B.TECH. - ELECTRONICS & COMMUNICATION ENGINEERING

Course Structure R-22

SEMESTER V

S. No.	Course Classification	Course Code	Name of the Subject	L	T	P	C	I	E	Total
1	**PC**	D45PC15	Control Systems	3	1	0	4	40	60	100
2	**PC**	D45PC16	Microprocessors and Microcontrollers	3	0	0	3	40	60	100
3	**HS**	D5HSBF	Business Economics and Financial Analysis	3	0	0	3	40	60	100
4	**PE**	D45PE1	**Professional Elective-I** 1.C++ and Data Structures 2. Data Communications and Computer Networks 3. Introduction to Embedded Systems 4. Artificial Intelligence	3	0	0	3	40	60	100
5	**OE**	D45OE1	Open Elective-I	3	0	0	3	40	60	100
6	**PC**	D45PC17	Microprocessor Lab	0	0	2	1	40	60	100
7	**PC**	D45PC18	Advanced Communications Lab	0	0	2	1	40	60	100
8	**HS**	D5HSE3	Advanced English Communication Skills Lab	0	0	4	2	40	60	100
9	**MC***	MC005	Entrepreneurship*	3	0	0	0	0	0	0
TOTAL				18	1	8	20	320	480	800

B.TECH. - ELECTRONICS & COMMUNICATION ENGINEERING

Course Structure R-22

SEMESTER VI

S. No.	Course Classification	Course Code	Name of the Subject	L	T	P	C	I	E	Total
1	**PC**	D46PC19	Antennas and Wave Propagation	3	0	0	3	40	60	100
2	**PC**	D46PC20	Digital Signal Processing	3	1	0	4	40	60	100
3	**PC**	D46PC21	VLSI Design	3	0	0	3	40	60	100
4	**PE**	D46PE2	**Professional Elective-II** 1. Digital Design through Verilog HDL 2.Cellular and Mobile Communications 3. Advanced Microcontrollers 4. Digital Image Processing	3	0	0	3	40	60	100
5	**OE**	D46OE2	Open Elective-II	3	0	0	3	40	60	100
6	**PC**	D46PC22	Digital Signal Processing Lab	0	0	2	1	40	60	100
7	**PC**	D46PC23	VLSI Design Lab	0	0	2	1	40	60	100
8	**PC**	D46PC24	Internet of Things Lab	0	0	2	1	40	60	100
9	**PC**	D46PC25	Mini Projects	0	0	2	1	40	60	100
10	**MC***	MC006	Cyber Security*	3	0	0	0	0	0	0
TOTAL				18	1	8	20	360	540	900

B.TECH. ELECTRONICS & COMMUNICATION ENGINEERING

CONTROL STSTEMS (D45PC15)

B.Tech V Semester **L/T/P/C**
3/1/0/4

Pre requisites: Ordinary Differential Equations & Laplace Transform, Mathematics I

COURSE OBJECTIVES:

1. To understand the different ways of system representations such as Transfer Function representation to assess the system dynamic response.
2. To assess the system performance using Time domain analysis and Methods for improving it.
3. To assess the system performance using Frequency domain analysis and techniques for improving the performance.
4. To design various Controllers and Compensators to improve system performance.
5. To understand the different ways of System behavior using State space representation for continuous systems

COURSE OUTCOMES: After completion of this course the student is able to

1. Classify the different open-loop and closed-loop control systems and develop mathematical models for linear time-invariant systems.
2. Determine time domain specifications of a second order system and analyse its response.
3. Apply frequency domain techniques to assess and analyse system performance.
4. Analyse the stability of linear systems using Nyquist stability criteria and design compensators to improve system performance.
5. Analyse MIMO system using state variable approach.

	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	2											2	
CO2	3	2											2	
CO3	3	3											3	
CO4	3	3	2										3	
CO5	3	2	2										2	

UNIT-I:

Introduction: Introduction to control systems- Differences between open loop and closed loop control systems- examples- Feedback Characteristics- Effects of feedback- Differential equations representation of physical systems-Impulse Response and transfer functions- Mathematical models of Electrical and Mechanical Systems- Analogous system.

Transfer Function Representation: Block diagram algebra- Representation by Signal flow graph – Reduction using mason's gain formula.

UNIT-II:

Time Response Analysis: Standard test signals- Time response of first and second order systems for standard test inputs- Design specifications for second order systems based on time response- Steady state response-Steady state errors and error constants

UNIT-III:

Stability Analysis: The concept of stability- Effects of Location of poles on stability- Relative Stability- Routh-Hurwitz criterion- Limitations of Routh's stability.

Root Locus Technique: The root locus concept-construction of root loci-Root contours- Effect of Adding poles and zeros.

Frequency Response Analysis: Introduction- Correlation between time and frequency response- Frequency domain specifications-Bode plots- Stability Analysis from Bode Plots.

UNIT-IV:

Stability Analysis In Frequency Domain: Polar Plots- Nyquist Plots and applications of Nyquist criterion to find the stability

Classical Control Design Techniques: Compensation techniques- Lag- Lead- Lead-Lag controllers design in frequency Domain, Introduction to PI, PD and PID controllers.

UNIT-V:

State Space Analysis of Continuous Systems: Concepts of state-state variables and state model-derivation of state models from block diagrams, Signal

Flow graphs and Electrical networks, Solution of the Time Invariant State Equation- State Transition Matrix and its Properties-Concepts of Controllability and Observability.

TEXT BOOKS:

1. I. J. Nagrath and M. Gopal, "Control Systems Engineering", New Age International (P) Limited, Publishers, 5th edition, 2009
2. B. C. Kuo, "Automatic Control Systems", John wiley and sons, 8th edition, 2003.

