B.TECH. ELECTRONICS AND COMMUNICATION ENGINEERING
R22 –OPEN ELECTIVES

S.No	Course Code	Course Title	L	T	P	Credits
1	**D45OE1**	Micro Processors And Microcontrollers	3	0	0	3
2	**D45OE2**	Principles of Electronic Communications	3	0	0	3
3	**D46OE1**	Artificial Neural Networks	3	0	0	3
4	**D46OE2**	Tele Communication Switching Systems And Networks	3	0	0	3
5	**D48OE1**	Embedded Systems Design				
6	**D48OE2**	Information Theory and Coding	3	0	0	3
7	**D48OE3**	Data Communications				
8	**D48OE4**	VLSI Design	3	0	0	3

MICROPROCESSORS AND MICROCONTROLLERS

L/T/P/C

Course Code: D45OE1 **3/0/0/3**

Course Objectives: To develop an understanding of the operations of microprocessors and micro controllers; machine language programming and interfacing techniques.

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

1. Apply knowledge of the internal architecture and organization of the 8086 microprocessor, and develop assembly language programs.
2. Analyze internal architecture, memory organization of 8051 controller and can develop programming
3. Construct interfacing techniques to 8086 and 8051 and define various serial communication standards.
4. Understand the internal architecture and organization of ARM processors/controllers, and apply assembly language programs for design.
5. Build the knowledge of the internal architecture and organization of advanced ARM Processors.

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1		2	3	2										3
CO2		2	3	2										3
CO3			3	3										3
CO4		2	3	3									2	3
CO5		2	3										2	2

UNIT – I

8086 Architecture: 8086 Architecture-Functional diagram, Register Organization,8086 Flag register and function of 8086 flags, Memory Segmentation, Programming Model, Memory addresses, Physical Memory Organization, Architecture of 8086, Pin diagram of 8086, Signal descriptions of 8086-common function signals, minimum and maximum mode signals, Timing diagrams , Interrupts of 8086.

Instruction Set and Assembly Language Programming of 8086: Instruction formats, Addressing modes, Instruction Set, Assembler Directives, Macros, and Simple Programs involving Logical, Branch and Call Instructions, Sorting, String Manipulations.

UNIT – II

Introduction to Microcontrollers: Overview of 8051 Microcontroller, Architecture, I/O Ports, Memory Organization, Addressing Modes and Instruction set of 8051.

8051 Real Time Control: Programming Timer Interrupts, Programming External Hardware Interrupts, Programming the Serial Communication Interrupts, Programming 8051 Timers and Counter.

UNIT – III

I/O And Memory Interface: 8255 PPI, Stepper motor interfacing to 8086,LCD, Keyboard, External Memory RAM, ROM Interface, ADC, DAC Interface to 8051.

Serial Communication and Bus Interface: Serial Communication Standards, Serial Data Transfer Scheme, On board Communication Interfaces-I2C Bus, SPI Bus, UART; External Communication Interfaces-RS232,USB.

UNIT – IV

ARM Architecture: ARM Processor fundamentals, ARM Architecture – Register, CPSR, Pipeline, exceptions and interrupts interrupt vector table, ARM instruction set – Data processing, Branch instructions, load store instructions, Software interrupt instructions, Program status register instructions, loading constants, Conditional execution, Introduction to Thumb instructions.

UNIT – V

Advanced ARM Processors: Introduction to CORTEX Processor and its architecture, OMAP Processor and its Architecture.

TEXT BOOKS:

1. A. K. Ray and K.M. Bhurchandani, "Advanced Microprocessors and Peripherals"–, MHE, 2nd Edition 2006.
2. , Kenneth. J. Ayala," The 8051 Microcontroller", Cengage Learning, 3rd Ed.
3. Andrew N SLOSS, Dominic SYMES, Chris WRIGHT,"ARM System Developers guide", Elsevier, 2012

REFERENCE BOOKS:

1. D. V. Hall, "Microprocessors and Interfacing", MGH, 2nd Edition 2006.
2. Shibu K.V, "Introduction to Embedded Systems", , MHE, 2009
3. K.Uma Rao, Andhe Pallavi, "The 8051Microcontrollers, Architecture and Programming and Applications" - Pearson, 2009.

