B.TECH. - ELECTRONICS & COMMUNICATION ENGINEERING

Course Structure R-22

SEMESTER VII

S.No.	Course Classification	Course Code	Name of the Subject	L	T	P	C	I	E	Total
1	**PC**	D47PC26	Microwave Engineering	3	1	0	4	40	60	100
2	**HS**	D7HSPE	Professional Ethics	2	0	0	2	40	60	100
3	**PE**	D47PE3	**Professional Elective –III** 1. Analog and Digital IC Design 2. Radar Engineering 3. Embedded System Design 4. Machine Learning	3	0	0	3	40	60	100
4	**PE**	D47PE4	**Professional Elective –IV** 1. Low Power VLSI Design 2. Satellite Communications 3. Real Time Operating Systems 4. Artificial Neural Networks	3	0	0	3	40	60	100
5	**PC**	D47PC27	Microwave Engineering Lab	0	0	2	1	40	60	100
6	**PW**	D47PW1	Project Stage-I	0	0	14	7	100		100
TOTAL				11	1	16	20	300	300	600

B.TECH. - ELECTRONICS & COMMUNICATION ENGINEERING

Course Structure R-22

S.No.	Course Classification	Course Code	Name of the Subject	L	T	P	C	I	E	Total
1	**PE**	D48PE5	**Professional Elective –V** 1. Memory Technologies 2. Optical Fiber Communications 3. Embedded C 4. Electronic Measurements and Instrumentation	3	0	0	3	40	60	100
2	**PE**	D48PE6	**Professional Elective –VI** 1. CPLD & FPGA Architectures and Applications 2. 5G Technology 3. ARM Architectures &Interface Protocols 4. Digital Signal Processors and Architectures	3	0	0	3	40	60	100
3	**OE**	D48OE3	Open Elective–III	3	0	0	3	40	60	100
4	**OE**	D48OE4	Open Elective –IV	3	0	0	3	40	60	100
5	**PW**	D48PW2	Project Stage-II	0	0	16	6	40	60	100
6		D48PWCV	Comprehensive Viva-Voce				1	100		100
7		D48PWTS	Technical Seminar				1	100		100
TOTAL				12	0	22	20	400	300	700

B.TECH. ELECTRONICS & COMMUNICATION ENGINEERING

MICROWAVE ENGINEERING (D47PC26)

B.TECH.VII SEMESTER **L/T/P/ C**
3/1/0/4

COURSE OBJECTIVES:

This is a core course in Microwave Communications domain, and covers contents related to Microwave theory and techniques. The main objectives of the course are:

1. To get familiarized with microwave frequency bands, their applications and to develop the theory related to microwave transmission lines, and to determine the characteristics of rectangular waveguides, microstrip lines, and different types of waveguide components and ferrite devices.
2. To understand the limitations and losses of conventional tubes at these frequencies.
3. To distinguish between different types of microwave tubes, their structures and principles of microwave power generation, and to characterize their performance features and applications - at tube levels as well as with solid state devices.
4. To impart the knowledge of Scattering Matrix, its formulation and utility, and establish the S- Matrix for various types of microwave junctions.
5. To understand the concepts of microwave measurements, identify the equipment required and precautions to be taken, and get familiarized with the methods of measurement of microwave power and various other microwave parameters.

COURSE OUTCOMES: Upon completing this course, the student will be able to

1. Analyze the rectangular wave guides, their mode characteristics, and design wave guides for solving practical microwave transmission line problems.
2. Analyze various microwave components such as cavity resonators, hybrid junctions and ferrite devices.
3. Demonstrate the characteristics of Microwave sources.
4. Demonstrate the characteristics of M type tubes and microwave solid-state devices.
5. Analyze the scattering parameters of microwave components and demonstrate various microwave bench setup formeasuring various parameters.

COURSE CODE-CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
C401.1	3	3										
C401.2	3	2										
C401.3	3	2										
C401.4	3	3										
C401.5	3	2										

UNIT – I:

Microwave Transmission Lines - I: Introduction, Microwave Spectrum and Bands,

Applications of Microwaves. Rectangular Waveguides – Solution of Wave Equations in Rectangular Coordinates, TE/TM mode analysis, Expressions for Fields, Characteristic Equation and Cut-off Frequencies, Filter Characteristics, Dominant and Degenerate Modes, Sketches of TE and TM mode fields in the cross-section, Mode Characteristics – Phase and Group Velocities, Wavelengths and Impedance Relations, Power Transmission, Impossibility of TEM Mode. Illustrative Problems, Micro strip Lines– Introduction, Zo Relations, and Effective Dielectric Constant.

UNIT – II:

Cavity Resonators– Introduction, Rectangular Cavities, Dominant Modes and Resonant Frequencies, Q Factor and Coupling Coefficients, Illustrative Problems

Waveguide Components and Applications: Coupling Mechanisms – Probe, Loop, Aperture types. Waveguide Discontinuities – Waveguide Windows, Tuning Screws and Posts, Matched loads. Waveguide, Attenuators – Different Types, Resistive Card and Rotary Vane Attenuators. Waveguide Phase Shifters – Types, Dielectric and Rotary Vane Phase Shifters, Waveguide Multiport Junctions – E plane and H plane Tees, Magic Tee. Directional Couplers – 2 Hole, Bethe Hole types, Illustrative Problems Ferrites– Composition and Characteristics, Faraday Rotation, Ferrite Components – Gyrator, Isolator, Circulator.

UNIT – III:

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 Small Signal 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, Illustrative Problems.

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

UNIT – IV:

M-Type Tubes: Introduction, Cross-field Effects, Magnetrons – Different Types, Cylindrical Traveling Wave Magnetron –Modes of Resonance and PI-Mode Operation, Separation of PI-Mode, o/p characteristics, Illustrative Problems.

Microwave Solid State Devices: Introduction, Classification, Applications. TEDs – Introduction, Gun Diodes – Principle, RWH Theory, Characteristics, Modes of Operation - Gunn Oscillation Modes, Introduction to Avalanche Transit Time Devices.

UNIT –V:

Scattering Matrix– Significance, Formulation and Properties, E plane and H plane Tees, Magic Tee, Circulator and Isolator, Illustrative Problems. Microwave Antennas- Fundamental Parameters, Definitions for Antennas, Radiation from Rectangular Antennas.

Microwave Measurements: Description of Microwave Bench – Different Blocks and their Features, Errors and Precautions, Microwave Power Measurement, Bolometers. Measurement of Attenuation, Frequency, Standing Wave Measurements – Measurement of Low and High VSWR, Cavity Q, Impedance Measurements.

TEXT BOOKS

1. Samuel Y. Liao, “Microwave Devices and Circuits ”, Pearson, 3rd Edition, 2003.
2. Herbert J. Reich, J.G. Skalnik, P.F. Ordung and H.L. Krauss, “Microwave Principles” , CBS Publishers and Distributors, New Delhi,2004.

REFERENCE BOOKS:

1. R.E. Collin, “Foundations for Microwave Engineering”, IEEE Press, John Wiley, 2nd Edition, 2002.
2. G. S. Raghuvanshi, “Microwave Engineering”, Cengage Learning India Pvt. Ltd., 2012.
3. Peter A. Rizzi,“Microwave Engineering Passive Circuits”, PHI, 1999.
4. David M. Pozar,“Microwave Engineering”, John Wiley & Sons (Asia) Pvt Ltd., 1989, 3r ed., 2011 Reprint.

B.TECH. ELECTRONICS & COMMUNICATION ENGINEERING

PROFESSIONAL ETHICS (D7HSPE)

B.Tech. VII Semester **L/T/P/C**
2/0/0/2

COURSE OBJECTIVE:
To enable the students to imbibe and internalize the values and ethical behavior in the personal and professional lives.