REFERENCE BOOKS:

1. Syed HasanSaeed,"Automatic Control Systems", S.K.KATARIA & SONS, New Delhi, 5th Revised Edition, 2007.
2. N. K. Sinha, "Control Systems", New Age International (P) Limited Publishers, 3rd Edition, 1998.
3. Katsuhiko Ogata, "Modern Control Engineering", Prentice Hall of India Pvt. Ltd., 3rd Edition, 1998.
4. S Palani, "Control Systems Engineering", McGraw Hill Education private limited, 2 nd Edition, 2010

B.TECH. ELECTRONICS & COMMUNICATION ENGINEERING
MICROPROCESSORSAND MICROCONTROLLERS (D45PC16)

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

Pre-Requisite: Digital logic Design

Course Objectives:

1. To familiarize the architecture of microprocessors and microcontrollers
2. To provide the knowledge about interfacing techniques of bus & memory.
3. To understand the concepts of ARM architecture
4. To study the basic concepts of Advanced ARM processors

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. Analyse 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

8086Architecture: 8086 Architecture-Functional diagram, Register Organization, 8086 Flag register, Memory Segmentation, Physical Memory organization, Pin diagram of 8086,Signal description of 8086-Common function signals, Minimum and Maximum mode signals, addressing modes, Instruction set, Assembler directives, Programming.

UNIT–II

Introduction to Microcontrollers: Overview of 8051 microcontroller, Architecture, I/O ports,Memory Organization, Addressing modes, 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 schemes, On board Communication Interfaces-I2CBus, SPI Bus,UART; External Communication Interfaces-RS-232,USB.

UNIT–IV

ARM Architecture: ARM Processor Fundamentals, Processor modes, ARM Architecture-Register, CPSR, Pipeline, exception 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, Simple programs, Introduction to Thumb Instructions.

UNIT-V

Advanced ARM Processors: Introduction to CORTEX Processor, features, applications and its architecture, Registers, Pipeline, interrupts, OMAP Processor and its Architecture.

TEXTBOOKS:

1. A.K.Ray and K Bhurchandani "Advanced Microprocessors and peripherals", , MHE.2ND Edition 2006.
2. Kenneth. J. Ayala "The 8051 Microcontroller", Cengage Learning., 3rdEd.
3. Andrew NSLOSS, "Dominic SYMES, Chris WRIGHT" ARM system Developers guide, Elsevier,2012.

REFERENCEBOOKS

1. D.V.Hall," Microprocessor and Interfacing", MGH, 2nd Edition2006.
2. Shibu K.V "Introduction to Embedded Systems", MHE, 2009.
3. K.Uma Rao, Anhe Pallavi, "The 8051 Microcontrollers Architecture and Programming and Applications"–, Pearson, 2009.
4. Donald Reay. "Digital Signal Processing and Applications with the OMAP-L138 Experimenter",WILEY2012

B.TECH. ELECTRONICS & COMMUNICATION ENGINEERING
BUSINESS ECONOMICS AND FINANCIAL ANALYSIS (D5HSBF)

B.Tech. V Semester

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

1. To learn the basic business type of the organization.
2. To acquire the knowledge and impact of the economy on business firms.
3. To analyze the business from the financial perspective.
4. To know the financial position of the company.
5. To predict the future of business

COURSE OUTCOMES

1. Analyze the total structure of the business &and able to identify and classify the different types of business entities.
2. Asses the demand &and supply analyses with the help of various measures and types of Elasticity of demand.
3. Develop the knowledge about production and cost analysis for product and services.
4. Interpret the fundamental concepts related to financial accounting.
5. Predict the financial position by analysing the financial statement of the company through various ratios.

	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					2	2		
CO2					2						2	2		
CO3											2	2		
CO4											3	2		
CO5											2			

UNIT – I

Introduction to Business and Economics:

Business: Define Business, characteristics of business, Types of Business Entities, Limited Liability Companies, Sources of Capital for a Company..

Economics: Significance of Economics, Micro and Macro Economic Concepts, and Importance of National Income, Business Cycle, Features and Phases of Business Cycle. Nature and Scope of Business Economics, Role of Business Economist,

UNIT – II

Demand Analysis:

Elasticity of Demand: Elasticity, Types of Elasticity, Law of Demand, Measurement and Significance of Elasticity of Demand, Factors affecting Elasticity of Demand, Elasticity of Demand in decision making, Demand Forecasting: Steps in Demand Forecasting, Methods of Demand Forecasting.

UNIT- III

Production, Cost, Market Structures & Pricing:

Production Analysis: production function, Law of returns to scale, Internal and External Economies of Scale.

Cost analysis: Cost concepts, Types of Costs. Break-even Analysis (BEA)

Pricing: Types of Pricing, product life cycle, **GST** (**Goods & service Tax**)

Market Structures- Types of competition, Features of Perfect competition, Monopoly and Monopolistic Competition, oligopoly.

UNIT - IV

Financial Accounting: Accounting concepts and Conventions, Accounting Equation, Double-Entry system of Accounting, Rules for maintaining Books of Accounts, Journal, Posting to Ledger, Preparation of Trial Balance, Elements of Financial Statements, and Preparation of Final Accounts.

UNIT - V

Financial Analysis through Ratios: Concept of Ratio Analysis, Liquidity Ratios, Turnover Ratios, Profitability Ratios, Proprietary Ratios, Solvency, Leverage Ratios (simple problems).

TEXT BOOKS:

1. D. D. Chaturvedi, S. L. Gupta, "Business Economics - Theory and Applications", International Book House Pvt. Ltd. 2013.
2. Dhanesh K Khatri, "Financial Accounting, Tata McGraw Hill", 2011.
3. Geethika Ghosh, Piyali Gosh, Purba Roy Choudhury, "Managerial Economics", 2e, Tata McGraw Hill Education Pvt. Ltd. 2012.
4. Rakesh garg, sandeep garg , "Hand book of GST " in India
5. A.R. Aryasri (2011), "Managerial Economics and Financial Analysis", TMH, India.

REFERENCES:

1. Paresh Shah, "Financial Accounting for Management 2e", Oxford Press, 2015.
2. S. N. Maheshwari, Sunil K Maheshwari, Sharad K Maheshwari, "Financial Accounting, 5e", Vikas Publications, 2013.

B.TECH. ELECTRONICS & COMMUNICATION ENGINEERING
C++ AND DATA STRUCTURES (D45PE1)

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

Course Objectives:

1. To understand the basic concepts such as Abstract Data Types, Linear and Non-Linear Data structures.
2. To understand the notations used to analyze the Performance of algorithms.
3. To understand the behavior of data structures such as stacks, queues, trees, hash tables, search trees, Graphs and their representations.
4. To choose an appropriate data structure for a specified application.
5. To understand and analyze various searching and sorting algorithms.
6. To learn to implement ADTs such as lists, stacks, queues, trees, graphs, search trees in C++ to solve problems.