PRINCIPLES OF ELECTRONIC COMMUNICATIONS

L/T/P/C

Course Code: D45OE2 **3/0/0/3**

Course Objectives: The objective of this subject is to:

Introduce the students to modulation and various analog and digital modulation schemes. They can have a broad understanding of satellite, optical, cellular, mobile, wireless and telecom concepts.

Course Outcomes: By completing this subject, the student can

1. Work on various types of modulations.
2. Should be able to use these communication modules in implementation.
3. Will have a basic understanding of various wireless and cellular, mobile and telephone communication systems.

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3													
CO2		3												
CO3	3													

UNIT - I

Introduction: Need for Modulation, Frequency translation, Electromagnetic spectrum, Gain, Attenuation and decibels.

UNIT - II

Simple description on Modulation: Analog Modulation-AM, FM, Pulse Modulation-PAM, PWM, PCM, Digital Modulation Techniques-ASK, FSK, PSK, QPSK modulation and demodulation schemes.

UNIT - III

Telecommunication Systems: Telephones Telephone system, Paging systems, Internet Telephony.

Networking and Local Area Networks: Network fundamentals, LAN hardware, Ethernet LANs, Token Ring LAN.

UNIT - IV

Satellite Communication: Satellite Orbits, satellite communication systems, satellite subsystems, Ground Stations Satellite Applications, Global Positioning systems.

Optical Communication: Optical Principles, Optical Communication Systems, Fiber –Optic Cables, Optical Transmitters & Receivers, Wavelength Division Multiplexing.

UNIT - V

Cellular and Mobile Communications: Cellular telephone systems, AMPS, GSM, CDMA, and WCDMA.

Wireless Technologies: Wireless LAN, PANs and Bluetooth, Zig Bee and Mesh Wireless networks, Wimax and MANs, Infrared wireless, RFID communication, UWB.

Text Books:

1. Louis E. Frenzel, "Principles of Electronic Communication Systems", McGraw Hill Publications, 2008.
2. Kennedy, Davis, "Electronic Communications systems, 4e", MC GRAW HILL EDUCATION, 1999

Reference Books:

1. Theodore Rapp port, "Wireless Communications - Principles and practice", Prentice Hall, 2002.
2. Roger L. Freeman, "Fundamentals of Telecommunications", 2e, Wiley publications.
3. Wayne Tomasi, "Introduction to data communications and networking", Pearson Education, 2005.

B.TECH. ELECTRONICS & COMMUNICATION ENGINEERING
ARTIFICIAL NEURAL NETWORKS

B.Tech. V Semester **L/T/P/C**
Course Code: D46OE1 **3/0/0/3**

Course Objectives:

1. To understand the biological neural network and to model equivalent neuron models.
2. To understand the architecture, learning algorithm and issues of various feed forward and feedback neural networks.

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

1. Understand different neural networks of various architectures both feed forward and feed backward.
2. Apply different learning rules to train the neural networks .
3. Perform the testing of neural networks and do the perform analysis of these networks for various pattern recognition applications.

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3													
CO2			3											
CO3		3												

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 Perceptron: 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 Hopfield Models – Hopfield Models, Computer Experiment

TEXT BOOKS:

1. Simon Haykin, "Neural Networks a Comprehensive Foundations", PHI edition.

REFERENCE BOOKS:

1. B. Yegnanarayana ,"Artificial Neural Networks" –Prentice Hall of India P Ltd 2005
2. Li Min Fu," Neural Networks in Computer Intelligence", TMH 2003
3. James A Freeman David M S Kapura, "Neural Networks" - Pearson Education 2004.
4. Jacek M. Zurada, "Introduction to Artificial Neural Systems", JAICO Publishing House Ed. 2006.

B.TECH. ELECTRONICS & COMMUNICATION ENGINEERING
TELE COMMUNICATION SWITCHING SYSTEMS AND NETWORKS

L/T/P/C
3/0/0/3

Course Code: D46OE2

COURSE OBJECTIVES:

The Course is designed

1. To provide students with a balanced blend of theoretical and practical aspects regarding Telecommunication Switching System.
2. To expose through the evolution of switching systems from manual and Electromechanical systems to stored-program-controlled digital systems
3. To provide knowledge to the students regarding design and performance analysis of various switching systems.
4. To train the students about basic Telephone Networks structures and traffic engineering concepts
5. To inculcate students on various internet concepts like OSI reference model, LAN, WAN, WAN, Repeaters, bridges, routers and gateways
6. To provide a comprehensive coverage of data communication networks and ISDN.