COURSE OUTCOMES: Upon completing this course, the student will be able to

1. Demonstrate comprehension of the fundamental purpose of the profession, including professional ethics, and applying ethics in both personal and professional spheres. L3
2. Recognize the significance of values and different moral and social concerns. L2
3. Display awareness of the professional rights and responsibilities of an Engineer, as well as the ability to analyze safety and risk benefits. L4
4. Summarize the rights and responsibilities associated with being an employee, team member, and global citizen. L2
5. Gain knowledge of the different roles engineers have in applying ethical principles across various professional levels and contemporary issues. L3

COURSE CODE-CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
C402.1	-	-	-	-	-	2	-	3	-	-	-	-
C402.2	-	-	-	-	-	2		3	-	-	-	-
C402.3	-	-	-	-	-	2		3	-	-	-	-
C402.4	-	-	-	-	-	2		3	2	-	-	-
C402.5	-	-	-	-	-	2	2	3	-	-	-	-

UNIT– I: Introduction to Professional Ethics: Basic Concepts, Governing Ethics, Personal & Professional Ethics, Ethical Dilemmas, Life Skills, Emotional Intelligence, Thoughts of Ethics, Value Education, Dimensions of Ethics, Profession and professionalism, Professional Associations, Professional Risks, Professional Account abilities, Professional Success, Ethics and Profession.

UNIT–II: Basic Theories: Basic Ethical Principles, Moral Developments, Deontology, Utilitarianism, Virtue Theory, Rights Theory, Casuist Theory, Moral Absolution, Moral

Rationalism, Moral Pluralism, Ethical Egoism, Feminist Consequentialism, Moral Issues, Moral Dilemmas, Moral Autonomy.

UNIT–III: Professional Practices in Engineering: Professions and Norms of Professional Conduct, Norms of Professional Conducts. Profession, Responsibilities, Obligations and Moral Values in Professional Ethics, Professional codes of ethics, the limits of predictability and responsibilities of the engineering profession. Central Responsibilities of Engineers The Centrality of Responsibilities of Professional Ethics; lessons from 1979 American Airlines DC-10 Crash and Kansas City Hyatt Regency Walk away Collapse.

UNIT– IV: Work Place Rights & Responsibilities: Ethics in changing domains of Research, Engineers and Managers; Organizational Complaint Procedure, difference of Professional Judgment within the Nuclear Regulatory Commission (NRC), the Hanford Nuclear Reservation. Ethics in changing domains of research-The US government wide definition of research misconduct, research is conduct distinguished from mistakes and errors, recent history of attention to research misconduct, the emerging emphasis on understanding and fostering responsible conduct, responsible authorship, reviewing & editing.

UNIT–V: Global issues in Professional Ethics: Introduction – Current Scenario, Technology Globalization of MNCs, International Trade, World Summits, Issues, Business Ethics and Corporate Governance, Sustainable Development Ecosystem, Energy Concerns, Ozone Deflection, Pollution, Ethics in Manufacturing and Marketing, Media Ethics; War Ethics; Bio Ethics, Intellectual Property Rights.

TEXT BOOKS:

1. R. Subramanian, "Professional Ethics" , Oxford University Press, 2015.
2. Caroline Whit beck, "Ethics in Engineering Practice & Research" , 2e, Cambridge University Press 2015.

REFERENCE BOOKS:

1. Charles E Harris Jr., Michael S Pritchard, Michael J Rabins,"Engineering Ethics, Concepts Cases" ,4e, Cengage learning, 2015.
2. Manuel GV elasquez,"Business Ethics concepts & Cases", 6e, PHI, 2008.

B.TECH. ELECTRONICS & COMMUNICATION ENGINEERING

ANALOG & DIGITAL IC DESIGN (D47PE3)

B.Tech. VII Semester **L/T/P/C**
3/0/0/3

COURSE OBJECTIVES:
The main objectives of course are to:

1. To understand most important building blocks of all CMOS analog ICs.
2. To study the basic principle of operation, the circuit choices and the tradeoffs involved in the MOS transistor level design common to all analog CMOS ICs.
3. To understand specific design issues related to single and multistage voltage, current and differential amplifiers.
4. To understand working of different combinational CMOS Logics.
5. To understand working of different dynamic sequential CMOS Logics.

COURSE OUTCOMES: Upon completing this course, the student will be able to

1. Design basic building blocks of CMOS analog ICs.
2. Design of analog CMOS sub circuits like current mirrors and voltage references.
3. Design various amplifiers like differential, current and operational amplifiers.
4. Analyze working of different combinational CMOS Logics.
5. Build sequential logic circuits like dynamic latches and registers with pipelining.

COURSE CODE-CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
C402.2.1	3	2	3	2	2	-	-	3	1	1	-	2
C402.2.2	3	2	3	2	2	-	-	3	1	1	-	2
C402.2.3	3	2	3	2	2	-	-	3	1	1	-	2
C402.2.4	3	3	2	2	2	-	-	3	1	1	-	2
C402.2.5	3	3	3	2	2	-	-	3	2	-	-	2

UNIT– I: MOS Devices and Modeling: The MOS Transistor, Passive Components- Capacitor & Resistor, Integrated circuit Layout, CMOS Device Modeling - Simple MOS Large-Signal Model, Other Model Parameters, Small Signal Model for the MOS Transistor, Computer Simulation Models, Sub-threshold MOS Model.

UNIT–II: Analog CMOS Sub-Circuits: MOS Switch, MOS Diode, MOS Active Resistor, Current Sinks and Sources, Current Mirrors, Current mirror with Beta Helper, Degeneration, Cascode current Mirror and Wilson Current Mirror, Current and Voltage References, Band gap Reference.

UNIT– III: CMOS Operational Amplifiers: Design of CMOS Op Amps, Compensation of Op Amps, Design of Two-Stage Op Amps, Power- Supply Rejection Ratio of Two-Stage Op Amps, Cascode Op Amps, Measurement Techniques of OP Amp.

UNIT– IV: Physical design flow: Floor planning, Placement, Routing, CTS.
Combinational logic: Static CMOS design, Logic effort, Ratioed logic, Pass transistor logic, Dynamic logic, Speed and power dissipation in dynamic logic, Cascading dynamic gates, CMOS transmission gate logic.

UNIT-V: Sequential Logic: Static latches and registers, Bi-stability principle, MUX based latches, Static SR flip-flops, Master-slave edge-triggered register, Dynamic latches and registers, Concept of pipelining, Pulse registers, and Non-bistable sequential circuit.

TEXT BOOKS:

1. Rabaey, Jan M., Anantha P. Chandrakasan, and Borivoje Nikolic, "Digital integrated
2. Circuits", 2nd Edition,Englewood Cliffs: Prentice hall, 2002.
3. Behzad Razavi, "Design of Analog CMOS Integrated Circuits" , TMH, 2007.
4. D. A. John& Ken Martin, Analog Integrated Circuit Design" , John Wiley, 1997.

REFERENCE BOOKS:

1. 1. Allen, Phillip E., and Douglas R. Holberg,"CMOS analog circuit design" , 3rd Edition, Elsevier, 2011.
2. Leblebici, Yusuf,"CMOS digital integrated circuits: analysis and design" ,3rd Edition, McGraw-Hill College, 1996.
3. Baker, R. Jacob,"CMOS: circuit design, layout, and simulation", Wiley-IEEE press, 2019.

B.ECH ELECTRONICS & COMMUNICATION ENGINEERING
RADAR ENGINEERING (D47PE3)

B. Tech. VII Semester **L /T/P/C**

3/0/0/3

Prerequisite: Analog and Digital Communications

COURSE OBJECTIVES:

1. To explore the concepts of radar and its frequency bands.
2. To understand Doppler Effect and get acquainted with the working principles of CW radar, FM-CW radar.
3. To impart the knowledge of functioning of MTI and Tracking Radars.
4. To explain the deigning of a Matched Filter in radar receivers.

