of Planning Approaches.
Planning and Acting in the Real World: Time, Schedules, and Resources, Hierarchical Planning,Planning and Acting in Nondeterministic Domains, Multi agent planning.

UNIT - V
Uncertain knowledge and Learning
Uncertainty: Acting under Uncertainty, Basic Probability Notation, and Inference Using Full Joint Distributions, Independence, Bayes' Rule and Its Use.
Probabilistic Reasoning: Representing Knowledge in an Uncertain Domain, the Semantics of Bayesian Networks, Efficient Representation of Conditional Distributions, Approximate Inference in Bayesian Networks, Relational and First-Order Probability, Other Approaches to Uncertain Reasoning; Dempster - Shafer theory.
Learning: Forms of Learning, Supervised Learning, Learning Decision Trees. Knowledge in Learning: Logical Formulation of Learning, Knowledge in Learning, Explanation-Based Learning, Learning Using Relevance Information, Inductive Logic Programming.

TEXT BOOKS

1. Artificial Intelligence A Modern Approach, Third Edition, Stuart Russell and Peter Norvig, Pearson Education-2015
2. Artificial Intelligence, 3rd Edn., E. Rich and K. Knight (TMH)-2017

REFERENCES:

1. Artificial Intelligence, 3rd Edn., Patrick Henny Winston, Pearson Education.-2002
2. Artificial Intelligence and Expert systems – Patterson, Pearson Education-2015

19EC4174: NETWORK SECURITY AND CRYPTOGRAPHY
(Professional Elective – III)

B.Tech IV Year I Semester

L	T	P	C
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Course Objectives:

- To Understand the basic concept of Cryptography and Network Security
- To understand the necessity of network security, threats/vulnerabilities to networks and countermeasures
- To understand Authentication functions with Message Authentication Codes and Hash Functions.
- To provide familiarity in Intrusion detection
- To know the firewall design principles

Course Outcomes: Upon completing this course, the student will be able to

- Describe network security fundamental concepts and principles
- Encrypt and decrypt messages using block ciphers and network security technology and protocols
- Analyze key agreement algorithms to identify their weaknesses
- Identify and assess different types of threats, malware, spyware, viruses, vulnerabilities
- Understand the web security

UNIT – I

Security Services, Mechanisms and Attacks, a Model for Internetwork security, Classical Techniques: Conventional Encryption model, Steganography, Classical Encryption Techniques**.** **Modern Techniques:** Simplified DES, Block Cipher Principles, Data Encryption standard, Strength of DES, Block Cipher Design Principles.

UNIT – II

Encryption: Triple DES, International Data Encryption algorithm, Blowfish, RC5, Characteristics of Advanced Symmetric block Ciphers. Placement of Encryption function, Traffic confidentiality, Key distribution, Random Number Generation.

UNIT – III

Public Key Cryptography: Principles, RSA Algorithm, Key Management, Diffie-Hellman Key Exchange, Elliptic Curve Cryptography.

Message Authentication and Hash Functions: Authentication requirements and functions, Message Authentication, Hash functions, Security of Hash functions.

UNIT - IV

Hash and Mac Algorithms: MD-5, Message digest Algorithm, Secure Hash Algorithm. Digital Signatures and Authentication protocols: Digital signatures, Authentication Protocols, Digital signature standards.

Authentication Applications: Kerberos, Electronic Mail Security: Pretty Good Privacy, SIME/MIME.

UNIT – V

IP Security: Overview, Architecture, Authentication, Encapsulating Security Payload, Key Management. Web Security: Web Security requirements, secure sockets layer and Transport Layer Security, Secure Electronic Transaction.

Intruders, Viruses and Worms: Intruders, Viruses and Related threats.

Fire Walls: Fire wall Design Principles, Trusted systems.

TEXT BOOKS:

1. Cryptography and Network Security: Principles and Practice - William Stallings, Pearson Education. 6th edition-2013
2. Network Security: The complete reference, Robert Bragg, Mark Rhodes, TMH, 1st edition-2004.

REFERENCE BOOKS:

1. Network Security Essentials (Applications and Standards) by William Stallings Pearson Education. 4th edition-2011
2. Fundamentals of Network Security by Eric Maiwald (Dreamtech press)-2017
3. Principles of Information Security, Whitman, Thomson 4th edition.
4. Introduction to Cryptography, Buchmann, Springer.2nd edition -2004

19EC4175: ADVANCED DIGITAL SIGNAL PROCESSING
(Professional Elective IV)

B.Tech IV Year I Semester

L	T	P	C
3	-	-	**3**

Prerequisite: Digital Signal Processing

Course Objectives

- To review the concepts of DFT, FFT and digital filters.
- To impart knowledge about Decimation, interpolation concepts.
- To discuss advanced filters and its properties
- To inculcate the concepts of power spectral estimation using different non parametric methods
- To Discuss the concepts of power spectral estimation using various parametric methods

Course Outcomes: After the successful completion of the course, student should be able to:

- Gain a thorough knowledge of Fourier transforms and filter design
- Understand and apply multirate signal processing methods and applications.
- Have an in-depth knowledge of advanced filters, their properties and real time applications
- Understand the concepts of power spectral estimation methods and their performance comparison
- Apply the knowledge of power spectral methods for various advanced filters

UNIT I:
Review of Fourier transforms, DFT, FFT. Design of Digital filters: Design of FIR filters-windowing Method, Design of IIR filters (Bilinear transformation), frequency transformations.

UNIT II:
Multirate Digital Signal Processing: Introduction, Decimation by a Factor D, and Interpolation by a Factor I, Sampling Rate Conversion by a Rational Factor I/D, Filter Design and Implementation for sampling rate Conversion, Multistage Implementation of Sampling Rate Conversion, Applications Of Multirate Signal Processing.

UNIT III:
Linear Prediction and Optimum Linear Filters: Innovations Representation of a Stationary Random Process, Forward and Backward linear prediction, Solution of the Normal Equations, Properties of linear prediction-Error Filter, AR Lattice and ARMA Lattice-Ladder Filters.

UNIT IV:
Power Spectral Estimation: Estimation of Spectra from Finite Duration Observations of Signal, the Periodogram, Use DFT in power Spectral Estimation, Bartlett, Welch and Blackman, Tukey methods, Comparison of performance of Non-Parametric Power Spectrum Estimation Methods

UNIT V:
Parametric Method Of Power Spectrum Estimation: Parametric Methods for power spectrum Estimation, Relationship between Auto-Correlation and Model Parameters, AR

(Auto-Regressive) Process and Linear Prediction, Yule-Walker, Burg and Unconstrained Least Squares Methods, Sequential Estimation, Moving Average (MA) and ARMA Models Minimum Variance Method, Pisarenko's Harmonic Decomposition Methods, MUSIC Method (**Multiple Signals Classification**).