COURSE OUTCOMES:

Having gone through this course, the students would be able to

1. Demonstrate knowledge about Telecommunication Switching Systems.
2. Analyze different switching methodologies.
3. Differentiate between signaling methods used in Telecommunication Networks
4. Exhibit a good knowledge on data communication networks and ISDN and be able to differentiate LAN, MAN, WAN.
5. Demonstrate an ability to work on various Telecommunication Network concepts.

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1			3											
CO2			3											
CO3		3												
CO4	3													
CO5			3											

UNIT -I

Telecommunication Switching Systems: Introduction, Elements of Switching Systems, Switching Network Configuration, Rotary Switches, Uniselector, Two Motion Selector, Trunking Principle, Principles of Cross Bar Switching, Crossbar Switch Configuration, Cross Point Technology, Crossbar Exchange Organization.

UNIT – II

Electronic Space Division Switching: Stored Program Control, Centralized SPC, Distributed SPC, Software Architecture, Application Software, Enhanced services, Two- Stage Networks, ThreeStage Networks, n-Stage Networks. Time Division Switching: Basic Time Division Space Switching, Basic Time Division Time Switching, Time Multiplexed Space Switching, Time Multiplexed Time Switching, Combination Switching, Three Stage Combination Switching, n - Stage Combinational Switching.

UNIT – III

Telecommunications Traffic: Introduction; The Unit of Traffic, Congestion, Traffic Measurement, A Mathematical Model, Lost-Call Systems-Theory, Traffic Performance, Loss Systems in Tandem, Use of Traffic Tables, Queuing Systems-The Second Erlang Distribution, Probability of Delay, Finite Queue Capacity, Some Other Useful Results, Systems with a Single Server, Queues in Tandem, Delay Tables, Applications of Delay Formulae.

UNIT – IV

Telephone Networks: Subscriber loop systems, switching hierarchy and routing, transmission plan, transmission systems, numbering plan, charging plan, Signaling techniques: In channel signaling, common channel signaling, Cellular mobile telephony. Data Networks: Data transmission in PSTNs, Switching techniques for data transmission, data communication architecture, link to link layers, end to end layers, satellite based data networks, LAN, MAN, Internetworking.

UNIT – V

Integrated Services Digital Network (ISDN): Introduction, motivation, new services, Network and protocol architecture, Transmission channels, User-Network interfaces, functional grouping, reference points, signaling, numbering, addressing, BISDN.

DSL Technology: ADSL, Cable Modem, Traditional Cable Networks, HFC Networks, Sharing, CM & CMTS and DOCSIS. SONET: Devices, Frame, Frame Transmission, Synchronous Transport Signals, STS I, Virtual Tributaries, and Higher rate of service.

TEXT BOOKS

1. Tyagarajan Viswanathan," Tele communication switching system and networks" -, PHI, 2000.

2. J. E Flood, "Telecommunications Switching and Traffic Networks," Pearson Education, 2006

3. B.A. Forouzan, "Data Communication & Networking" -, TMH, 4th Edition, 2004.

REFERENCE BOOKS

1. J. Bellamy, John Wiley," Digital telephony" -, 2nd edition, 2001.

2. - Achyut. S. Godbole, "Data Communications & Networks", TMH, 2004.

3. - H. Taub& D. Schilling, "Principles of Communication Systems", TMH, 2ndEdition, 2003.

B.TECH. ELECTRONICS & COMMUNICATION ENGINEERING

EMBEDDED SYSTEMS DESIGN

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

Course Code: D48OE1 **3/ 0 /0/ 3**

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:

1. Understands the basic concepts of Embedded Systems
2. Formulates typical Embedded System
3. Illustrates the trends in Embedded Industry
4. Outlines the concepts of RTOS based Embedded System Design
5. Analyze Task Communication in RTOS

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3													
CO2		3												
CO3			3											
CO4	3													
CO5			3											

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-out 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, Frameworks & Alliances, Bottlenecks, Development Platform Trends, Cloud, Internet Of Things (IoT) & Embedded Systems. Communication Interface: Onboard and External Communication Interfaces.