COURSE OUTCOMES: Upon completing this course, the student will be able to

1. Demonstrate the working principle of pulse radar and establish the complete radar range equation, identifying the significance and choice of all parameters involved, and solve numerical problems to establish the radar characteristics. L3
2. Compare for the need and functioning of CW, FM-CW and MTI radars, identifying the complete block diagrams and establishing their characteristics. L3
3. Illustrate the DLC characteristics, account for the range gated Doppler filter bank, and estimate the MTI radar performance characteristics and limitations. L3
4. Distinguish between Sequential Lobing, Conical Scan, and Monopules type of Tracking Radars, specify their requirements and compare their characteristic features. L2
5. Design the matched filter response characteristics for radar applications and account for correlation receivers; to distinguish between different radar displays and duplexers. L5

COURSE CODE-CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
C402.2.1	2	2										
C402.2.2		2										
C402.2.3		2										
C402.2.4	2	2	2									
C402.2.5	2	2	2									

UNIT– I: Basics of Radar: Maximum Unambiguous Range, Simple form of Radar Equation, Radar Block Diagram and Operation, Radar Frequencies and Applications. Prediction of Range Performance, 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– II: CW and Frequency Modulated Radar: Doppler Effect, CW Radar – Block Diagram, Isolation between Transmitter 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- C Waltimeter.

UNIT–III: MTI and Pulse Doppler Radar: Principle, MTI Radar - Power Amplifier Transmitter and Power Oscillator Transmitter, Delay Line Cancellers – Filter Characteristics, Blind Speeds, Double Cancellation, Staggered PRFs. Range Gated Doppler Filters. MTI Radar Parameters, Limitations to MTI Performance, MTI versus Pulse Doppler Radar.

UNIT–IV: Tracking Radar: Tracking with Radar, Sequential Lobing, Conical Scan, Mono pulse Tracking Radar – Amplitude Comparison Mono pulse (one- and two- coordinates), Phase Comparison Mono pulse, Tracking in Range, Acquisition and Scanning Patterns, Comparison of Trackers.

UNIT–V Detection of Radar Signals in Noise Matched Filter Receiver – Response Characteristics and Derivation, Correlation Function and Cross-correlation Receiver, Efficiency of Non- matched Filters, Matched Filter with Non-white Noise.
Radar Receivers – Noise Figure and Noise Temperature, Displays – types. Duplexers – Branch type and Balanced type, Circulators as Duplexers. Introduction to Phased Array Antennas – Basic Concepts, Radiation Pattern, Beam Steering and Beam Width changes, Applications, Advantages and Limitations.

TEXT BOOKS:

1. Merrill I. Skolnik,"Introduction to Radar Systems" , TMH Special Indian Edition, 2nd Edition, 2007.

REFERENCE BOOKS:

1. Byron Edde, "Radar: Principles, Technology, Applications" , Pearson Education, 2004.
2. Peebles, Jr., P.Z.,"Radar Principles" , Wiley, New York, 1998.
3. Mark A. Richards, James A. Scheer, William A.Holm, Yesdee "Principles of Modern Radar: Basic Principles" , 2013.
4. Merrill I. Skolnik,"Radar Handbook" , 3rd Ed., McGraw Hill Education, 2008.

B.TECH ELECTRONICS & COMMUNICATION ENGINEERING
EMBEDDED SYSTEM DESIGN (D47PE3)

B.Tech. VII Semester **L/T/P/C 3/0/03**

COURSE OBJECTIVES:

1. To provide an overview of Design Principles of Embedded System.
2. To provide clear understanding about the role of firmware, operating systems in correlation with hardware systems.

COURSE OUTCOMES: Upon completing this course, the student will be able to

1. Apply their understanding of embedded system characteristics and quality attributes to for real-world embedded system applications.
2. Demonstrate the core embedded system components such as processors, ASICs, PLDs, and firmware design approaches for specific domain applications.
3. Apply their knowledge of embedded industry trends and communication interfaces for a specific embedded system application
4. Demonstrate the principles of real-time operating systems and analyze the task scheduling algorithms.
5. Analyze various task communication/ synchronization issues and techniques.

COURSE CODE-CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
C403.1	3											
C403.2	3	3	3	2								
C403.3	3	3	3	2								
C403.4	3	3	2	2								
C403.5	3	2	2	2								

UNIT– I: Introduction to Embedded Systems: Definition of Embedded System Embedded Systems Vs. General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems.

UNIT–II: Typical Embedded System: Core of the Embedded System: General Purpose and

Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS).
Embedded Firmware: Reset Circuit, Brown-our Protection Circuit, Oscillator Unit, Real Time Clock, Watchdog Timer, Embedded Firmware Design Approaches and Development Languages.

UNIT–III: Trends in Embedded Industry: Processor Trends in Embedded Systems, Embedded OS Trends, Development Language Trends, Open Standards, Frame works & Alliances, Bottlenecks, Development Platform Trends, Cloud, Internet Of Things (IoT) & Embedded Systems. Communication Interface**,** on board and External Communication Interface

UNIT–IV: RTOS Based Embedded System Design: Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling.

UNIT–V: Task Communication: Shared Memory, Message Passing, Remote Procedure Call and Sockets, Task Synchronization. Communication/Synchronization Issues, Task Synchronization Techniques, Device Drivers, How to Choose an RTOS.

TEXT BOOKS:

1. Shibu K.V, "Introduction to Embedded Systems", Mc Graw Hill.

REFERENCE BOOKS:

1. Raj Kamal,"Embedded Systems", Mc Graw Hill Education.
2. Frank Vahid, Tony Givargis, "Embedded System Design", John Wiley.
3. Lyla,"Embedded Systems", Pearson, 2013.
4. David E. Simon,"An Embedded Software Primer", Pearson Education.

B.TECH. ELECTRONICS & COMMUNICATION ENGINEERING

Machine Learning (D47PE3)

B.Tech. VII Semester **L/T/P/C**
3/0/0/3

COURSE OBJECTIVES:

1. To introduce the foundations of Artificial Neural Networks
2. To acquire the knowledge on Deep Learning Concepts
3. To learn various types of Artificial Neural Networks
4. To gain knowledge to apply optimization strategies

COURSE OUTCOMES: Upon completing this course, the student will be able to

1. Ability to apply the concepts of Neural Networks. L3
2. Ability to relate the Learning Networks in modeling real world systems. L3
3. Able to apply and use an efficient algorithm for Deep Models. L3
4. Ability to apply optimization strategies for large scale applications. L3
5. Able to analyze graphical models. L4

COURSE CODE-CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
C403.1	3	2	2	2	3							2
C403.2	3	2	3	2	3							2
C403.3	3	3	3	2	3							2
C403.4	3	2	3	3	3							3
C403.5	3	3	3	3	3							2

UNIT - I

Artificial Neural Networks Introduction, Basic models of ANN, important terminologies, Supervised Learning Networks, Perceptron Networks, Adaptive Linear Neuron, Back-propagation Network. Associative Memory Networks. Training Algorithms for pattern association, BAM and Hopfield Networks.

UNIT - II

Unsupervised Learning Network- Introduction, Fixed Weight Competitive Nets, Maxnet, Hamming Network, Kohonen Self-Organizing Feature Maps, Learning Vector Quantization, Counter Propagation Networks, Adaptive Resonance Theory Networks. Special Networks- Introduction to various networks.

UNIT - III

Linear Models: Linear Basis Function Models -Maximum likelihood and least squares, Geometry of least squares , Sequential learning, Regularized least squares, Multiple outputs , The Bias- Variance Decomposition, Bayesian Linear Regression -Parameter distribution, Predictive, Equivalent, Bayesian Model Comparison, Probabilistic

Generative Models-Continuous inputs, Maximum likelihood solution, Discrete features, Exponential family, Probabilistic Discriminative Models -Fixed basis functions, Logistic regression, Iterative reweighted least squares, Multiclass logistic regression, Probit regression, Canonical link functions.