TEXT BOOKS:

1. Digital Signal Processing principles –algorithms and Applications- john G. Proakis – PHI – 3rd edition 2002.
2. Theory and Application of Digital Signal Processing by Lawrence R. Rabiner, Bernard Gold -1975
3. Advanced Digital Signal Processing – Theory and Applications – Glenn Zelniker, Fred J. Taylor.1st edition-1993

REFERENCE BOOKS

1. Digital Signal Processing – S Salivahanan. A Vallavaraj C. Gnanapriya –TMH – 2nd reprint 2001.
2. Digital Signal Processing – Sanjit K. Mitra – TMH second edition-2001.
3. Digital Signal Processing – J.S. Chitode – First Edition, 2008, Technical Publications.

19EC4176: WIRELESS COMMUNICATIONS AND NETWORKS
(Professional Elective IV)

B.Tech IV Year I Semester

L	T	P	C
3	-	-	**3**

Prerequisite: Digital Communications

Course Objectives:

- To provide the students with the fundamental treatment about many practical and theoretical concepts that forms basic of wireless communications.
- To provide students to acquire knowledge in the field of wireless communications with an ability to integrate existing and upcoming wireless technologies.
- To provide an analytical perspective on the design and analysis of the traditional and emerging wireless networks, and to discuss the nature of, and solution methods to, the fundamental problems in wireless networking.
- Ability to evaluate design challenges, constraints and security issues associated with ad-hoc wireless networks.
- To understand the architecture and operation of various wireless wide area networks.

Course Outcomes: Upon completion of the course, the student will be able to:

- Understand cellular system design concepts.
- Analyze various multiple path loss models for large-scale and small-scale radio propagations.
- Familiar with some of the existing and emerging wireless standards.
- Analyze and design various receiver techniques.
- Understand architectures, functioning, protocols, capabilities and applications of various wireless communication networks.

UNIT – I

The Cellular Concept-System Design Fundamentals:

Introduction, Frequency Reuse, Channel Assignment Strategies, Handoff Strategies-Prioritizing Handoffs, Practical Handoff Considerations, Interference and system capacity – Co channel Interference and system capacity, Channel planning for Wireless Systems, Adjacent Channel Interference, Power Control for Reducing interference, Trunking and Grade of Service, Improving Coverage & Capacity in Cellular Systems- Cell Splitting, Sectoring.

UNIT – II

Mobile Radio Propagation: Large-Scale Path Loss:

Introduction to Radio Wave Propagation, Free Space Propagation Model, Relating Power to Electric Field, The Three Basic Propagation Mechanisms, Reflection-Reflection from Dielectrics, Brewster Angle, Reflection from prefect conductors, Ground Reflection (Two- Ray) Model, Diffraction-Fresnel Zone Geometry, Knife-edge Diffraction Model, Multiple knife-edge Diffraction, Scattering, Outdoor Propagation Models- Longley-Rice Model, Okumura Model, Hata Model, PCS Extension to Hata Model, Walfisch and Bertoni Model, Wideband PCS Microcell Model, Indoor Propagation Models-Partition losses (Same Floor),Partition losses between Floors, Log-distance path loss model, Ericsson Multiple Breakpoint Model, Attenuation Factor Model, Signal penetration into buildings, Ray Tracing and Site Specific Modeling.

UNIT – III

Mobile Radio Propagation: Small –Scale Fading and Multipath:

Small Scale Multipath propagation-Factors influencing small scale fading, Doppler shift, Impulse Response Model of a multipath channel- Relationship between Bandwidth and Received power, Small-Scale Multipath Measurements-Direct RF Pulse System, Spread Spectrum Sliding Correlator Channel Sounding, Frequency Domain Channels Sounding, Parameters of Mobile Multipath Channels-Time Dispersion Parameters, Coherence Bandwidth, Doppler Spread and Coherence Time, Types of Small-Scale Fading-Fading effects Due to Multipath Time Delay Spread, Flat fading, Frequency selective fading, Fading effects Due to Doppler Spread-Fast fading, slow fading, Statistical Models for multipath Fading Channels-Clarke's model for flat fading, spectral shape due to Doppler spread in Clarke's model, Simulation of Clarke and Gans Fading Model, Level crossing and fading statistics, Two-ray Rayleigh Fading Model.

UNIT – IV

Equalization and Diversity:

Introduction, Fundamentals of Equalization, Training A Generic Adaptive Equalizer, Equalizers in a communication Receiver, Linear Equalizers, Non-linear Equalization- Decision Feedback Equalization (DFE), Maximum Likelihood Sequence Estimation (MLSE) Equalizer, Algorithms for adaptive equalization-Zero Forcing Algorithm, Least Mean Square Algorithm, Recursive least squares algorithm. Diversity Techniques-Derivation of selection Diversity improvement, Derivation of Maximal Ratio Combining improvement, Practical Space Diversity Consideration-Selection Diversity, Feedback or Scanning Diversity, Maximal Ratio Combining, Equal Gain Combining, Polarization Diversity, Frequency Diversity, Time Diversity, RAKE Receiver.

UNIT – V

Wireless Networks:

Introduction to wireless Networks, Advantages and disadvantages of Wireless Local Area Networks, WLAN Topologies, WLAN Standard IEEE 802.11, IEEE 802.11 Medium Access Control, Comparison of IEEE 802.11 a, b, g and n standards, IEEE 802.16 and its enhancements, Wireless PANs, Hiper Lan, WLL.

TEXT BOOKS:

1. Wireless Communications, Principles, Practice – Theodore, S. Rappaport, 2nd Ed., 2002, PHI.
2. Wireless Communications-Andrea Goldsmith, 2005 Cambridge University Press.
3. Principles of Wireless Networks – Kaveh Pah Laven and P. Krishna Murthy, 2002, PE

REFERENCES:

1. Wireless Digital Communications – Kamilo Feher, 1999, PHI.
2. Wireless Communication and Networking – William Stallings, 2003, PHI.
3. Mobile Cellular Communication – Gottapu Sasibhushana Rao, Pearson Education, 2012.

19EC4177: INTERNET OF THINGS
(Professional Elective IV)

B.Tech IV Year I Semester

L	T	P	C
3	-	-	**3**

Prerequisite: MPMC, DCN

Course Objectives:

- To learn about the IoT Architecture and Protocol
- To introduce IoT protocol and its applications
- To learn about the IoT Physical Devices and End Points
- To understand the various types of cloud services
- To know the Privacy and Security Issues of IoT devices.