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: Task 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
INFORMATION THEORY AND CODING

B.Tech. VIII Semester **L/T/P/C**
Course Code: D48OE2 **3/0/0/3**

Course Objectives:
The course objectives are:

1. To provide insight to the concept of information in the context of communication theory and its significance in the design of communication receivers.
2. To explore in detail, the calculation of channel capacity to support error free transmission and also most commonly used source coding & channel coding algorithms.

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

1. Understand the concept of information and entropy
2. Understand Shannon's theorem for coding
3. Calculation of channel capacity
4. Apply coding techniques

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3													
CO2	3													
CO3			3											
CO4	3													

UNIT I:
Information Theory: Basics of information, entropy, conditional entropy, entropy for discrete ensembles, discrete memory less channel, bounds discrete channels, channel capacity, mutual information.

UNIT II:
Source Coding: Source coding theorem-code efficiency, redundancy, variance; Shannon's noisy coding theorem, Shannon's noise less coding theorem, Shannon's Hartley theorem application to continuous channel, Shannon's Fano coding, Huffman coding.

UNIT III:

Techniques of Coding and Decoding: Linear block codes: principle of block coding, matrix description of linear block codes, hamming codes, error detection and correction capabilities of hamming codes.

UNITIV:

Cyclic Codes: Algebric structure, syndrome calculation, error correction using syndrome vector, syndrome decoder for (n,k) block code, error correction capability, advantages and disadvantages of cyclic codes.

UNIT V:

Convolution Codes: Analysis of convolutional encoders, Markov sources-code tree, trellis, state diagram for convolutional encoder, uniquely detectable codes, Viterbi algorithm, advantages and disadvantages of convolutional codes.

Text Books:

1. N. Abramson, "Information and Coding", McGraw Hill, 1963.
2. M. Mansurpur," Introduction to Information Theory", McGraw Hill, 1987.
3. R.B. Ash, "Information Theory", Prentice Hall, 1970.
4. Shu Lin and D.J. Costello Jr., "Error Control Coding", Prentice Hall, 1983.

Reference Books:

1. Herbert Taub, Donald L schilling, GouthamSaha, "Principles of Communication Systems"-, 3rd Edition, McGraw Hill, 2008.
2. Sam Shanmugam, John Wiley, "Digital and analog communication systems"-, 2005.
3. Simon Haykin, John Wiley" Digital communication—, 2005.
4. B.P.Lathi," Communication Systems"- BS Publications 2006

B.TECH. ELECTRONICS & COMMUNICATION ENGINEERING
DATA COMMUNICATIONS

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

Course Code: D48OE3 **3/ 0 /0/ 3**

Course Objectives:

The course objectives are:

1. To provide a solid conceptual understanding of the fundamentals of data communications, protocols and signal transmission.
2. To prepare students with basic knowledge of multiplexing and spreading techniques.
3. To provide students with knowledge in various types of transmission media and switching techniques.
4. To analyze various error detection and correction codes in data communication.
5. To provide better understanding of data communication equipments.

Course Outcomes:

At the end of the course, Students will be able to

1. Understand the standards organization for data communications, basic concepts of network architecture and signals.
2. Understand the concepts of multiplexing and spreading techniques.
3. Analyze various transmission media and switching techniques in data communication.
4. Emphasizes the importance of data communication codes and error control.
5. Understand various data communication equipments.

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3													
CO2	3													
CO3		3												
CO4	3													
CO5	3													

UNIT – I:

Introduction to Data Communication

Standards Organizations for Data Communications, Layered Network Architecture, Open Systems Interconnection, Data Communications Circuits, Serial and parallel Data Transmission, Data communications Circuit Arrangements, Data communications Networks, Alternate Protocol Suites.

Signals, Noise, Modulation, And Demodulation: Signal Analysis, Electrical Noise and Signal-to-Noise Ratio, Analog Modulation Systems, Information Capacity, Bits, Bit Rate, Baud, and M-ary Encoding, Digital Modulation.