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

1. Ability to Use appropriate data structures to represent data items in real world problem
2. Ability to analyse the time and space complexities of algorithms
3.Ability to design programs using a variety of data structures such as stacks, queues, hash tables, binary trees, search trees, heaps, graphs, and B-trees.
4. Able to analyse and implement various kinds of searching and sorting 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	2											3	2
CO2		3											2	2
CO3		3	3										3	3
CO4	3	3	2										3	2

UNIT – I

C++ Programming Concepts: Review of C, input and output in C++, functions in C++- value parameters, reference parameters, Parameter passing, function overloading, function templates, Exceptions-throwing an exception and handling an exception, arrays, pointers, new and delete operators, class and object, access specifiers, friend functions, constructors and destructor, Operator overloading, class templates, Inheritance and Polymorphism.

Basic Concepts - Data objects and Structures, Algorithm Specification-Introduction, Recursive algorithms, Data Abstraction, Performance analysis- time complexity and space complexity, Asymptotic Notation-Big O, Omega and Theta notations, Complexity Analysis Examples, Introduction to Linear and Non-Linear data structures.

UNIT - II

Representation of single, two-dimensional arrays, sparse matrices-array and linked representations. Linear list ADT-array representation and linked representation, Singly Linked Lists- Operations-Insertion, Deletion, circularly linked lists-Operations for Circularly linked lists, Doubly Linked Lists-Operations- Insertion, Deletion. Stack ADT, definition, array and linked implementations, applications-infix to postfix conversion, Postfix expression evaluation, recursion implementation, Queue ADT, definition, array and linked Implementations, Circular Queues-Insertion and deletion operations.

UNIT - III

Trees – definition, terminology, Binary trees-definition, Properties of Binary Trees, Binary Tree ADT, representation of Binary Trees-array and linked representations, Binary Tree traversals, Threaded binary trees, Priority Queues –Definition and applications, Max Priority Queue ADT-implementation-Max Heap-Definition, Insertion into a Max Heap, Deletion from a Max Heap.

UNIT – IV

Searching - Linear Search, Binary Search, Hashing-Introduction, hash tables, hash functions, Overflow Handling, Comparison of Searching methods. Sorting-Insertion Sort, Selection Sort, Radix Sort, Quick sort, Heap Sort, Merge sort, Comparison of Sorting methods.

UNIT - V

Graphs–Definitions, Terminology, Applications and more definitions, Properties, Graph ADT, Graph Representations- Adjacency matrix, Adjacency lists, Graph Search methods - DFS and BFS, Complexity analysis, Search Trees-Binary Search Tree ADT, Definition, Operations- Searching, Insertion and Deletion, Balanced search trees-AVL Trees-Definition and Examples only, B-Trees-Definition and Examples only, Red-Black Trees-Definitions and Examples only, Comparison of Search Trees.

TEXT BOOKS:

1. Sartaj Sahni, “Data structures, Algorithms and Applications in C++”, 2nd Edition, Universities Press.
2. Adam Drozdek, “Data structures and Algorithms in C++”, 4th edition, Cengage learning.

REFERENCE BOOKS:

1. J. Hubbard, Schaum’s, “Data structures with C++, outlines”, TMH.
2. M.T. Goodrich, R. Tamassia and D. Mount, “Data structures and Algorithms in C++”, Wiley India.
3. M. A. Weiss, “Data structures and Algorithm Analysis in C++”, 3rd edition, Pearson.
4. D. Samanta, “Classic Data Structures”, 2nd edition, PHI.

B.TECH. ELECTRONICS & COMMUNICATION ENGINEERING

DATA COMMUNICATIONS AND COMPUTER NETWORKS (D45PE1)

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

3/0/0/3

Pre-requisite: Digital Communications

Course Objectives:

1. To introduce the Fundamentals of data communication networks
2. To demonstrate the Functions of various protocols of Data link layer.
3. To demonstrate Functioning of various Routing protocols.
4. To introduce the Functions of various Transport layer protocols.
5. To understand the significance of application layer protocols

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

1. Categorize the various types and functions of data communication networks based on their characteristics.
2. Design and analyze various error detection techniques.
3. Demonstrate the mechanism of routing the data in network layer
4. Know the significance of various flow control and congestion control mechanisms and analyze their impact on network efficiency.
5. Use various application layer protocols, and investigate their functioning, while also getting familiar with security standards in data communication networks.

	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												
CO2		3												2
CO3	2													
CO4		3												2
CO5		3												2

UNIT - I:

Introduction to Data Communications: Components, Data Representation, Data Flow, Networks Distributed Processing, Network Criteria, Physical Structures, Network Models, Categories of Networks Interconnection of Networks, The Internet - A Brief History, The Internet Today, Protocol and Standards- Protocols, Standards, Standards Organizations, Internet Standards. Network Models, Layered Tasks, OSI model, Layers in OSI model, TCP/IP Protocol Suite, Addressing Introduction, Wireless Links and Network Characteristics, WiFi: 802.11 Wireless LANs -The 802.11 Architecture.

UNIT - II:

Data Link Layer: Links, Access Networks, and LANs- Introduction to the Link Layer, The Services Provided by the Link Layer, Types of errors, Redundancy, Detection vs Correction, Forward error correction Versus Re-transmission Error-Detection and Correction Techniques, Parity Checks, Check summing Methods, Cyclic Redundancy Check (CRC) , Framing, Flow Control and Error Control protocols , Noisy less Channels and Noisy Channels, HDLC, Multiple Access Protocols, Random Access ,ALOHA, Controlled access, Channelization Protocols. 802.11 MAC Protocol, IEEE 802.11Frame.

UNIT - III:

The Network Layer: Introduction, Forwarding and Routing, Network Service Models, Virtual Circuit and Datagram Networks-Virtual-Circuit Networks, Datagram Networks, Origins of VC and Datagram Networks, Inside a Router-Input Processing, Switching, Output Processing, Queuing, The Routing Control Plane, The Internet Protocol (IP): Forwarding and Addressing in the Internet- Datagram format,Ipv4 Addressing, Internet Control Message Protocol(ICMP), IPv6.