UNIT - IV

Kernel Methods: Constructing Kernels, Radial Basis Function Networks - Nadaraya-Watson model, Gaussian Processes -Linear regression revisited, Gaussian processes for regression, Learning the hyper parameters, Automatic relevance determination, Gaussian processes for classification, Laplace approximation, Connection to neural networks, Sparse Kernel Machines- Maximum Margin Classifiers, Overlapping class distributions, Relation to logistic regression, Multiclass SVMs, SVMs for regression, Computational learning theory, Relevance Vector Machines- RVM for regression, Analysis of sparsity, RVM for classification.

UNIT-V

Graphical Models: Bayesian Networks, Example: Polynomial regression, Generative models, Discrete variables, Linear-Gaussian models, Conditional Independence- Three example graphs, D-separation, Markov Random Fields -Conditional independence properties, Factorization properties, Illustration: Image de-noising, Relation to directed graphs, Inference in Graphical Models- Inference on a chain, Trees, Factor graphs, The sum-product algorithm, The max-sum algorithm, Exact inference in general graphs, Loopy belief propagation, Learning the graph structure.

TEXT BOOKS:

1. C. Bishop ,"Pattern Recognition and Machine Learning",Springer, 2006.
2. Simon Haykin,"Neural Networks and Learning Machines", 3rd Edition, Pearson Prentice Hall.

REFERENCE BOOKS:

1. Nils J. Nilsson ,"Introduction to machine learning", Stanford University Stanford.
2. William J. Deuschle ," Undergraduate Fundamentals of Machine Learning", thesis Harvard College, Cambridge.
3. Shai Shalev-Shwartz, Shai Ben-David,"Understanding Machine Learning, From theory to Algorithms", Cambridge University press, 2014.

B.TECH. ELECTRONICS & COMMUNICATION ENGINEERING
LOW POWER VLSI DESIGN (D47PE4)

B.Tech. VII Semester **L/T/P/C**
3/0/0/3

COURSE OBJECTIVES:

The student will be able to

1. Understand the Fundamentals of Low Power VLSI Design.
2. Study low-Power Design Approaches, Power estimation and analysis.
3. Study and analyze the Low-Voltage Low-Power Adders, Multipliers.
4. Know concepts of Low-Voltage Low-Power Memories and Future Trend and Development of DRAM.

COURSE OUTCOMES: Upon completing this course, the student will be able to

1. Infer about the second order effects of MOS transistor characteristics. L4
2. Analyze and implement various CMOS static logic circuits. L4
3. Investigate the design techniques low voltage and low power CMOS circuits for various applications. L4
4. Organize the different types of memory circuits and their design. L5
5. Design and implementation of various structures for low power applications. L5

COURSE CODE-CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
C402.2.1	3	3	2	3	2				1	1		2
C402.2.2	3	3	3	2	2				1	1		2
C402.2.3	3	3	3	3	3				1	1		2
C402.2.4	3	2	3	2	2				1	1		2
C402.2.5	3	3	3	2	3				1	1		2

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, Pre-charge and Equalization Circuit, Low Power SRAM Technologies, Basics of DRAM, Self-Refresh Circuit, Future Trend and Development of DRAM.

TEXT BOOKS:

1. Sung-Mo Kang, Yusuf Leblebici, "CMOS Digital Integrated Circuits – Analysis and Design", TMH, 2011.
2. Kiat-Seng Yeo, Kaushik Roy, "Low-Voltage, Low-Power VLSI Subsystems", TMH Professional Engineering.

REFERENCE BOOKS:

1. Ming-BO Lin, "Introduction to VLSI Systems: A Logic, Circuit and System Perspective", CRC Press.
2. Anantha Chandrakasan, "Low Power CMOS Design", IEEE Press, /Wiley International, 1998.
3. Kaushik Roy, Sharat C. Prasad, "Low Power CMOS VLSI Circuit Design", John Wiley, & Sons, 2000.
4. Gary K. Yeap, "Practical Low Power Digital VLSI Design", Kluwer Academic Press, 2002.
5. Bellamour, M. I. Elamasri, "Low Power CMOS VLSI Circuit Design", A Kluwer Academic Press.
6. Siva G. Narendran, AnathaChandrakasan, "Leakage in Nanometer CMOS Technologies", Springer, 2005.

B.TECH. ELECTRONICS & COMMUNICATION ENGINEERING
SATELLITE COMMUNICATIONS (D47PE4)

B.Tech. VII Semester **L/T/P/C**
3/0/0/3

COURSE OBJECTIVES:

The course objectives are:

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

COURSE OUTCOMES: Upon completing this course, the student will be able to

1. Illustrate the historical background, basic concepts, and frequency allocations for satellite communication.
2. Interpret satellite sub-systems such as telemetry, tracking, command, monitoring and power systems, etc.
3. To analyze satellite links for specified C/N, providing system design examples.
4. Explain the components and functionality of earth station technology and tracking system.
5. Illustrate navigation and GPS.

COURSE CODE-CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
C404.1.1	3	3										
C404.1.2	3	2										
C404.1.3	3	3										
C404.1.4	3	3										
C404.1.5	2	2										

UNIT – I:

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

Orbital Mechanics and Launchers: Orbital Mechanics, Orbital Period and Velocity, Look Angle determination, Orbital Perturbations, Orbit determination, Launches and Launch vehicles**,** Orbital Effects in Communication Systems Performance, Orbital Elements.

UNIT – II:

Satellite Subsystems: Attitude and Orbit Control System, Telemetry, Tracking, Command

and Monitoring, Power Systems, Communication Subsystems, Satellite Antennas, Equipment Reliability and 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 Access: Frequency Division Multiple Access (FDMA), Intermodulation, 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 Transmission and 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 NGSO Constellation 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. Timothy Pratt, Charles Bostian and Jeremy Allnutt,"Satellite Communications" ,WSE, Wiley Publications, 2nd Edition,2003.
2. Wilbur L. Pritchard, Robert A Nelson and Henri G.Suyder houd,"Satellite Communications Engineering", 2nd Edition, Pearson Publications, 2003.

REFERENCE BOOKS:

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

B.TECH. ELECTRONICS & COMMUNICATION ENGINEERING
REAL TIME OPERATING SYSTEM (D47PE4)

B.Tech. VII Semester **L/T/P/C**
3/0/0/3

COURSE OBJECTIVES:

1. To provide broad understanding of the requirements of Real Time Operating Systems.
2. To make the student understand, applications of these Real Time features using case studies.

COURSE OUTCOMES: Upon completing this course, the student will be able to

1. Illustrate introduction to UNIX/ LINUX. L3
2. Demonstrate how a real-time operating system kernel is implemented. L3
3. Illustrate how the real-time operating system implements time management and explain how tasks are managed. L3
4. Analyze how tasks can communicate using semaphores, mailboxes, and queues. L4
5. Investigate different real time operating systems like RT Linux, Vx Works, MicroC /OS-II, Tiny OS. L4

COURSE CODE-CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
C404.2.1	2	2										
C404.2.2	3	2										
C404.2.3	2	2										
C404.2.4	2	2										
C404.2.5	2	2										

UNIT-I: Introduction: Introduction to UNIX/LINUX, Over view of Commands, File I/O, (open, create, close, seek, read, write), Process Control (fork, vfork, exit, wait,wait pid, 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 andI/O

Pipes, Event Registers, Signals, Other Building Blocks, Component Configuration, BasicI/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 RsTOS
RTL inux, Micro C/OS-II, Vx Works, Embedded Linux and Tiny OS.

TEXT BOOKS:
1. Qing Li,"Real Time Concepts for Embedded Systems", Elsevier,2011

REFERENCE BOOKS:
1. Raj kamal,"Embedded Systems-Architecture, Programming and Design",2007,TMH.
2. Richard Stevens,"Advanced UNIX Programming".
3. Dr.Craig Hollabaugh,"Embedded Linux: Hardware, Software and Interfacing".