UNIT – II:

Multiplexing and Spreading:

Multiplexing: Frequency-Division Multiplexing, Wavelength-Division Multiplexing, Synchronous Time-Division Multiplexing, Statistical Time-Division Multiplexing

Spread spectrum: Frequency Hopping Spread Spectrum (FHSS), Direct Sequence Spread Spectrum (DSSS)

UNIT – III:

Transmission media: Guided Media-Twisted-pair cable, Coaxial cable, Fiber-Optic cable
Unguided Media- Radio Waves, Microwaves, Infrared.

Switching: Circuit-switched networks, Datagram networks. Virtual-circuit networks

UNIT – IV:

Data Communications Codes, Error Control, and Data Formats: Data Communications Character Codes, Bar Codes, Error Control, Error Detection, Error Correction, Character Synchronization

UNIT – V

Data Communications Equipment: Digital Service Unit and Channel Service Unit, Voice Band Data Communication Modems, Bell Systems- Compatible Voice- Band Modems, Voice Band Modern Block Diagram, Voice- Band Modem Classifications, Asynchronous Voice-Band Modems, Synchronous Voice-Band Modems, Modem Synchronization, Cable Modems, Probability of Error and Bit Error Rate.

TEXTBOOKS

1. Behrouz A. Forouzan, “Data Communications and Networking 5E”, 5th Edition, Tata McGraw-Hill, 2013.
2. Wayne Tomasi, “Introduction to Data Communications and Networking”, Pearson Education.

REFERENCE BOOKS

1. William Stallings: “Data and Computer Communication”, 8th Edition, Pearson Education, 2007.
2. Godbole Achyut, ”Data Communication and Networks” McGraw Hill, New Delhi, 2006.
3. Gupta Prakash, “Data Communication and Computer Networks” C. Pearson Education. New Delhi, 2006.
4. Gallow, “Computer Communications and Networking Technologies”, Second Edition, Thomson.
5. Computer Networking and Internet, Fred Halsll, Lingana Gouda Kulkarni, Fifth Edition, Pearson Education

B.TECH. ELECTRONICS & COMMUNICATION ENGINEERING
VLSI DESIGN

L/T/P/C

Course Code: D48OE4 **3/0/0/3**

Prerequisites: Knowledge of Electronic Devices & Circuits, Electronic Circuit analysis and Digital Electronics (Switching theory and logic design)

Course Objectives:

1. Acquire qualitative knowledge about the fabrication process of integrated circuit using MOS transistors. Acquires knowledge about basic electrical properties of MOS.
2. Preparing the layout of any logic circuit which helps to understand and estimate parasitic of any logic circuit.
3. Designing of different types of logic gates using CMOS logic and analyze their transfer characteristics.
4. Provide design concepts required to design data path building blocks and memories.
5. Design logic circuits using PLA, PAL, FPGA and CPLD. Understand different types of faults that can occur in a system and learn the concept of testing and adding extra hardware to improve testability of system.

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

CO1: Acquire qualitative knowledge about the fabrication of MOS transistors

CO2: Design layout of any logic circuit with proper design rules.

CO3: Implement transistor level circuits for equivalent logic circuits.

CO4: Design sub systems like data, control and memory modules.

CO5: Implement any logic circuit using various Programmable Logic Devices.

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3													
CO2				3										
CO3			3											
CO4				3										
CO5			3											

UNIT I

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

BASIC ELECTRICAL PROPERTIES : Basic Electrical Properties of MOS and BiCMOS Circuits: Ids-Vds relationships, MOS transistor threshold Voltage, gm, gds, figure of merit; Pass 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 Capacitances, Fan-in and 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. Kamran Eshraghian, Eshraghian Dougles and A. Pucknell , “Essentials of VLSI circuits and systems” –, PHI, 2005 Edition.
2. Neil H.E. Weste, David Harris, Ayan Banerjee,”CMOS VLSI Design” –a circuits and systems perspective, Peason, 2009.
3. M.MICHAEL VAL, “VLSI DESIGN”-, 2001, CRC PRESS

REFERENCE BOOKS:

1. Ming-BO Lin,”Introduction to VLSI Systems: A Logic, Circuit and systems Perspective”-, CRC Press, 2011.
2. John.P.Uyemura, “CMOS logic circuit Design” –, Springer, 2007.
3. Wayne Wolf, “Modern VLSI Design”–Pearson Education, 3rd Edition, 1997.