UNIT - IV:

Transport Layer: Introduction and Transport Layer Services : Relationship Between Transport and Network Layers, Overview of the Transport Layer in the Internet, Multiplexing and De multiplexing, Connectionless Transport: UDP -UDP Segment Structure, UDP Checksum, Principles of Reliable Data Transfer-Building a Reliable Data Transfer Protocol, Pipelined Reliable Data Transfer Protocols, Go Back-N(GBN), Selective Repeat(SR), Connection Oriented Transport: TCP - The TCP Connection, TCP Segment Structure, Round-Trip Time Estimation and Timeout, Reliable Data Transfer, Flow Control, TCP Connection Management, Principles of Congestion Control - The Cause and the Costs of Congestion, Approaches to Congestion Control

UNIT - V:

Application Layer:

Principles of Networking Applications – Network Application Architectures, Processes Communicating, Transport Services Available to Applications, Transport Services Provided by the File Transfer: FTP,-FTP Commands and Replies, Electronic Mail in the Internet- STMP, Comparison with HTTP, DNS-The Internet's Directory Service – Service Provided by DNS, Overview of How DNS Works, DNS Records and messages.

Security:

Symmetric-Key Cryptography-Traditional Ciphers, Modern Ciphers, Data Encryption Standard, Advanced Encryption Standard (AES),Asymmetric-Key Cryptography-RSA and Diffie-Hellman algorithms.

TEXTBOOKS:

1. Kurose James F, Keith, “Computer Networking A Top-Down Approach –W”, 6th Edition, Pearson.
2. Behrouz A. Forouzan, “Data Communications and Networking”, McGraw-Hill Education, 4th Edition

REFERENCES:

1. Bhusan Trivedi, “Data communication and Networks” -, Oxford university press, 2016
2. Andrew S Tanenbaum, “Computer Networks“, Pearson Education, 4th Edition
3. W. A. Shay, Cengage,”Understanding Communications and Networks”, 3rd Edition

B.TECH. ELECTRONICS & COMMUNICATION ENGINEERING
INTRODUCTION TO EMBEDDED SYSTEMS (D45PE1)

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

COURSE OBJECTIVES:

The objective of this course is to enable the students to understand embedded system basics andapply that knowledge to design and develop embedded solutions.

COURSE OUTCOMES: On completion of the course, student will able to

1. Illustrate the constraints and challenges of an Embedded System design.
2. Demonstrate the custom single purpose processors.
3. Demonstrate the general-purpose processors.
4. Analyze various state machine models.
5. Analyze simple examples of embedded system.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2		2											
CO2			3	2									2	
CO3	2		2											
CO4			3	2									2	
CO5			2	2										

UNIT- I:

INTRODUCTION: Embedded Systems Overview, Design Challenges, Processor Technology, IC Technology, Design Technology, and Trade-offs.

UNIT-II:

CUSTOM SINGLE PURPOSE PROCESSORS: Combinational logic, Sequential logic, custom single purpose processor design, RT-level custom single purpose processor design, optimizing custom single purpose processors.

UNIT- III:

GENERAL PURPOSE PROCESSORS: Basic architecture, Operation, Programmer's view, Development environment, Application Specific Instruction-Set Processors (ASIPs), selecting a microprocessor, General purpose processor design.

UNIT-IV:

STATE MACHINE AND CONCURRENT MODELS: Introduction, Models vs. Languages, Text Vs. Graphics, An introductory example, Finite State Machines with data path model (FSMD), Using State Machines, HCFSM and State chart language, Program State Machine Model (PSM), The role of appropriate model and language, Concurrent process model.

UNIT V:

EXAMPLES OF EMBEDDED SYSTEMS: Mobile Phone, Automotive Electronics, Radio Frequency Identification, Wireless Sensor Networks, Robotics, Biomedical Application, Brain Machine Interface.

TEXT BOOKS:

1. Frank Vahid, Tony Givargis, "Embedded System Design" - A Unified Hardware/Software Introduction", Wiley India Edition, 3rd Edition, 2008.
2. Lyla B. Das, "Embedded Systems", Pearson Education, 2013.

REFERENCE BOOKS:

1. Shibu K.V, "Introduction to Embedded Systems", McGraw Hill.
2. Raj Kamal, "Embedded Systems - Architecture, Programming and Design", 2nd Edition, McGraw Hill, 2008.
3. Wayne Wolf, "Computers and Components: Principles of Embedded Computing System Design", Elsevier

B.TECH. ELECTRONICS & COMMUNICATION ENGINEERING

ARTIFICIAL INTELLIGENCE (D45PE1)

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

Course Objectives:
The objectives of the course are to:

1. To impart knowledge about Artificial Intelligence.
2. To give understanding of the main abstractions and reasoning for intelligent systems.
3. To enable the students to understand the basic principles of Artificial Intelligence in various applications.

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

1. Relate the basics of the theory and about intelligent agents.
2. Capable of using heuristic searches, apply problem solving methods
3. Apply AI techniques to real-world problems to develop knowledge representation of intelligent systems.
4. Relate appropriately from a range of techniques and acquire knowledge when implementing intelligent systems.
5. Analyze structure of expert systems

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	1	1	1	-	-	-	-	1	-	
CO2	3	3	2	2	1	1	1	-	-	-	-	1	-	
CO3	3	3	2	2	3	1	1	-	-	-	-	1	2	
CO4	3	3	3	2	3	1	1	-	-	-	-	1	2	
CO5	3	3	3	2	3	1	1					1	2	

UNIT- I: Introduction

Introduction–Definition – foundation of AI and history of AI intelligent agents: Agents and Environments, the concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation

UNIT- II: Problem Solving Methods

Problem solving Methods – Search Strategies- Searching for solutions, uniformed search strategies – Breadth first search, depth first Search. Search with partial information (Heuristic search) Hill climbing, A* ,AO* Algorithms, Problem reduction, Game Playing-Adversial search, Games, mini-max algorithm, optimal decisions in multiplayer games, Problem in Game playing, Alpha-Beta pruning, Evaluation functions.