Course Outcomes: Upon completion of the Course, the students will be able to

- Understand the IoT technology and IoT architecture
- Know about the IoT communication models
- Develop IoT application using Raspberry PI
- Classify various types of Cloud Computing
- Understand the security in IoT

UNIT I

Introduction, IoT Components, Characteristics of IoT, IoT technologies, Issues and Challenges of IoT, IoT Architecture, IoT Impact, IoT Network Architecture and Design, The Core IoT Functional Stack

UNIT II

M2M to IoT an architectural overview, IoT reference model, main design principles and need Capability, Physical Design of IoT – IoT Protocols, IoT communication models, Domain pecific IoTs, IoT applications– Home, City, Environment, Energy, Retail, Agriculture, Industry, health

UNIT III

IoT Physical Devices and End Points: What is an IoT Device? Exemplary Device: Raspberry Pi, About the Board, Linux on Raspberry Pi, Raspberry Pi Interfaces, Programming Raspberry Pi with Python, Other IoT Devices.

UNIT IV

IoT Physical Servers and Cloud Based Services, Types of Cloud Computing, Software as a Service (Saas), Platform as a service (PaaS), Infrastructure as a service (IaaS), anything as a Service (XaaS) , Virtualization In Cloud Computing and Types, Virtualization benefits , Issues In Cloud Computing, Characteristics of Cloud Computing.

UNIT V

Internet of Things Privacy, Security and Governance: Introduction, Overview of Governance, Privacy and Security Issues, Contribution from FP7 Projects, Security, Privacy and Trust in IoT Data Platforms for Smart Cities, First Steps Towards a Secure Platform

TEXT BOOKS

1. ArshdeepBahga and Vijai Madisetti, A Hands-on Approach Internet of Things, Universities Press, 2015.
2. Gastón C. Hillar, Internet of Things with Python, Packt Publishing Ltd 2016.

REFERENCE BOOKS

1. Rethinking the Internet of Things: A scalable Approach to Connecting Everything, by Francisda Costa, ISBN: 978-1-4302-5740-0, 2013
2. Architecting the Internet of Things, by Dieter Uckelmann, Mark Harrison and Florian Michahelles, ISBN: 978-3-642-19157-2, 2011.

19EC4178: REALTIME OPERATING SYSTEM DESIGN
(Professional Elective IV)

B.Tech IV Year I Semester

L	T	P	C
3	-	-	**3**

Prerequisite: ESD

Course Objectives:

- To provide broad understanding of the requirements of Real Time Operating Systems.
- To understand the concept of Scheduling, Message Queues, Semaphores.
- To understand the Real time operating system concepts (Services, pipes and I/O subsystems
- To understand the Real time operating system concepts Interrupts, RTC, deadlocks, memory management, file management.
- To understand real-time operating system (RTOS) and the types of RTOS With case studies.

Course Outcomes: Upon completing this course, the students will be able to

- Explain real-time concepts such as preemptive multitasking, task priorities, priority inversions, mutual exclusion, context switching, and synchronization, interrupt latency and response time, and semaphores.
- Describe how a real-time operating system kernel is implemented.
- Explain how the real-time operating system implements time management.
- Know tasks can communicate using semaphores, mailboxes, and queues.
- Implement a real-time system on an embedded processor

UNIT – I:

Introduction: Introduction to UNIX/LINUX, Overview of Commands, File I/O, (open, create, close, lseek, read, write), Process Control (fork, vfork, exit, wait, waitpid, exec).

UNIT – II:

Real Time Operating Systems: Brief History of OS, Defining RTOS, The Scheduler, Objects, Services, Characteristics of RTOS, Defining a Task, asks States and Scheduling, Task Operations, Structure, Synchronization, Communication and Concurrency. Defining Semaphores, Operations and Use, Defining Message Queue, States, Content, Storage, Operations and Use

UNIT – III:

Objects, Services and I/O: Pipes, Event Registers, Signals, Other Building Blocks, Component Configuration, Basic I/O Concepts, I/O Subsystem

UNIT – IV:

Exceptions, Interrupts and Timers: Exceptions, Interrupts, Applications, Processing of Exceptions and Spurious Interrupts, Real Time Clocks, Programmable Timers, Timer Interrupt Service Routines (ISR), Soft Timers, Operations.

UNIT – V:

Case Studies of RTOS: RT Linux, Micro C/OS-II, Vx Works, Embedded Linux, and TinyOS.

TEXT BOOK:

1. Qing Li, “Real Time Concepts for Embedded Systems”, 2011, Elsevier.

REFERENCE BOOKS:

1. Rajkamal, “Embedded Systems- Architecture, Programming, and Design”, 2007, TMH.
2. W. Richard Stevens, Stephan A. Rago, “Advanced UNIX Programming”, 2006, 2nd Edition, Pearson.
3. Dr. Craig Hollabaugh, “Embedded Linux: Hardware, Software and Interfacing”, 2008, 1st Edition, Pearson

19EC4151: VLSI- DESIGN LAB

B.Tech IV Year I Semester

L	T	P	C
-	-	3	1.5

Course objectives: Train the students

1. To understand the design of analog and digital circuits using CAD tools.
2. To understand the DRC rules for layout design.
3. To understand the process of physical verification, floor planning.
4. To understand the circuit optimization with respect to area, power and delay.
5. To analyze the results of logic and timing simulations and to extract the parasitics.

Course outcomes: By the end of the course student will be able to

1. Design CMOS logic circuits .
2. Simulate circuits within a CAD tool and compare to design specifications.
3. Design Layout, physical verification, placement & route for complex design.
4. Designing of optimized layouts satisfying DRC rules with respect to area, power and delay
5. Analyze DC/Transient characteristics of analog/digital design and to extract the parasitics.

List of Experiments

Design and implementation of the following CMOS digital/analog circuits using **Cadence /Mentor Graphics / Synopsys /Equivalent** CAD tools. The design includes layout and Scaling of CMOS Inverter for different technologies, study of secondary effects (temperature, power supply and process Corners), Circuit optimization with respect to area, performance and/or power, Layout, Extraction of Parasitic and back annotation, modifications in circuit parameters and layout consumption, DC/ Transient analysis, Verification of layouts (DRC, LVS)

VLSI Programs:

- Introduction to layout design rules, Layouts, physical verification, placement & route for complex design and static timing analysis of the following:

1. Basic logic gates
2. CMOS inverter
3. CMOS NOR gates
4. CMOS NAND gates
5. CMOSXOR gates
6. CMOSMUX gates
7. Design of any Boolean expression using AOI/OAI gates
8. Static/Dynamic logic circuit(register cell)
9. Latch
10. NMOS Pass transistor design
11. PMOS Pass transistor design
12. Layout of any combinational circuit (complex CMOS logic gate.
13. Analog Circuit simulation(AC analysis)–CS amplifier
14. Analog Circuit simulation(AC analysis)–CD amplifier