B.TECH. ELECTRONICS & COMMUNICATION ENGINEERING
ARTIFICIAL NEURAL NETWORKS (D47PE3)

B.Tech. VII Semester **L/T/P/C 3/0/0/3**

Prerequisite: Calculus, Linear Algebra, Probability

COURSE OBJECTIVES:

1. To understand the biological neural network and to model equivalent neuron models.
2. To understand the architecture, learning algorithms
3. To know the issues of various feed forward and feedback neural networks.
4. To explore the Neuro dynamic models for various problems.

COURSE OUTCOMES: Upon completing this course, the student will be able to

1. Build the similarity of Biological networks and neural networks. L3
2. Practice the training of neural networks using various learning rules. L3
3. Demonstrate the concepts of forward and backward propagations. L3
4. Practice Self Organization Maps. L3
5. Construct the Hopfield models. L3

COURSE CODE-CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
C404.2.1	3	1	1	1	1					1		2
C404.2.2	3	3	2	1	2					1		2
C404.2.3	3	2	1	1	2					1		3
C404.2.4	3	2	2	1	2		1			1		2
C404.2.5	3	2	1	2	2							2

UNIT-I:

Introduction: A Neural Network, Human Brain, Models of a Neuron, Neural Networks viewed as Directed Graphs, Network Architectures, Knowledge Representation, Artificial Intelligence and Neural Networks

Learning Process: Error Correction Learning, Memory Based Learning, Hebbian Learning, Competitive, Boltzmann Learning, Credit Assignment Problem, Memory, Adaption, Statistical Nature of the Learning Process

UNIT-II:

Single Layer Perceptrons: Adaptive Filtering Problem, Unconstrained Organization Techniques, Linear Least Square Filters, Least Mean Square Algorithm, Learning Curves, Learning Rate Annealing Techniques, Perceptron –Convergence Theorem, Relation Between Perceptron and Bayes Classifier for a Gaussian Environment

Multilayer Perceptron: Back Propagation Algorithm XOR Problem, Heuristics, Output

Representation and Decision Rule, Computer Experiment, Feature Detection.

UNIT-III:

Back Propagation: Back Propagation and Differentiation, Hessian Matrix, Generalization, Cross Validation, Network Pruning Techniques, Virtues and Limitations of Back Propagation Learning, Accelerated Convergence, Supervised Learning

UNIT-IV:

Self-Organization Maps (SOM): Two Basic Feature Mapping Models, Self-Organization Map, SOM Algorithm, Properties of Feature Map, Computer Simulations, Learning Vector Quantization, Adaptive Patter Classification

UNIT-V:

Neuro Dynamics: Dynamical Systems, Stability of Equilibrium States, Attractors, Neuro Dynamical Models, Manipulation of Attractors as a Recurrent Network Paradigm.

Hop field Models–Hop field Models, restricted boltzmen machine.

TEXT BOOKS:

1. Simon S Haykin,"Neural Networks a Comprehensive Foundations", PHI Ed.
2. Jacek M.Zurada,"Introduction to Artificial Neural Systems", JAICO Publishing House ,Ed.2006.

REFERENCE BOOKS:

1. Li Min Fu,"Neural Networks in Computer Intelligence", TMH,2003.
2. James A Freeman David, MS Kapura,"Neural Networks", Pearson Ed., 2004.
3. B.Vegnanarayana,"Artificial Neural Networks", Prentice Hall of India, P.Ltd,2005.

B.TECH. ELECTRONICS & COMMUNICATION ENGINEERING

MICROWAVE ENGINEERING LAB (D47PC27)

B.TECH.VII SEMESTER **L/T/P/C**
0 /0 /2 /1

COURSE OBJECTIVES:

1. The goal of this course is to introduce students to the concepts and principles of the advanced microwave engineering.
2. To understand the operation of different types of Microwave sources.
3. Scattering parameters are defined and used to characterized services and system behavior.

COURSE OUTCOMES:

1. Understand and analyze the operating principles and characteristics of microwave devices and components.
2. Measure and interpret key microwave parameters such as VSWR, impedance, attenuation, and frequency.
3. Determine scattering (S-) parameters of various microwave junctions to assess power distribution and signal behavior.
4. Apply measurement techniques and analytical skills to characterize waveguide structures and components used in microwave systems.

COURSE CODE-CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
C405.1					3			3	3			
C405.2					3			3	3			
C405.3					3			3	3			
C405.4								3	3			

Note: Minimum of 12 experiments to be conducted List of Experiments

1. Analysis of Reflex Klystron Characteristics
2. Analysis of Gunn Diode Characteristics
3. Measurement of Directional Coupler Parameters
4. VSWR Measurement of Matched load
5. VSWR measurement of open and short circuit loads
6. Measurement of Waveguide Parameters
7. Measurement of Impedance of a given Load
8. Measurement of Scattering Parameters of a E plane Tee
9. Measurement of Scattering Parameters of a H plane Tee
10. Measurement of Scattering Parameters of a Magic Tee
11. Measurement of Scattering Parameters of an Isolator
12. Measurement of Scattering Parameters of a Circulator
13. Attenuation Measurement of a waveguide
14. Frequency Measurement of a waveguide

B.TECH. ELECTRONICS & COMMUNICATIONENGINEERING

MEMORY TECHNOLOGIES (D48PE5)

B. TECH VIII SEMESTER **L/T/P/C**
3/0/0/ 3

PRE - REQUISITES:

1. Good knowledge on sequential circuits design.
2. Requires basic knowledge of fabrication process.

COURSE OBJECTIVES:

1. This course gives an idea about different types of memories, its architecture and technologies used in the industry.
2. How to design for testing and to create a good fault model for successful testing is looked into.
3. The course also takes one through reliability and effect of radiation and the advanced memory technologies and packaging.

COURSE OUTCOMES: Upon completing this course, the student will be able to

1. Design SRAM, DRAM and Nonvolatile Memory Architectures. L5
2. Illustrate Memory Fault Modeling, Testing, and Memory Design for Testability. L3
3. Specify design trade-off in Memory design. L2
4. Investigate RAM Failure Modes and Mechanism. L4
5. Illustrate Experimental Memory Devices. L3

COURSE CODE-CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
C405.1	3	2	3	2	3				1	1		2
C405.2	3	3	2	3	2				1	1		2
C405.3	2	3	2	2	2				1	1		2
C405.4	3	3	2	3	2				1	1		2
C405.5	2	2	2	2	2				1	1		2

Unit-I

Random Access Memory Technologies-Static Random Access Memories (SRAMs): SRAM Cell Structures-MOS SRAM Architecture-MOS SRAM Cell and Peripheral Circuit Operation- Bipolar, SRAM Technologies-Silicon On Insulator (SOl) Technology-Advanced SRAM Architectures and Technologies- Application Specific SRAMs. Dynamic Random Access Memories (DRAMs): DRAM Technology Development-CMOS DRAMs-DRAMs Cell Theory and Advanced Cell Structures- BiCMOS DRAMs-Soft Error Failures in DRAMs-Advanced DRAM Designs and Architecture- Application Specific DRAMs.

Unit-II

Non-Volatile Memories-Masked Read-Only Memories (ROMs)- High Density ROMs-Programmable Read-Only Memories (PROMs)- Bipolar PROMs-CMOS PROMs-

Erasable (UV) - Programmable Road-Only Memories (EPROMs)-Floating- Gate EPROM Cell-One- Time Programmable(OTP) EPROMS-Electrically Erasable PROMs(EEPROMs) - EEPROM Technology And Architecture-Nonvolatile SRAM-Flash Memories(EPROMs or EEPROM)- Advanced Flash Memory Architecture.