UNIT- III: Knowledge Representation

First Order Predicate Logic – Prolog Programming – Unification – Forward Chaining-Backward Chaining – Resolution – Knowledge Representation – Ontological Engineering-Categories and Objects – Events – Mental Events and Mental Objects – Reasoning Systems for Categories – Reasoning with Default Information

UNIT- IV: Knowledge Acquisition

Introduction to Learning, Rule Induction, Learning from observation Inductive learning, Decision trees, Explanation based learning, Statistical Learning methods, Reinforcement Learning. Learning Using neural Networks, Probabilistic Learning Natural Language Processing.

UNIT- V: Expert systems

Introduction, basic concepts, structure of expert systems, the human element in expert systems how expert systems works, problem areas addressed by expert systems, expert systems success factors, types of expert systems, expert systems and the internet interacts web, model based reasoning, case based reasoning, explanation & meta knowledge inference with uncertainty representing uncertainty. Concepts, structure of expert systems, the human element in expert systems how expert systems works, problem areas addressed by expert systems, expert systems success factors, types of expert systems, expert systems and the internet interacts web, model based reasoning, case based reasoning, explanation & meta knowledge inference with uncertainty representing uncertainty.

TEXT BOOKS:

1. S. Russel and P. Norvig, “Artificial Intelligence – A Modern Approach”, Second Edition, Pearson Education
2. David Poole, Alan Mackworth, Randy Goebel,” Computational Intelligence: a logical approach”,Oxford University Press.

REFERENCE BOOKS:

1. G. Luger, “Artificial Intelligence: Structures and Strategies for complex problem solving”, Fourth Edition, Pearson Education.
2. J. Nilsson, “Artificial Intelligence: A new Synthesis”, Elsevier Publishers.

B.TECH. ELECTRONICS & COMMUNICATION ENGINEERING
MICROPROCESSORS AND MICROCONTROLLERS LAB (D45PC17)

B.Tech. V Semester **L/T/P/C**
0/0/2/1

Pre-Requisite: Digital logic Design Lab

Course Objectives:

1. To develop an understanding of the operations of microprocessors and microcontrollers using machine language programming and interfacing techniques.

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

1. Apply the fundamentals of assembly level programming for microprocessors/ microcontrollers
2. Analyse the instruction set of 8086 and use it to develop programs.
3. Analyse the instruction set of 8051 and use it to develop programs.
4. Analyse different I/O devices which can be interfaced to microprocessor and microcontroller.
5. Analyse the instruction set of ARM and use it to develop programs.

	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			3	3					3
CO2					3			3	3					3
CO3					3			3	3					3
CO4					3			3	3				2	3
CO5					2			2	2				2	3

Note:-Minimum of 12 experiments to be conducted.

1. Programs for 16 bit arithmetic operations 8086 (using various addressing modes)
2. Programs for sorting an array for 8086.
3. Programs for searching for a number of characters in a string for 8086.
4. Programs for string manipulation for 8086.
5. Parallel communication between two microprocessor kits using 8255.
6. Serial communication between two microprocessor kits using 8251.
7. Interfacing to 8086 and programming to control stepper motor.
8. Programming using arithmetic, logical and bit manipulation instructions of 8051.
9. Program and verify Timer/Counter in 8051.
10. Program and verify interrupt handling in 8051.
11. UART operation in 8051.
12. Communication between 8051 kit and PC.
13. Interfacing LCD to 8051
14. Programs for arithmetic operations using ARM7.
15. Program for Digital output (blink LEDs) using ARM7.
16. Program to display message on LCD using ARM7.
17. Interfacing seven segment display to ARM7.

B.TECH. ELECTRONICS & COMMUNICATION ENGINEERING

ADVANCED COMMUNICATION LAB (D45PC18)

B.Tech. V Semester **L/T/P/C**
0/0/2/ 1

Pre-Requisite: AC, DC, AWP

COURSE OBJECTIVES:

1. Gain an in-depth understanding of advanced concepts in communication systems, including modulation techniques.
2. Explore and implement advanced modulation schemes like QAM and OFDM.
3. Explore the key components of fibre optic communication systems, including optical fibres and lasers.

COURSE OUTCOMES:

On completion of this lab course the students will be able to:

1. Analyze sampling theorem, TDM, Frequency synthesizer and Pre emphasis & de-emphasis circuits.
2. Demonstrate proficiency in implementing and analyzing advanced modulation techniques, such as QAM, OFDM and ADM.
3. Apply the principles of analog and digital signal transmission in fiber optic 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			3	3					3
CO2					3			3	3					3
CO3					3			3	3					3

LIST OF EXPERIMENTS

1. Sampling theorem
2. Pre-emphasis and De- emphasis
3. Time Division Multiplexing
4. Orthogonal Frequency Division Multiplexing
5. Quadrature Amplitude Modulation
6. Adaptive Delta Modulation
7. Frequency Synthesizer
8. Fiber Optic Link Digital
9. Fiber Optic Link Analog
10. Laser Diode

B.TECH. ELECTRONICS & COMMUNICATION ENGINEERING
ADVANCED ENGLISH COMMUNICATION SKILLS LAB (D5HSE3)

B.Tech. V Semester. **L T P C**
0/0/4/2

1. Introduction

The introduction of the Advanced English Communication Skills Lab is considered essential at the B.Tech 3rd year level. At this stage, the students need to prepare themselves for their career which may require them to listen to, read, speak and write in English both for their professional and interpersonal communication in the globalised context.

The proposed course should be a laboratory course to enable students to use appropriate English and perform the following:

1. Gathering ideas and information to organise ideas relevantly and coherently.
2. Making oral presentations.
3. Writing formal letters.
4. Transferring information from non-verbal to verbal texts and vice-versa.
5. Writing project/research reports/technical reports.
6. Participating in group discussions.
7. Engaging in debates.
8. Facing interviews.
9. Taking part in social and professional communication.