Note: Any **TEN of** the above 14 experiments are to be conducted

19EC4152: ANTENNAS AND MICROWAVE ENGINEERING LAB

B.Tech IV Year I Semester

L	T	P	C
-	-	3	1.5

Course Objectives:

- To study mode characteristics of reflex klystron and GUNN diode
- To measure the frequency and VSWR generated by source and the load
- To become familiar with the basic technique for measuring S-parameters of microwave junctions
- To study the function of multihole directional coupler
- To observe the radiation pattern of horn antenna and uniform linear array

Course Outcomes: at the end of the course, students will be able to

- Analyze the characteristics of reflex Klystron and GUNN diode.
- Measure the Frequency, Wavelength and VSWR of a microwave signal and load.
- Determine the performance parameters of microwave junctions
- Measure the coupling factor and isolation of directional coupler
- Analyze the radiation pattern characteristics of horn antenna and uniform linear array

LIST OF EXPERIMENTS:

Part-A

MATLAB/C/Scilab Simulation of the following antenna arrays (Plotting radiation pattern)

1. Broad side linear array with uniform spacing and amplitude
2. End fire linear array with uniform spacing and amplitude
3. Binomial array

Part-B

1. Measurement of Radiation pattern and Beam width for the Horn Antenna
2. Reflex Klystron Characteristics
3. Gunn Diode Characteristics
4. Attenuation measurement
5. Directional coupler Characteristics
6. Measurement of Wave guide parameters.
7. VSWR measurement
8. Scattering parameters of wave guide circulator
9. Scattering parameters of wave guide multiport junction (E/H/magic Tee)

19EC4181: MAJOR PROJECT PHASE – I

B.Tech IV Year I Semester

L	T	P	C
-	-	6	3

19EC4182: MINI PROJECT

B.Tech IV Year I Semester

L	T	P	C
-	-	-	2

19MB4211: MANAGEMENT SCIENCE

	L	T	P	C
B. Tech IV Year II Semester	**3**	**-**	**-**	**3**

Prerequisites: Business Economics and Financial analysis

Course Objectives:

- To acquire knowledge about management and organisation
- To understand operations and marketing management
- To understand human resource management
- To know about project management through some methods
- To know strategies for business

Course Outcomes: At the end of this course, students will demonstrates the ability to

- Plan an organisational structure for a given context in the organisation
- Carry out production operations through Work study, to understand the markets, customers and competition better and price the given products appropriately.
- Ensure quality for a given product or service plan and control the HR function better
- Plan, schedule and control projects through PERT and CPM
- Evolve a strategy for a business or service organisation

UNIT -I: INTRODUCTION TO MANAGEMENT AND ORGANISATION

Concepts of Management and organization- nature, importance and Functions of Management, Systems Approach to Management - Taylor's Scientific Management Theory– Fayal's Principles of Management – Maslow's theory of Hierarchy of Human Needs – Douglas McGregor's Theory X and Theory Y – Hertzberg Two Factor Theory of Motivation - Leadership Styles, Social responsibilities of Management.

Designing Organisational Structures: Basic concepts related to Organisation - Departmentation and Decentralisation, Types and Evaluation of mechanistic and organic structures of organisation and suitability.

UNIT -II: OPERATIONS AND MARKETING MANAGEMENT

Plant location and Plant Layout-Methods of production (Job, Batch and Mass Production), Work Study -Basic procedure involved in Method Study and Work Measurement – Business Process Reengineering (BPR)

Statistical Quality Control: Control charts for Variables and Attributes (simple Problems) and Acceptance Sampling, TQM, Six Sigma, Objectives of Inventory control, EOQ, ABC Analysis, Purchase Procedure, Stores Management and Stores Records – JIT System, Supply Chain Management, Functions of Marketing, Marketing Mix, and Product Life Cycle, Channels of distribution.

UNIT -III: HUMAN RESOURCES MANAGEMENT (HRM)

Concepts of HRM, HRD and Personnel Management and Industrial Relations (PMIR), HRM vs PMIR

Basic functions of HR Manager: Manpower planning, Recruitment, Selection, Training and Development, Placement, Wage and Salary Administration, Promotion, Transfer, Separation, Performance Appraisal, Grievance Handling, Job Evaluation and Merit Rating.

UNIT -IV: PROJECT MANAGEMENT (PERT/CPM)
Network Analysis, Programme Evaluation and Review Technique (PERT), Critical Path Method (CPM), identifying critical path, Probability of Completing the project within given time, Project Cost Analysis, Project Crashing (simple problems).

UNIT -V:STRATEGIC MANAGEMENT AND CONTEMPORARY STRATEGIC ISSUES: Mission, Goals, Objectives, Policy, Strategy, Programmes, Elements of Corporate Planning Process, Environmental Scanning, Value Chain Analysis, SWOT Analysis, Steps in Strategy Formulation and Implementation, Generic Strategy alternatives. Bench Marking and Balanced Score Card as Contemporary Business Strategies.

TEXT BOOKS:

1. Stoner, Freeman, Gilbert, "*Management"*, 6th Ed, Pearson Education, New Delhi, 2004.
2. P. Vijaya Kumar, N. Appa Rao and Ashima B. Chhalill, "*Management Science*", Cengage India Pvt Ltd, 2012.

REFERENCE BOOKS:

1. Kotler Philip and Keller Kevin Lane: "*Marketing Management"*, Pearson, 2012.
2. Koontz and Weihrich: "*Essentials of Management"*, McGraw Hill, 2012.
3. Thomas N.Duening and John M.Ivancevich "*Management—Principles and Guidelines"*, Biztantra, 2012.
4. Kanishka Bedi, "*Production and Operations Management"*, Oxford University Press, 2012.
5. Samuel C.Certo: "*Modern Management"*, 2012.
6. Schermerhorn, Capling, Poole and Wiesner: "*Management"*, Wiley, 2012.
7. Parnell: "*Strategic Management"*, Cengage, 2012.
8. Lawrence R Jauch, R. Guptaand William F.Glueck:"*Business Policy and Strategic Management"*, Frank Bros. 2012.
9. Aryasri: "*Management Science"*, McGraw Hill, 2012

19 EC4271: SPEECH SIGNAL PROCESSING
(Professional Elective–V)

B.Tech IV Year II Semester

L	T	P	C
3	-	-	**3**

Prerequisites: SS

Course objectives

- To understand the anatomy and physiology of acoustic production and perception model.
- To introduce the characteristics of Speech signals and the related time and frequency domain methods for speech analysis and speech compression
- To Understand predictive coding techniques for speech compression
- To study the concept of Homomorphic system and analyze various audio coding techniques with applications
- To understand speech recognition, synthesis and speaker identification

Course outcomes: Upon completing this course, the students will be able to

- Model an electrical equivalent of Speech Production System.
- Understand and classify Speech signals with related time and frequency domain methods for speech analysis and speech compression
- Extract the LPC coefficients that can be used to synthesize or compress the speech.
- Design a homomorphic vocoder for coding and decoding of speech.
- Extract the features for automatic speaker recognition systems

UNIT –I:

Fundamentals of Digital Speech Processing: Anatomy & Physiology of Speech Organs, The process of Speech Production, Acoustic Phonetics, Articulatory Phonetics, The Acoustic Theory of Speech Production- Uniform lossless tube model, effect of losses in vocal tract, effect of radiation at lips, Digital models for speech signals.