Unit-III

Memory Fault Modeling, Testing, And Memory Design For Testability And Fault Tolerance-RAM Fault Modeling, Electrical Testing, Pseudo Random Testing-Megabit DRAM Testing-Nonvolatile Memory Modeling and Testing- IDDQ Fault Modeling and Testing-Application Specific Memory Testing.

UNIT-IV

Semiconductor Memory Reliability And Radiation Effects-General Reliability Issues-RAM Failure Modes and Mechanism-Nonvolatile Memory Reliability-Reliability Modeling and Failure Rate Prediction- Design for Reliability-Reliability Test Structures-Reliability Screening and Qualification. Radiation Effects-Single Event Phenomenon (SEP)-Radiation Hardening Techniques-Radiation Hardening Process and Design Issues-Radiation Hardened Memory Characteristics-Radiation Hardness Assurance and Testing - Radiation Dosimeter-Water Level Radiation Testing and Test Structures.

Unit-V

Advanced Memory Technologies And High-Density Memory Packaging Technologies- Ferroelectric Random Access Memories (FRAMs)-Gallium Arsenide (GaAs) FRAMs-Analog Memories-Magneto resistive Random Access Memories (MRAMs)- Experimental Memory Devices. Memory Hybrids and MCMs (2D)-Memory Stacks and MCMs (3D)-Memory MCM Testing and Reliability Issues-Memory Cards-High Density Memory Packaging Future Directions.

TEXT BOOKS:

1. Ashok K.Sharma, “Semiconductor Memories Technology, Testing and Reliability”, Prentice- Hall of India Private Limited, New Delhi, 1997.

REFERENCE BOOKS:

1. Luecke Mize Care, “Semiconductor Memory design & application”, Mc-Graw Hill.
2. Belty Prince, “ Semiconductor Memory Design Handbook”.
3. “Memory Technology design and testing”1999 IEEE International Workshop on: IEEE Computer Society Sponsor (S).

B.TECH.ELECTRONICS&COMMUNICATIONENGINEERING
OPTICAL FIBRE COMMUNICATIONS (D48PE5)

B.Tech. VIII Semester **L/T/P/C**
3/0/0/3

COURSE OBJECTIVES:
The objectives of the course are:
1. To realize the significance of optical fibre communications.
2. To understand the construction and characteristics of optical fibre cable.
3. To develop the knowledge of optical signal sources and power launching.
4. To identify and understand the operation of various optical detectors.
5. To understand the design of optical systems and WDM.

COURSE OUTCOMES: Upon completing this course, the student will be able to

1. Understand and analyze the constructional parameters of optical fibers. L5
2. Estimate the losses due to attenuation, absorption, scattering and bending. L2
3. Compare various optical sources and choose suitable one for different applications. L3
4. Understand various optical detectors for different applications. L2
5. Design an optical system. L5

COURSE CODE-CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
C405.1	3	3	2	2	2				1	1		2
C405.2	3	3	2	3	2				1	1		2
C405.3	3	2	3	2	2				1	1		2
C405.4	3	2	2	2	2				1	1		2
C405.5	3	3	3	2	3				2	1		2

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, 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, External

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. Gerd Keiser, "Optical Fiber Communications", Mc Graw Hill Education, 4th Edition,2008.
2. John M. Senior, "Optical Fiber Communications" , Pearson Education, 3rd Edition, 2009.

REFERENCE BOOKS:

1. D.K.Mynbaev, S.C.Gupta and Lowell L. Scheiner,"Fiber Optic Communications" ,PearsonEducation, 2005.
2. S.C.Gupta, "Optical Fibre Communication and its Applications" ,PHI, 2005.
3. Govind P. Agarwal, "Fiber Optic Communication Systems", John Wiley, 3rd Edition, 2004.
4. Donald J.Sterling Jr. ,"Introduction to Fiber Optics",Cengage learning, 2004.

B.TECH. ELECTRONICS & COMMUNICATION ENGINEERING
EMBEDDED C (D48PE5)

B.Tech. VIII Semester **L/T/P/C**
3/0/0/3

COURSE OBJECTIVES:

1. To explore the difference between general purpose programming languages and Embedded Programming Language.
2. To provide case studies for programming in embedded systems.

COURSE OUTCOMES: Upon completing this course, the student will be able to

1. Illustrate the basics of Embedded C with reference to 8051. L3
2. Operate how to handle control and data pins at hardware level. L3
3. Illustrate the objective nature of Embedded C. L3
4. Demonstrate the knowledge about real time constraints. L3
5. Apply the specifications of real time embedded programming with case studies. L3

COURSE CODE-CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
C405.1	3	2	2	2	2				1	1		2
C405.2	3	3	3	2	2				1	1		2
C405.3	3	2	2	2	2				1	1		2
C405.4	3	3	3	3	2				1	1		2
C405.5	3	3	3	3	3				2	1		2

UNIT-I: Programming Embedded Systems in C:
Introduction, What is an embedded system, Which processors should you use, Which programming language should you use, Which operating system should you use, How do you develop embedded software, Conclusions.
Introducing the 8051Microcontroller Family: Introduction, What's in a name, The external interface of the Standard 8051, Reset requirements, Clock frequency and performance, Memory issues ,I/O pins, Timers, Interrupts, Serial interface, Power consumption, Conclusions.

UNIT-II: Reading Switches: Introduction, Basic techniques for reading from port pins, Example: Reading and writing bytes, Example: Reading and writing bits (simple version), Example: Reading and writing bits (generic version), the need for pull-up resistors, Dealing with switch bounce, Example: Reading switch inputs (basic code), Example: Counting goats, Conclusions.

UNIT–III: Adding Structure to your Code
Introduction, Object-oriented programming with C, The Project Header (MAIN.H), The Port Header (PORT.H), Example: Restructuring the 'Hello Embedded World' example, Example: Restructuring the goat-counting example, Further examples, Conclusions.

UNIT–IV: Meeting Real-Time Constraints
Introduction, creating hardware delays using Timer 0 and Timer 1, Examples on

delay, timeouts, Conclusions.

UNIT–V: Case Study: Intruder Alarm System
Introduction, The software architecture, Key software components used in this example, running the program, the software, Conclusions.

TEXT BOOKS:
1. Michael J.Pont,“Embedded C”,Pearson Education.

REFERENCE BOOKS:
1. Nigel Gardner,“PIC micro MCU C-An introduction to programming, The Microchip PIC in CCS C ” .

B.TECH. ELECTRONICS & COMMUNICATION ENGINEERING

ELECTRONIC MEASUREMENTS AND INSTRUMENTATION (D48PE5)

B.Tech. VIII Semester **L/T/P/C**
3/0/0/3

Prerequisite: Basic Electrical and Electronics Engineering

COURSE OBJECTIVES:

1. It provides an understanding of various measuring system functioning and metrics for performance analysis.
2. Provides understanding of principle of operation, working of different electronic instruments viz. signal generators, signal analyzers, recorders and measuring equipment.
3. Understanding the concepts of various measuring bridges and their balancing conditions.
4. Provides understanding of use of various measuring techniques for measurement of different physical parameters using different classes of transducers.

COURSE OUTCOMES: Upon completing this course, the student will be able to

1. Measure electrical parameters with different meters and relate the basic definition of measuring parameters. L3
2. Use various types of signal generators, signal analyzers for generating and analyzing various real-time signals. L4
3. Operate an Oscilloscope to measure various signals. L3
4. Analyze various physical parameters by appropriately selecting the transducers. L4
5. Analyze various bridges and measurement of physical parameters. L4

COURSE CODE-CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
C405.1	3	2	2	2	2				1	1	-	2
C405.2	3	3	3	3	2				1	1	-	2
C405.3	3	2	3	2	3				1	1	-	2
C405.4	3	3	3	3	2				1	1	-	2
C405.5	3	3	3	3	2				1	1	-	2

UNIT - I:

Block Schematics of Measuring Systems:

Performance Characteristics: Static Characteristics: Accuracy, Precision, Resolution. Dynamic Characteristics: Repeatability, Reproducibility, Fidelity, Lag. Types of Errors: Gaussian Error, Root Sum Squares formula.