2. Objectives:

This Lab focuses on using multi-media instruction for language development to meet the following targets:

a. To improve the students' fluency in English, with a focus on vocabulary
b. To enable them to listen to English spoken at normal conversational speed by educated Englishspeakers
c. To respond appropriately in different socio-cultural and professional contexts
d. To communicate their ideas relevantly and coherently in writing
e. To prepare the students for placements.

Course outcomes:

1. Experiment with use of words by studying prefixes, suffixes, collections and contextual usage.
2. Distinguish between free writing and structured writing and improving writing skills.
3. Choosing how to start a conversation and using the right body language.
4. Assessing oneself and understanding the dynamics of group discussions, organizing ideas etc.
5. Prioritizing the requirements needed to participate in interviews
   learning the strategies like opening and answering strategies to make oneself effective in an interview.

	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			3									
CO2	3		3											
CO3	2		3						3					
CO4	3		2					2						
CO5					2			3	2					

3. Syllabus:

The following course content to conduct the activities is prescribed for the Advanced English Communication Skills (AECS) Lab:

1. **Activities on Listening and Reading Comprehension:** Active Listening – Development of Listening Skills Through Audio clips - Benefits of Reading – Methods and Techniques of Reading – Basic Steps to Effective Reading – Common Obstacles – Discourse Markers or Linkers - Sub-skills of reading - Reading for facts, negative facts and Specific Details- Guessing Meanings from Context, Inferring Meaning - Critical Reading — Reading Comprehension – Exercises for Practice.
2. **Activities on Writing Skills**: Vocabulary for Competitive Examinations - Planning for Writing – Improving Writing Skills - Structure and presentation of different types of writing – Free Writing and Structured Writing - Letter Writing –Writing a Letter of Application –Resume vs. Curriculum Vitae – Writing a Résumé – Styles of Résumé - e-Correspondence – Emails – Blog Writing - (N)etiquette – Report Writing – Importance of Reports – Types and Formats of Reports– Technical Report Writing– Exercises for Practice.
3. **Activities on Presentation Skills -** Starting a conversation – responding appropriately and relevantly

   – using the right language and body language – Role Play in different situations including Seeking Clarification, Making a Request, Asking for and Refusing Permission, Participating in a Small Talk – Oral presentations (individual and group) through JAM sessions- PPTs – Importance of Presentation Skills – Planning, Preparing, Rehearsing and Making a Presentation – Dealing with Glossophobia or Stage Fear – Understanding Nuances of Delivery - Presentations through Posters/Projects/Reports – Checklist for Making a Presentation and Rubrics of Evaluation
4. **Activities on Group Discussion (GD):** Types of GD and GD as a part of a Selection Procedure - Dynamics of Group Discussion- Myths of GD - Intervention, Summarizing - Modulation of Voice, Body Language, Relevance, Fluency and Organization of Ideas – Do's and Don'ts - GD Strategies – Exercises for Practice.

5. **Interview Skills**: Concept and Process - Interview Preparation Techniques - Types of Interview Questions – Pre-interview Planning, Opening Strategies, and Answering Strategies - Interview Through Tele-conference & Video-conference - Mock Interviews.

4. Minimum Requirement:

The Advanced English Communication Skills (AECS) Laboratory shall have the following infra-structuralfacilities to accommodate at least 35 students in the lab:

- Spacious room with appropriate acoustics
- Round Tables with movable chairs
- Audio-visual aids
- LCD Projector
- Public Address system
- One PC with latest configuration for the teacher
- T. V, a digital stereo & Camcorder
- Headphones of High quality

5. Suggested Software:

The software consisting of the prescribed topics elaborated above should be procured and used.

1. TOEFL & GRE(KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)
2. Oxford Advanced Learner's Dictionary, 10th Edition
3. Cambridge Advanced Learner's Dictionary
4. DELTA's key to the Next Generation TOEFL Test: Advanced Skill Practice.
5. Lingua TOEFL CBT Insider, by Dreamtech

6. Books Recommended:

1. Rizvi, M. Ashraf (2018). *Effective Technical Communication*. (2nd ed.). McGraw Hill Education (India)Pvt. Ltd.
2. Suresh Kumar, E. (2015). *Engineering English.* Orient BlackSwan Pvt. Ltd.
3. Bailey, Stephen. (2018). Academic *Writing: A Handbook for International Students.* (5th Edition).Routledge.
4. Koneru, Aruna. (2016). *Professional Communication*. McGraw Hill Education (India) Pvt. Ltd.
5. Raman, Meenakshi & Sharma, Sangeeta. (2022). *Technical Communication, Principles and Practice.* (4TH Edition) Oxford University Press.
6. Anderson,Paul V. (2007). *Technical Communication***.** Cengage Learning Pvt. Ltd. New Delhi.
7. McCarthy, Michael; O'Dell, Felicity & Redman, Stuart. (2017). *English Vocabulary in Use* Series.Cambridge University Press
8. Sen, Leela. (2009). *Communication Skills.* PHI Learning Pvt Ltd., New Delhi.
9. Elbow, Peter. (1998). *Writing with Power.* OxfordUniversity Press.
10. Goleman, Daniel. (2013). *EmotionalIntelligence*: *Why it can matter more than IQ.* Bloomsbury Publishing.

B.TECH. ELECTRONICS & COMMUNICATION ENGINEERING

ANTENNAS AND WAVE PROPAGATION (D46PC19)

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

Pre-Requisite: EMTL

Course Objectives: This can be termed a middle level course in the electronic communication engineering domain. The course deals with antenna basics, different types of antennas, some design features, antenna measurements and wave propagation, and has the following main objectives:

1. To understand the concept of radiation, antenna definitions and significance of antenna parameters, to derive and analyze the radiation characteristics of thin wire dipole antennas and solve numerical problems.
2. To distinguish between UHF, VHF and Microwave Antennas, their requirements, specifications, characteristics and design relations.
3. To analyze the characteristics of Yagi-Uda antennas, helical antennas, pyramidal horns, micro strip patch antennas and parabolic reflectors and identify the requirements to facilitate their design.
4. To identify the antenna array requirements and understand the set-up requirements for microwave measurements.
5. To define and distinguish between different phenomenon of wave propagation.