UNIT –II:

Time Domain Models for Speech Processing: Introduction- Window considerations, Short time energy and average magnitude Short time average zero crossing rate, Speech Vs Silence discrimination using energy and zero crossing, Pitch period estimation using a parallel processing approach, The short time autocorrelation function, The short time average magnitude difference function, Pitch period estimation using the autocorrelation function.

UNIT –III:

Linear Predictive Coding (LPC) Analysis: Basic principles of Linear Predictive Analysis: The Autocorrelation Method, The Covariance Method, Solution of LPC Equations: Cholesky Decomposition Solution for Covariance Method, Durbin's Recursive Solution for the Autocorrelation Equations, Comparison between the Methods of Solution of the LPC Analysis Equations, Applications Of LPC Parameters: Pitch Detection using LPC Parameters, Formant Analysis using LPC Parameters.

UNIT –IV:

Homomorphic Speech Processing: Introduction, Homomorphic Systems for Convolution: Properties of the Complex Cepstrum, Computational Considerations, the Complex Cepstrum of Speech, Pitch Detection, Formant Estimation, The Homomorphic Vocoder. Speech

Enhancement: Nature of Interfering sounds, Speech enhancement techniques: Single Microphone Approach: spectral Subtraction, Enhancement by re-synthesis, Comb filter, Wiener filter, Multi microphone Approach

UNIT-V:

Automatic Speech & Speaker Recognition: Basic pattern recognition approaches, parametric Representation of speech, evaluating the similarity of speech patterns, isolated digit Recognition System, Continuous digit Recognition System. Hidden Markov Model (HMM) for Speech: Hidden Markov Model (HMM) for speech recognition, Viterbi algorithm, Training and testing using HMMS. Speaker Recognition: Recognition techniques, Features that distinguish speakers, Speaker Recognition Systems: Speaker Verification System, Speaker Identification System.

TEXT BOOKS:

1. L.R. Rabiner and S. W. Schafer, "Digital Processing of Speech Signals", Pearson Education. I edition 2003
2. Douglas O'Shaughnessy, "Speech Communications: Human & Machine", 2nd Ed., Wiley India, 2000.

REFERENCE BOOKS:

1. L.R Rabinar and R W Jhaung, "Digital Processing of Speech Signals", 1978, Pearson Education.

19 EC4272: SATELLITE COMMUNICATIONS
(Professional Elective–V)

B.Tech IV Year II Semester

L	T	P	C
3	-	-	**3**

Prerequisite: Analog and Digital Communications

Course Objectives:

- To prepare students to excel in basic knowledge of satellite communication principles
- To provide students with solid foundation in orbital mechanics and launches for the satellite communication
- To train the students with a basic knowledge of link design of satellite with a design examples
- To provide better understanding of multiple access systems and earth station technology
- To understand the concepts of satellite navigation and GPS.

Course Outcomes: Upon completing this course, the student will be able to

- Understand basic concepts and frequency allocations for satellite communication, orbitalmechanics and launch vehicles.
- Envision the satellite sub systems and design satellite links for specified C/N.
- Ability to summarize the propagation effects in satellite communication
- Understand the various multiple access techniques for satellite communication systems and earth station technologies.
- Known the concepts of LEO, GEO Stationary Satellite Systems and satellite navigation

UNIT - I:

Introduction: Origin of Satellite Communications, Historical Back-ground, Basic Concepts of SatelliteCommunications, Frequency Allocations for Satellite Services, Applications, Future Trends of SatelliteCommunications.

Orbital Mechanics and Launchers: Orbital Mechanics, Look Angle determination, Orbital Perturbations, Orbit determination, Launches and Launch vehicles, Orbital Effects in CommunicationSystems Performance.

UNIT - II:

Satellite Subsystems: Attitude and Orbit Control System, Telemetry, Tracking, Command And Monitoring, Power Systems, Communication Subsystems, Satellite Antennas, Equipment ReliabilityAnd Space Qualification.

UNIT - III:

Satellite Link Design: Basic Transmission Theory, System Noise Temperature and G/T Ratio, Design of Down Links, Up Link Design, Design Of Satellite Links For Specified C/N, System Design.Examples.

Multiple Accesses: Frequency Division Multiple Access (FDMA), Inter modulation, Calculation of C/N, Time Division Multiple Access (TDMA), Frame Structure, Examples, Satellite Switched TDMA Onboard Processing, DAMA, Code Division Multiple Access (CDMA), Spread Spectrum Transmissionand Reception.

UNIT - IV:

Earth Station Technology: Introduction, Transmitters, Receivers, Antennas, Tracking Systems,Terrestrial Interface, Primary Power Test Methods.

UNIT - V:

Low Earth Orbit and Geo-Stationary Satellite Systems: Orbit Considerations, Coverage and Frequency Consideration, Delay & Throughput Considerations, System Considerations, Operational NGSOConstellation Designs.

Satellite Navigation & Global Positioning System: Radio and Satellite Navigation, GPS Position Location Principles, GPS Receivers and Codes, Satellite Signal Acquisition, GPS Navigation Message, GPS Signal Levels, GPS Receiver Operation, GPS C/A Code Accuracy, Differential GPS.

TEXT BOOKS:

1. Satellite Communications – Timothy Pratt, Charles Bostian and Jeremy Allnutt, WSE, WileyPublications, 2nd Edition, 2003.
2. Satellite Communications Engineering – Wilbur L. Pritchard, Robert A Nelson and Henri G.Suyderhoud, 2nd Edition, Pearson Publications, 2003.

REFERENCE BOOKS:

1. Satellite Communications: Design Principles – M. Richharia, BS Publications, 2nd Edition, 2003.
2. Satellite Communication - D.C Agarwal, Khanna Publications, 5th Ed.
3. Fundamentals of Satellite Communications – K.N. Raja Rao, PHI, 2004
4. Satellite Communications – Dennis Roddy, McGraw Hill, 4th Edition, 2009.