Measuring Instruments: DC Voltmeters, D' Arsonval Movement, DC Current Meters, AC Voltmeters and Current Meters, Ohmmeters, Multimeters, Meter Protection, Extension of Range, True RMS Responding Voltmeters, Specifications of Instruments.

UNIT - II:

Signal Analyzers: AF, HF Wave Analyzers, Harmonic Distortion, Heterodyne wave Analyzers, Spectrum Analyzers, Power Analyzers, Capacitance-Voltage Meters, Oscillators. Signal Generators: AF, RF Signal Generators, Sweep Frequency Generators, Pulse and Square wave Generators, Function Generators, Arbitrary Waveform Generator, Video Signal Generators, and Specifications.

UNIT III:

Oscilloscopes: CRT, Block Schematic of CRO, Time Base Circuits, Lissajous Figures, CRO Probes, High Frequency CRO Considerations, Delay lines, Applications: Measurement of Time, Period and Frequency Specifications.

Special Purpose Oscilloscopes: Dual Trace, Dual Beam CROs, Sampling Oscilloscopes, Storage Oscilloscopes, Digital Storage CROs.

UNIT IV:

Transducers: Classification, Strain Gauges, Bounded, unbounded; Force and Displacement Transducers, Resistance Thermometers, Hotwire Anemometers, LVDT, Thermocouples, Synchros, Special Resistance Thermometers, Digital Temperature sensing system, Piezoelectric Transducers, Variable Capacitance Transducers, Magneto Strictive Transducers, gyroscopes, accelerometers.

UNIT V:

Bridges: Wheat Stone Bridge, Kelvin Bridge, and Maxwell Bridge.

Measurement of Physical Parameters: Flow Measurement, Displacement Meters, Liquid level Measurement, Measurement of Humidity and Moisture, Velocity, Force, Pressure - High Pressure, Vacuum level, Temperature -Measurements, Data Acquisition Systems.

TEXT BOOKS:

1. A.D. Helbincs, W. D. Cooper,"Modern Electronic Instrumentation and Measurement Techniques", PHI 5th Edition 2003.
2. H. S. Kalsi ,"Electronic Instrumentation",TMH, 2nd Edition 2004.

REFERENCE BOOKS:

1. A K Sawhney, "Electrical and Electronic Measurement and Measuring Instruments", Dhanpat Rai& Sons, 2013.
2. David A. Bell,"Electronic Instrumentation and Measurements", Oxford Univ. Press, 1997.
3. T.R. Padmanabham,"Industrial Instrumentation", Springer 2009.
4. K. Lal Kishore,"Electronic Measurements and Instrumentation", Pearson Education 2010.

B.TECH ELECTRONICS & COMMUNICATION ENGINEERING

CPLD AND FPGA ARCHITECTURES AND APPLICATIONS (D48PE6)

B.Tech. VIII semester **L/T/P/C**
3/0/0/3

Pre-Requisites: Programmable logic devices, combinational and sequential logic circuit design.

COURSE OBJECTIVES:

1. To understand the types of programmable logic devices and the differences between these devices.
2. To know the types of FPGA's and their programming technologies.
3. To understand about the SRAM programmable FPGA's and their programming technology.

COURSE OUTCOMES: Upon completing this course, the student will be able to

1. Apply the concept of programming logic devices for various applications. L3
2. Acquire knowledge of various programming methods in FPGA. L2
3. Design anti-fuse FPGA based architectures. L5
4. Design SRAM based FPGA architectures. L5
5. Design CPLD and FPGA architectures for real time applications. L5

COURSE CODE-CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
C405.1	3	2	2	2	2	-	-	-	1	1	-	2
C405.2	3	2	2	2	2	-	-	-	1	1	-	2
C405.3	3	3	3	3	3	-	-	-	2	1	-	2
C405.4	3	3	3	3	3	-	-	-	2	1	-	2
C405.5	3	3	3	3	3	-	-	-	2	1	-	2

UNIT-I

Introduction to Programmable Logic Devices: Introduction, Simple Programmable Logic Devices –Read Only Memories, Programmable Logic Arrays, Programmable Array Logic, Programmable Logic Devices/Generic Array Logic; Complex Programmable Logic Devices – Architecture of Xilinx Cool Runner XCR3064XL CPLD, CPLD Implementation of a Parallel Adder with Accumulation.

UNIT-II

Field Programmable Gate Arrays: Organization of FPGAs, FPGA Programming Technologies, and Programmable Logic Block Architectures, Programmable Interconnects, and Programmable I/O blocks in FPGAs, Dedicated Specialized Components of FPGAs, and Applications of FPGAs.

UNIT -III

SRAM Programmable FPGAs: Introduction, Programming Technology, Device Architecture, the Xilinx XC2000, XC3000 and XC4000 Architectures.

UNIT -IV

Anti-Fuse Programmed FPGAs: Introduction, Programming Technology, Device Architecture, The Actel ACT1, ACT2 and ACT3 Architectures.

UNIT -V

Design Applications: General Design Issues, Counter Examples, A Fast Video Controller, A Position Tracker for a Robot Manipulator, A Fast DMA Controller, Designing Counters with ACT devices, Designing Adders and Accumulators with the ACT Architecture.

TEXT BOOKS:

1. Stephen M. Trimberger, "Field Programmable Gate Array Technology", Springer International Edition.
2. Charles H. Roth Jr, Lizy Kurian John, "Digital Systems Design", Cengage Learning.

REFERENCE BOOKS:

1. John V. Oldfield, Richard C. Dorf, "Field Programmable Gate Arrays", Wiley India.
2. Pak K. Chan/Samiha Mourad, "Digital Design Using Field Programmable Gate Arrays", Pearson Low Price Edition.
3. Ian Grout, "Digital Systems Design with FPGAs and CPLDs", Elsevier, Newnes.
4. Wayne Wolf, "Modern Semiconductor Design Series",Prentice Hall Modern, Semiconductor Design Series.

B.TECH. ELECTRONICS & COMMUNICATION ENGINEERING
5G TECHNOLOGY (D48PE6)

B.Tech. VIII Semester **L/T/P/C**
3/0/0/3

COURSE OBJECTIVE:

The aim of this course is to let the students

1. Understand that air Interface is one of the most important elements that differentiate between 2G, 3G, 4G and 5G.
2. 3G was CDMA based, 4G was OFDMA based; this course reveals the contents of air interface for 5G.
3. 4G brought in a deluge of infotainment services, 5G aims to provide extremely low delay services, great service in crowd.
4. Enhanced mobile broadband (virtual reality being made real), ultra-reliable and secure connectivity, ubiquitous QoS, and highly energy efficient networks.

COURSE OUTCOMES : Upon completing this course, the student will be able to

1. Understand and explain the channel models of 5G and the use cases for 5G. L2
2. Analyse use of MIMO in 5G and its techniques. L4
3. Draw and explain 5G architecture, its components and functional criteria. L2
4. Study the in-depth functioning of 5G radio access technologies. L2
5. Understand interference management, mobility management and security issues in 5G. L2

COURSE CODE-CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
C405.2.1	3	2	2	2	2	-	-	-	1	1	-	2
C405.2.2	3	3	3	3	3	-	-	-	1	1	-	2
C405.2.3	3	2	2	2	2	-	-	-	1	1	-	2
C4052..4	3	2	2	2	2	-	-	-	1	1	-	2
C405.2.5	3	2	2	2	2	-	-	-	1	1	-	2

UNIT - I: Multiple Input Multiple Output (MIMO) Communications:

Spatial Multiplexing, Spatial Diversity, Beam forming in MIMO systems, Hybrid Precoding, 5G Communication Landscape, Related work on 5G.