Course Outcomes: Having gone through this course on Antenna Theory and Wave Propagation, the students would be able to:

1. Analyse the mechanism of radiation from antennas, and calculate the parameters for practical scenarios.
2. Analyse the radiation patterns of various VHF,UHF & microwave antennas.
3. Analyse micro strip rectangular patch antennas and parabolic reflector antennas, exploring their features and performance.
4. Analyse linear array analysis and techniques for antenna parameter measurements
5. Determine characteristic features of different wave propagation mechanisms

	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	3	2											2
CO2		2												
CO3	3	3	2											2
CO4		3												2
CO5		2												

UNIT – I

Antenna Basics: Introduction, Basic Antenna Parameters – Patterns, Beam Area, Radiation Intensity, Beam Efficiency, Directivity-Gain-Resolution, Antenna Apertures, Effective Height, Friss transmission equation, Illustrative Problems.

Fields from Oscillating Dipole, Field Zones, Front - to-back Ratio, Antenna Theorems, Radiation, Retarded Potentials – Helmholtz Theorem

Thin Linear Wire Antennas – Radiation from Small Electric Dipole, Quarter Wave Monopole and Half Wave Dipole – Current Distributions, Field Components, Radiated Power, Radiation Resistance, Beam Width, Directivity, Effective Area and Effective Height, Natural Current Distributions, Far Fields and Patterns of Thin Linear Centre-fed Antennas of Different Lengths, Illustrative Problems.

Loop Antennas - Introduction, Small Loop, Comparison of Far Fields of Small Loop and Short Dipole, Radiation Resistances and Directivities of Small Loops (Qualitative Treatment).

UNIT - II

VHF, UHF and Microwave Antennas - I : Arrays with Parasitic Elements, Yagi-Uda Array, Folded Dipoles and their Characteristics, Helical Antennas – Helical Geometry, Helix Modes, Practical Design Considerations for Mono filar Helical Antenna in Axial and Normal Modes, Horn Antennas – Types, Fermat's Principle, Optimum Horns, Design Considerations of Pyramidal Horns, Illustrative Problems.

UNIT - III

VHF, UHF and Microwave Antennas - II: Microstrip Antennas – Introduction, Features, Advantages and Limitations, Rectangular Patch Antennas – Geometry and Parameters, Characteristics of Microstrip Antennas. Reflector Antennas – Introduction, Flar Sheet and Corner Reflectors, Paraboloidal Reflectors – Geometry, Pattern Characteristics, Feed Methods, Reflector Types – Related Features, Illustrative Problems.

UNIT – IV

Antenna Arrays: Point Sources – Definition, Patterns**,** arrays of 2 Isotropic Sources **-** Different Cases, Principle of Pattern Multiplication, Uniform Linear Arrays – Broadside Arrays, End fire Arrays, EFA with Increased Directivity, Derivation of their Characteristics and Comparison, BSAs with Non-uniform Amplitude Distributions – General Considerations and Binomial Arrays, Planar arrays (Qualitative treatment), Illustrative Problems.

Antenna Measurements: Introduction, Concepts - Reciprocity, Near and Far Fields, Coordinate System, Sources of Errors. Patterns to be Measured, Directivity Measurement, Gain Measurements (by Comparison, Absolute and 3-Antenna Methods)

UNIT - V

Wave Propagation – I: Introduction, Definitions, Categorizations and General Classifications, Different Modes of Wave Propagation, Ray/Mode Concepts, Ground Wave Propagation (Qualitative Treatment) – Introduction, Plane Earth Reflections, Space and Surface Waves, Wave Tilt, Curved Earth Reflections. Space Wave Propagation – Introduction, Field Strength Variation with Distance and Height, Effect of Earth's Curvature, Absorption, Super Refraction, M-Curves and Duct Propagation, Scattering Phenomena, Troposphere Propagation.

Wave Propagation – II: Sky Wave Propagation – Introduction, Structure of Ionosphere, Refraction and Reflection of Sky Waves by Ionosphere, Ray Path, Critical Frequency, MUF, LUF, OF, Virtual Height and Skip Distance, Relation between MUF and Skip Distance, Multi- hop Propagation.

TEXT BOOKS:

1. J.D. Kraus, R.J. Marhefka and Ahmad S. Khan,"Antennas and Wave Propagation" –, MCGRAW HILL EDUCATION, New Delhi, 4th ed., (Special Indian Edition), 2010.
2. E.C. Jordan and K.G. Balmain "Electromagnetic Waves and Radiating Systems", PHI,2nd ed., 2000.

REFERENCE BOOKS:

1. C.A. Balanis, John Wiley "Antenna Theory" - & Sons, 3rd Ed., 2005.
2. K.D. Prasad, Satya Prakashan "Antennas and Wave Propagation" –, Tech India Publications, New Delhi, 2001.

B.TECH. ELECTRONICS & COMMUNICATION ENGINEERING

DIGITAL SIGNAL PROCESSING (D46PC20)

B.Tech. VI Semester **L/T/P/C**
3/1/0/4

PREREQUISITES:

To have Knowledge of Signals and Systems.

COURSE OBJECTIVES:

1. Describe the necessity and efficiency of digital signal processing.
2. Design and implementation of FIR and IIR digital filters.
3. Describe the basics of Multirate digital signal processing and its application.
4. Describe the DSP processor architecture for the efficient implementation of digital filters.

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

1. Apply time, frequency, and Z-transform analysis techniques on signals and systems.
2. Calculate time domain and frequency domain of signals using DFT and develop FFT Algorithm for faster realization of signals and systems.
3. Design Digital IIR filters from analog filters using various techniques and analyze the realization of Digital filter.
4. Design a FIR digital filter based on given specifications, comprehend the significance of various filters, analyse its realization and their impact on signal processing.
5. Analyze Multi rate signal processing, DSP processor and its architecture.

	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	3	2											2
CO2	2	3	2										3	2
CO3			3										3	3
CO4			3										3	3
CO5		3												2

UNIT – I:

INTRODUCTION: Discrete time signals & sequences, discrete time systems, Block diagram of DSP, Time and Frequency response analysis of Discrete time systems.

Z-TRANSFORMS: Introduction, Relation between DTFT and Z-transforms, Relation between Laplace Transform and Z-transforms, Properties, Poles and Zeros in Z-plane, Region of convergence, System function, stability criterion, Inverse z-transform, Solution of difference equations, Applications.