19EC4273: LOW POWER VLSI
(Professional Elective–V)

B.Tech IV Year II Semester

L	T	P	C
3	-	-	**3**

Prerequisite: VLSI Design

Course Objectives: To

- Know the low power low voltage VLSI design
- Understand the impact of power with different Design approaches.
- Know about Low-Voltage Low-Power adders.
- Know about Low-Voltage Low-Power multipliers.
- Understand different Low-Power Memories.

Course Outcomes: Upon completing this course, the student will be able to

- Understand the need of Low power circuit design.
- Attain the knowledge of architectural approaches.
- Analyze and design Low-Voltage Low-Power adders.
- Analyze and design Low-Voltage Low-Power multipliers.
- Have the knowledge in the design of Low-Voltage Low-Power Memories

UNIT - I:

Fundamentals: Need for Low Power Circuit Design, Sources of Power Dissipation – Switching Power Dissipation, Short Circuit Power Dissipation, Leakage Power Dissipation, Glitching Power Dissipation,Short Channel Effects –Drain Induced Barrier Lowering and Punch Through, Surface Scattering, Velocity Saturation, Impact Ionization, Hot Electron Effect.

UNIT - II:

Low-Power Design Approaches: Low-Power Design through Voltage Scaling – VTCMOS circuits, MTCMOS circuits, Architectural Level Approach –Pipelining and Parallel Processing Approaches.

Switched Capacitance Minimization Approaches: System Level Measures, Circuit Level Measures,And Mask level Measures.

UNIT - III:

Low-Voltage Low-Power Adders: Introduction, Standard Adder Cells, CMOS Adder's Architectures, Ripple Carry Adders, Carry Look- Ahead Adders, Carry Select Adders, Carry Save Adders, Low- Voltage Low-Power Design Techniques –Trends of Technology and Power Supply Voltage, Low- Voltage Low-Power Logic Styles.

UNIT - IV:

Low-Voltage Low-Power Multipliers: Introduction, Overview of Multiplication, Types of Multiplier Architectures, Braun Multiplier, Baugh- Wooley Multiplier, Booth Multiplier, Introduction to Wallace Tree Multiplier.

UNIT-V: Low-Voltage Low-Power Memories: Basics of ROM, Low-Power ROM Technology, Future Trend And Development of ROMs, Basics of SRAM, Memory Cell, Precharge and Equalization Circuit, Low-PowerSRAM Technologies, Basics of DRAM, Self-Refresh Circuit, Future Trend and Development of DRAM.

TEXT BOOKS:

1. CMOS Digital Integrated Circuits – Analysis and Design – Sung-Mo Kang, Yusuf Leblebici,TMH, 4th edition 2019.
2. Low-Voltage, Low-Power VLSI Subsystems – Kiat-Seng Yeo, Kaushik Roy, TMH ProfessionalEngineering -2004.

REFERENCE BOOKS:

1. Introduction to VLSI Systems: A Logic, Circuit and System Perspective – Ming-BOLin, CRCPress, 2011
2. Low Power CMOS VLSI Circuit Design – Kaushik Roy, Sharat C. Prasad, John Wiley & Sons,2000.
3. Practical Low Power Digital VLSI Design – Gary K. Yeap, Kluwer Academic Press,2002.
4. Leakage in Nanometer CMOS Technologies – Siva G. Narendran, Anatha Chandrakasan, Springer, 2005.

19EC4274: DIGITAL SIGNAL PROCESSORS AND ARCHITECTURE
(Professional Elective–V)

B.Tech IV Year II Semester

L	T	P	C
3	-	-	**3**

Prerequisite: DSP

Course Objectives:

- To familiar with digital transform techniques.
- To introduce architectural features of programmable DSP Processors of TI and Analog Devices.
- To give practical examples of DSP Processor architectures for better understanding.
- To develop the programming knowledge using Instruction set of DSP Processors.
- To understand interfacing techniques to memory and I/O devices.

Course Outcomes: After the successful completion of the course, student should be able to:

- Gets an in depth knowledge of DSP processors their architectures.
- Acquire knowledge of DSP computational building blocks and knows how to achieve speed in DSP processor or architecture
- Develop basic DSP algorithms using DSP processors
- Acquire knowledge about various addressing modes of DSP TMS 320C54XX and able to program DSP processors
- Knows programming language techniques, integration of DSP programmable devices with memories and I/O peripherals

.

UNIT–I:

Introduction to Digital Signal Processing: Introduction, A Digital signal-processing system, The sampling process, Discrete time sequences. Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), Linear time-invariant systems, Digital filters, Decimation and interpolation.

Computational Accuracy in DSP Implementations: Number formats for signals and Coefficients in DSP systems, Dynamic Range and Precision, Sources of error in DSP Implementations, A/D Conversion errors, DSP Computational errors, D/A Conversion Errors, Compensating filter.

UNIT–II:

Architectures for Programmable DSP Devices: Basic Architectural features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation Unit, Programmability and Program Execution, Speed Issues, Features for External interfacing.

UNIT-III:

Programmable Digital Signal Processors: Commercial Digital signal-processing Devices, Data Addressing modes of TMS320C54XX DSPs, Data Addressing modes of TMS320C54XX Processors, Memory space of TMS320C54XX Processors, Program Control, TMS320C54XX Instructions and Programming, On Chip Peripherals, Interrupts

of TMS320C54XX processors, Pipeline Operation of TMS320C54XX Processors.

UNIT–IV:

Analog Devices Family of DSP Devices: Analog Devices Family of DSP Devices – ALU and MAC block diagram, Shifter Instruction, Base Architecture of ADSP2100, ADSP-2181 high Performance Processor .Introduction to Blackfin Processor - The Black fin Processor, Introduction to Micro Signal Architecture, Overview of Hardware Processing Units and Register files, Address Arithmetic Unit, Control Unit, Bus Architecture and Memory, Basic Peripherals.

UNIT–V:

Interfacing Memory and I/O Peripherals to Programmable DSP Devices: Memory space organization, External bus interfacing signals, Memory interface, Parallel I/O interface, Programmed I/O, Interrupts and I/O, Direct memory access(DMA).

TEXT BOOKS:

1. Digital Signal Processing implementations –Avtar Singh and S.Srinivasan, Thomson Publications, 2004.
2. A Practical Approach To Digital Signal Processing- K Padmanabhan, R.Vijayarajeswaran, Ananthi.S, New Age International, 2006/2009
3. Embedded Signal Processing with the Micro Signal Architecture Publisher: Woon- SengGan, Sen M.Kuo,Wiley-IEEEPress,2007

REFERENCE BOOKS:

1. Digital Signal Processors, Architecture, Programming and Applications– B.Venkataramani and M.Bhaskar, 2002, TMH.
2. Digital Signal Processing–JonathamStein, 2005, JohnWiley.
3. DSP Processor Fundamentals, Architectures & Features – Lapsley etal.2000,S.Chand &Co.