UNIT - II:

Introduction to Mobile Wireless Technology Generations:

5G, WISDOM, GIMVC, Requirements of 5G, standardization of WISDOM, Vision of 5G, WISDOM Concept and Challenges, Cellular D2D Communication, D2D Using Physical Layer Network Coding, Using FFR and Using Cognitive Radio.

SMNAT: Introduction, Network Architecture and the Process, Implementation of SMNAT for In- Band- D2D and Interoperability with WISDOM, Description of Network elements of SMNAT and Call Flow for Session Establishment.

UNIT - III: Radio Wave Propagation for Mm Wave:

Introduction, Large-scale Propagation Channel Effects, Small-Scale Channel Effects, Spatial Characterization of Multipath and Beam Combing, Outdoor Channel Models, Indoor Channel Models.

UNIT - IV: Higher layer Design Considerations for Mm Wave:

Challenges when Networking Mm Wave Devices, Beam Adaptation Protocols, Relaying for Coverage Extension, Support for Multimedia Transmission, Multiband considerations, Performance of Cellular networks, Mm Wave Standardization: ECMA-387, IEEE 802.11ad.

UNIT - V: BEYOND 2020

Major Challenges Surrounding Future Cyber Security, Users Awareness, Spectrum Related Security Issues in CRNs. Challenges for 2020 and beyond, Future Mobile Technologies, High Altitude Stratospheric Platform Station Systems, Human Bond Communications, CONASENSE.

TEXT BOOKS :

1. Afif Osseiran, Jose F. Monserrat, Patrick Marsch, "5G Mobile and Wireless Communications Technology",Cambridge University Press, Second Edition, 2011.

REFERENCE BOOKS:

1. Erik Dahlman, Stefan Parkvall, Johan Skold,"5G NR: The Next Generation Wireless Access Technology" ,Elsevier,First Edition, 2016.
2. Jonathan Rodriguez ,"Fundamentals of 5G Mobile Networks",Wiley, First Edition, 2010.

B.TECH. ELECTRONICS & COMMUNICATION ENGINEERING

ARM ARCHITECTURE AND INTERFACE PROTOCOLS (D48PE6)

B.Tech. VIII SEMESTER **L/T/P/C**
3/0/0/ 3

Pre-Requisite: Knowledge of Digital electronics, Micro controller Architecture and Programming.

COURSE OBJECTIVES:

1. Collect knowledge of architecture of ARM 7processor, LPC2148 and assembly programming of ARM.
2. Learn to design, construct, and program, verify, analyze and troubleshoot ARM assembly and C language programs and supporting hardware.

COURSE OUTCOMES: Upon completing this course, the student will be able to

1. Illustrate the features of embedded systems, architecture of ARM7 and applications. L3
2. Analyze the instruction set and development tools of ARM. L4
3. Analyze the THUMB state and achieving competency in assembly programming of ARM. L4
4. Analyze the exception, interrupts and interrupt handling schemes. L4
5. Illustrate the architectural features of LPC2148 microcontrollers. L3

COURSE CODE-CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
C406.1	3	2	2	2	2	-	-	-	1	1	-	2
C406.2	3	3	3	3	3	-	-	-	1	1	-	2
C406.3	3	3	3	3	3	-	-	-	1	1	-	2
C406.4	3	3	3	3	3	-	-	-	1	1	-	2
C406.5	3	2	2	2	2	-	-	-	1	1	-	2

UNIT-1: ARM Embedded Systems and ARM Processor Fundamentals. The RISC design philosophy, ARM design philosophy, embedded system hardware- AMBA bus protocol, embedded system software- applications. ARM core data flow model, Registers, CPSR-Processor modes, Banked registers. Pipeline - Characteristics.

UNIT-2: ARM Instruction Set. Fundamentals of ARM instructions, Barrel shifter, Classification and explanation of instructions with examples-Data processing, Branch, Load-store, SWI and Program Status Register instruction.

UNIT-3: Introduction to THUMB and ARM Programming Introduction to THUMB, Differences between ARM and THUMB, Register usage in Thumb, ARM Thumb Interworking. General Structure of ARM assembly module, Assembler directives- AREA, ENTRY, END, SPACE, DCD, DCB, DCW, DCI, DCQ, EQU, EXPORT, ALIGN, CODE16, CODE32, DATA. Simple ALP programs on Arithmetic & logical operations,

Factorial, string operation, sorting, searching, and Scan.

UNIT-4: Exception and Interrupt handling schemes Exception handling- ARM processor exceptions and modes, vector table, exception priorities, link register offsets. Interrupts- assigning interrupts, interrupt latency, IRQ and FIQ exceptions with example- code for enabling and disabling IRQ and FIQ exceptions, Comparison between exception and interrupts. Interrupt handling schemes- nested interrupt handler, non-nested interrupt handler. Basic interrupt stack design.

UNIT-5: LPC2148 ARM CPU LPC 2148 - Salient features, applications, block diagram, memory mapping. Functional features of Interrupt controller, RTC, USB, UART, I2C, SPI, SSP controllers, watch dog timers and other system control units.

TEXT BOOKS:

1. Andrew N. SLOSS,"ARM System Developer's guide", ELSEVIER Publications.
2. William Hohl, "ARM Assembly Language",CRC Press.

REFERENCE BOOKS:

1. Steve Furber, "ARM System-on-chip Architecture", Pearson Education.
2. James K. Peckol," Embedded Systems: A Contemporary Design Tool".

B.TECH ELECTRONICS & COMMUNICATION ENGINEERING

DSP PROCESSORS AND ARCHITECTURES (D48PE6)

B.Tech. VIII SEMESTER **L/T/P/C**
3/1/0/ 3

COURSE OBJECTIVES:

1. Understand the basics of Digital Signal Processing and transforms.
2. Able to distinguish between the architectural features of general purpose processors and DSP processors.
3. Understand the architectures of TMS320C54xx devices and ADSP 2100 DSP devices.
4. Able to write simple assembly language programs using instruction set of TMS320C54xx.
5. Can interface various devices to DSP Processors

COURSE OUTCOMES: Upon completion of this course the student will be able to:

1. Comprehend the concepts of digital signal processing techniques. L2
2. Analyze the various Architectures for Programmable DSP Devices. L4
3. Illustrate Architectural features of programmable DSP devices. L3
4. Analyze the performance of processor based on pipe lining concepts. L4
5. Illustrate the Implementations of Basic DSP Algorithms & Interfacing. L3

COURSE CODE-CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
C407.1	3	2	2	2	2	-	-	-	1	1	-	2
C407.2	3	3	3	3	3	-	-	-	1	1	-	2
C407.3	3	2	2	2	2	-	-	-	1	1	-	2
C407.4	3	3	3	3	3	-	-	-	1	1	-	2
C407.5	3	2	2	2	3	-	-	-	1	1	-	2

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 ADSP 2100, ADSP2181 high performance processor. Introduction to Blackfin Processor- The Blackfin 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. Avtar Singh and S. Srinivasan,"Digital Signal Processing", Thomson Publications, 2004.
2. K.Padmanabhan,R. Vijayarajeswaran, Ananthi. S,"A Practical Approach To Digital Signal Processing", New Age International, 2006/2009.
3. Woon-SengGan, Sen M. Kuo,"Embedded Signal Processing with the Micro Signal Architecture",Wiley-IEEE Press, 2007.

REFERENCE BOOKS:

1. B. Venkataramani and M. Bhaskar,"Digital Signal Processors, Architecture, Programming and Applications", 2002, TMH.
2. Lapsley,"DSP Processor Fundamentals, Architectures & Features", S. Chand & Co.
3. Amy Mar, "Digital Signal Processing Applications Using the ADSP-2100 Family", PHI.
4. Steven W. Smith,"The Scientist and Engineer's Guide to Digital Signal Processing", California Technical Publishing.
5. David J. Katz and Rick Gentile,"Embedded Media Processing of Analog Devices", Newnes.