19EC4275: SOFTWARE DEFINED RADIO
(Professional Elective–VI)

B.Tech IV Year II Semester

L	T	P	C
3	-	-	**3**

Prerequisite: ADC, PTSP

Course Objectives:

- To analyze and design software defined radio systems.
- To understand radio frequency translation for software defined radio.
- To understand various Radio Resource Management Techniques.
- To analyze the optimization algorithms for reconfiguration of network elements.
- To understand the case studies and object oriented representation of SDR

.

Course Outcomes: at the end of course students will be able to

- Define software radio and explain characteristics and architecture of software radio.
- Design, develop and evaluate a software defined radio system.
- Explain Radio Resource Management in Heterogeneous Networks
- Classify and Rate Reconfigurable Hardware and Develop Optimization algorithms
- Explain Object – Oriented Representation of Radios and Network Resources

UNIT – I:

Introduction: The Need for Software Radios, What is Software Radio, Characteristics and benefits of Software radio- Design Principles of Software Radio.

RF Implementation issues- The Purpose of RF Front – End, Dynamic Range- the Principal Challenge of Receiver Design – RF Receiver Front- End Topologies- Enhanced Flexibility of the RF Chain with Software Radios- Importance of the Components to Overall Performance- Transmitter Architectures and Their Issues- Noise and Distortion in the RF Chain, ADC and DAC Distortion.

UNIT – II:

Profile and Radio Resource Management: Communication Profiles- Introduction, Communication Profiles, Terminal Profile, Service Profile, Network Profile, User Profile, Communication Profile Architecture, Profile Data Structure, XML Structure, Distribution of Profile Data, Access to Profile Data, Management of Communication Profiles, Communication Class marks, Dynamic Class marks For Reconfigurable Terminals.

UNIT – III:

Radio Resource Management in Heterogeneous Networks: Introduction, Definition of Radio Resource Management, Radio Resource Units over RRM Phases, RRM Challenges and Approaches, RRM Modelling and Investigation Approaches, Investigations of JRRM in Heterogeneous Networks, Measuring Gain in the Upper Bound Due to JRRM, Circuit-Switched System, Packet-Switched System.

UNIT – IV:

Reconfiguration of the Network Elements: Introduction, Reconfiguration of Base Stations and Mobile Terminals, Abstract Modelling of Reconfigurable Devices, the Role of Local Intelligence in Reconfiguration, Performance Issues, Classification and Rating of Reconfigurable Hardware, Processing Elements, Connection Elements, Global Interconnect

Networks, Hierarchical Interconnect Networks, Installing a New Configuration, Applying Reconfiguration Strategies, Optimised Reconfiguration, Optimisation Parameters and Algorithms, Optimization Algorithms, Specific Reconfiguration Requirements.

UNIT – V:

Object – Oriented Representation of Radios and Network Resources: Networks- Object Oriented Programming- Object Brokers- Mobile Application Environments- Joint Tactical Radio System.

Case Studies in Software Radio Design: Introduction and Historical Perspective, SPEA Keasy, JTRS, Wireless Information Transfer System, SDR-3000 Digital Transceiver Subsystem, Spectrum Ware.

TEXT BOOKS:

1. Markus Dillinger, Kambiz Madani, "Software Defined Radio Architecture System and Functions", WILEY 2003
2. Walter Tuttle Bee, "Software Defined Radio: Enabling Technologies", 2002, Wiley Publications.

REFERENCE BOOKS:

1. Jeffrey H. Reed, "Software Radio: A Modern Approach to Radio Engineering", 2002, PEA Publication.
2. Paul Burns, "Software Defined Radio for 3G", 2002, Artech House.
3. Joseph Mitola, "Software Radio Architecture: Object Oriented Approaches to wireless System Engineering", 2000, John Wiley & Sons.

19EC4276: WIRELESS SENSOR NETWORKS
(Professional Elective–VI)

B.Tech IV Year II Semester

L	T	P	C
3	-	-	**3**

Prerequisite: ADC, DCN

Course Objectives:

- To acquire the basic knowledge about Wireless Sensor Networks.
- To understand issues, challenges and emerging technologies for wireless sensor networks
- To have ability to understand various routing protocols and MAC Protocols
- To understand various data gathering and data dissemination methods
- To Study about design principles, node architectures, hardware and software required for implementation of wireless sensor networks.

Course Outcomes: Upon completion of the course, the student will be able to:

- Analyze and compare various architectures of Wireless Sensor Networks
- Understand Design issues and challenges in wireless sensor networks
- Design, Simulate and Compare the performance of various routing and MAC protocol
- Analyze and compare various data gathering and data dissemination methods
- Analyze the standard requirements for communication between WSN and Internet and also understand different OS environments.

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:
Routing protocols, MAC protocols: Classification of MAC Protocols, S-MAC Protocol, B-MAC protocol,IEEE 802.15.4 standard and ZigBee

UNIT - IV:
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 - V:
Design Principles for WSNs, Gateway Concepts Need for gateway, WSN to Internet Communication, and Internet to WSN Communication. Single-node architecture, Hardware components & design Constraints, Operating systems and execution environments, introduction to TinyOS and nesC.

TEXT BOOKS:

1. Ad-Hoc Wireless Sensor Networks- C. Siva Ram Murthy,B. S. Manoj, Pearson
2. Principles of Wireless Networks – Kaveh Pah Laven and P. Krishna Murthy, 2002, PE

REFERENCE BOOKS:

1. Wireless Digital Communications – Kamilo Feher, 1999, PHI.
2. Wireless Communications-Andrea Goldsmith, 2005 Cambridge University Press.
3. Mobile Cellular Communication – Gottapu Sasibhushana Rao, Pearson Education, 2012.
4. Wireless Communication and Networking – William Stallings, 2003, PHI.

19EC4277: PRINCIPLES OF NAVIGATION SYSTEMS
(Professional Elective–VI)

B.Tech IV Year II Semester

L	T	P	C
3	-	-	**3**

Course objectives

- To introduce the concepts of navigation system architecture and Satellite Navigation, ranging analysis.
- To describe the navigation signal components in terms of purpose, properties and power level, and comparison of GPS technologies.
- To have the concepts of Receiver Architecture, receiver design options and Data Errors mechanisms, and error minimizations.
- To provide differential navigation for the better ranging, and navigation message secure transmission configurations.
- To explain the various types of navigation Applications in various fields,RINEX format.

Course Outcomes: At the end of the course, the student will be able to:

- Understand the fundamental concepts navigation and GLONASS Overview, User position and velocity calculations.
- Learn navigation signal structure and its components in terms of power levels and navigation comparison between GPS and GALILEO.
- Understand the working of Receiver architecture and types of Data Errors.
- Understand about Differential GPS, Geometric analysis and GPS/INS Integration architectures.
- Understand the navigation in surveying, Mapping and Geographical Information System, and GPS data in RINEX format, determining position.

UNIT - I

Introduction: Basic concept, system architecture, GPS and GLONASS Overview, Satellite Navigation, Time and GPS, User position and velocity calculations, GPS, Satellite Constellation, Operation Segment, User receiving Equipment, Space Segment Phased development, GPS aided Geo Augmented navigation (GAGAN) architecture.

UNIT - II

Signal Characteristics: GPS signal components, purpose, properties and power level, signal Acquisition and tracking, Navigation information extraction, pseudo range estimation, frequency Estimation, GPS satellite position calculation, Signal structure, anti spoofing (AS), selective Availability, Difference between GPS and GALILEO satellite construction.

UNIT - III

GPS Receivers & Data Errors: Receiver Architecture, receiver design options, Antenna design, GPS Error sources, SA errors, propagation errors, ionosphere error, troposphere error, multipath, Ionosphere error, estimation using dual frequency GPS receiver, Methods of multipath mitigation, Ephemeris data errors, clock errors.

UNIT - IV

Differential GPS: Introduction, LADGPS, WADGPS, Wide Area Augmentation systems, GEO Uplink subsystem, GEO downlink systems, Geo Orbit determination, Geometric analysis, covariance Analysis, GPS /INS Integration Architectures

UNIT - V

GPS Applications: GPS in surveying, Mapping and Geographical Information System, Precision Approach Aircraft landing system, Military and Space application, and intelligent transportation System. GPS orbital parameters, description of receiver independent exchange format (RINEX), Observation data and navigation message data parameters, GPS position determination, least squares Method

TEXT BOOK:

1. Mohinder S.Grewal, Lawrence R.Weill, Angus P.Andrews, "Global positioning systems, Inertial Navigation and Integration", Wiley 2007.
2. E.D.Kaplan, Christopher J. Hegarty, "Understanding GPS Principles and Applications", Artech House Boston 2005.

REFERENCE:

1. Pratap Misra, Per Enge, "Global positioning system: signals, measurement and performance", Revised second edition 2010.

19EC4278: OPTICAL FIBER COMMUNICATION
(Professional Elective–VI)

B.Tech IV Year II Semester

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Prerequisite: ADC

Course Objectives: The objectives of the course are:

- To realize the significance of optical fiber communications.
- To understand the construction and characteristics of optical fiber cable.
- To develop the knowledge of optical signal sources and power launching.
- To identify and understand the operation of various optical detectors.
- To understand the design of optical systems and WDM.

Course Outcomes: At the end of the course, the student will be able to:

- Understand and analyze the constructional parameters of optical fibers.
- Learn characteristics of optical fiber.
- Design an optical system.
- Estimate the losses due to attenuation, absorption, scattering and bending.
- Compare various optical detectors and choose suitable one for different applications.

UNIT - I

Overview of Optical Fiber Communication: - Historical development, the general system, Advantages of Optical Fiber Communications, Optical Fiber Wave Guides- Introduction, Ray Theory Transmission, Total Internal Reflection, Acceptance Angle, Numerical Aperture, Skew Rays, Cylindrical Fibers- Modes, V number, Mode Coupling, Step Index Fibers, and Graded Index Fibers.

Single Mode Fibers- Cut off Wavelength, Mode Field Diameter, Effective Refractive Index, Fiber Materials Glass, Halide, Active Glass, Chalgenide Glass, Plastic Optical Fibers.

UNIT - II

Signal Distortion in Optical Fibers: Attenuation, Absorption, Scattering and Bending Losses, Core And Cladding Losses, Information Capacity Determination, Group Delay, Types of Dispersion – Material Dispersion, Wave-Guide Dispersion, Polarization Mode Dispersion, Intermodal Dispersion, Pulse Broadening, Optical Fiber Connectors- Connector Types, Single Mode Fiber Connectors, Connector Return Loss.

UNIT - III

Fiber Splicing: Splicing Techniques, Splicing Single Mode Fibers, Fiber Alignment and Joint Loss- Multimode Fiber Joints, Single Mode Fiber Joints.

Optical Sources- LEDs, Structures, Materials, Quantum Efficiency, Power, Modulation, Power Bandwidth Product, Injection Laser Diodes- Modes, Threshold Conditions, Ex

Quantum Efficiency, Laser Diode Rate Equations, Resonant Frequencies, Reliability of LED& ILD.

Source to Fiber Power Launching: - Output Patterns, Power Coupling, Power Launching, Equilibrium Numerical Aperture, Laser Diode to Fiber Coupling.

UNIT - IV

Optical Detectors: Physical Principles of PIN and APD, Detector Response Time, Temperature Effect on Avalanche Gain, Comparison of Photo Detectors, Optical Receiver Operation-Fundamental Receiver Operation, Digital Signal Transmission, Error Sources, Receiver Configuration, Digital Receiver Performance, Probability of Error, Quantum Limit, Analog Receivers.

UNIT - V

Optical System Design: Considerations, Component Choice, Multiplexing, Point-to- Point Links, System Considerations, Link Power Budget with Examples, Overall Fiber Dispersion in Multi-Mode and Single Mode Fibers, Rise Time Budget with Examples. Transmission Distance, Line Coding in Optical Links, WDM, Necessity, Principles, Types of WDM, Measurement of Attenuation and Dispersion, Eye Pattern.

TEXT BOOKS:

1. Optical Fiber Communications – Gerd Keiser, TMH, 4th Edition, 2008.
2. Optical Fiber Communications – John M. Senior, Pearson Education, 3rd Edition, 2009.

REFERENCE BOOKS:

1. Fiber Optic Communications – D.K. Mynbaev, S.C. Gupta and LowellScheiner, Pearson Education, 2005.
2. Text Book on Optical Fiber Communication and it's Applications – S.C. Gupta, PHI,2005.
3. Fiber Optic Communication Systems – Govind P. Aggarwal, John Wiley, 3rd Edition, 2004.
4. Introduction to Fiber Optics by Donald J. Sterling Jr. Cengage learning, 2004.
5. Optical Communication Systems – John Gowar, 2nd Edition, PHI, 2001.

19EC4281: MAJOR PROJECT-PHASE II

B.Tech IV Year II Semester

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