UNIT – II:

DISCRETE AND FAST FOURIER TRANSFORM: Discrete Fourier Transform (DFT), Computation of DFT, Properties of DFT, Linear and Circular Convolution, Filtering of long duration sequences. FFT algorithms: Radix- 2 Decimation in Time and Decimation in Frequency algorithms, FFT, Inverse FFT

UNIT – III:

DIGITAL FILTER (IIR) DESIGN: Butterworth and Chebyshev approximations- IIR digital filter design techniques- Backward difference algorithm, Step and Impulse Invariant technique, bilinear transformation technique, Spectral transformations, Realization of IIR digital filters.

UNIT – IV:

DIGITAL FILTERS (FIR) DESIGN: Amplitude and phase responses for FIR filters- Linear phase filters, Design of FIR digital filters-Fourier series method, Window techniques, Frequency sampling technique, Realizations, Comparison between FIR and IIR filters.

UNIT – V:

MULTIRATE DIGITAL SIGNAL PROCESSING: Introduction, Down sampling, Up sampling, Decimation, Interpolation, Sampling Rate conversion by a Rational factor I/D, Multistage implementation of Sampling Rate conversion, Applications of Multirate Signal Processing.

INTRODUCTION TO DSP PROCESSORS: Introduction, Evolution of Digital signal processors, TMS320C54XX processors, Architecture, Addressing modes, Instruction set.

TEXT BOOKS:

1. Alan V. Oppenheim and Ronald W. Schafer, “Digital Signal Processing”, 2/e, PHI, 2010.
2. John G. Proakis and Dimtris G. Manolakis, “Digital Signal Processing: Principles, Algorithms and Application”, 4/e, PHI, 2007.
3. Avathar Singh and S. Srinivasan, “Digital Signal Processing using DSP Micrprocessor”, 2/e, Thomson Books, 2004.
4. John G Proakis and Vinay K Ingle, “ Digital Signal Processing using MATLAB” 3/e, Cengage Learning, 1997.
5. Richard G Lyons, “Understanding Digital Signal Processing”, 3/e, Prentice Hall.

REFERENCE BOOKS:

1. Ashok Ambardar.” Analog and Digital signal processing”-2nd Edition,Brooks/cole publishing company,2006.

2. S.Shalivahanan,” Digital signal processing”, A. and C.Gnanapriya,TMH,2009.

3. Loney Ludeman,John Wiley “Fundamentals of Digital signal processing”,2009

B.TECH. ELECTRONICS & COMMUNICATION ENGINEERING

VLSI DESIGN (D46PC21)

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

Pre-Requisites: Analog Electronics, Digital logic Design

Course Objectives:

1. Acquire qualitative knowledge about the fabrication process of integrated circuit using MOS, CMOS and Bi CMOS transistors and 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:

1. Demonstrate the fabrication process of integrated circuits using MOS transistors, including understanding the steps involved and the overall process flow.
2. Design the layout of a logic gates, considering parasitic effects and estimating their impact on circuit performance.
3. Analyze the time delay of CMOS inverter and to investigate the effect of capacitive loads
4. Build the different data path subsystem and serial access memories.
5. Construct the programmable logic devices and illustrate the testing strategies.

	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	3									3	
CO2	3	3	2											3
CO3		2	3	2										2
CO4	2	3		3									3	
CO5		2	3		2									3

UNIT-I

Introduction to IC Technology: Introduction, MOS, PMOS, NMOS, CMOS & Bi CMOS technologies, new trends in VLSI.

Basic Electrical Properties: Basic Electrical Properties of MOS: Ids-V_{ds} relationships, MOStransistor threshold Voltage V_t ,trans conductance g_m, output conductance g_{ds}, figure of merit ωo; Various pull ups, NMOS Inverter, CMOS Inverter an analysis and design, Bi-CMOS Inverters.

UNIT-II

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

UNIT-III

Gate Level Design: Designing static CMOS circuits for Logic Gates, Switch logic, Alternate gate circuits, power, time delays, Driving large Capacitive Loads, Wiring Capacitances, Fan-in and fan-out, Choice of layers.

UNIT-IV

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

Array Sub systems: ROM, Serial access memories, SRAM, DRAM.

UNIT-V

Programmable Logic Devices: Programmable Logic Array (PLA), Programmable Array Logic (PAL), FPGAs, CPLDs, Standard Cells.

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

TEXTBOOKS:

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.

REFERENCEBOOKS:

1. Ming-BOL,"Introduction to VLSI Systems: A Logic, Circuit and systems Perspective"-, CRC Press, 2011.
2. P. Uyemura , "CMOS logic circuit Design-John", Springer, 2007.
3. Wayne Wolf, "Modern VLSI Design"-, Pearson Education, 3rd Edition, 1997.
4. N.H.E.Weste & D.Harris, "CMOS VLSI Design: A Circuits and Systems Perspective", 4th Edition, Pearson, 2011.
5. J.Rabey & B.Nikolic, "Digital Integrated circuits", 2nd Edition, Pearson, 2003.

B.TECH. ELECTRONICS & COMMUNICATION ENGINEERING

DIGITAL DESIGN THROUGH VERILOG HDL (D46PE2)

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

Pre-Requisite: Switching Theory and Logic Design

COURSEOBJECTIVES:

1. To build Verilog design modules using the constructs and conventions of the Verilog HDL programming language and various modeling styles supported by the language.
2. To distinguish between the various modeling styles like structural, register-transfer (dataflow), and algorithmic (behavioral) and make use of various levels of abstraction for modeling digital hardware systems.
3. To develop advanced complex systems for real time environment and to develop required skills in this programming language of as per the needs of the industry.

COURSE OUTCOMES: On completion of this course, the students will be able to:

1. Apply the Verilog hardware description language to simulate, and synthesize computer hardware structures.
2. Organize the design flow for FPGA and ASIC with a historical development of the Verilog HDL.
3. Compose program codes for structural, behavioral and data flow modeling of combinational and sequential logic using Verilog HDL.
4. Design tasks and assignments effectively as instructed with the use of modern technology through research and case studies.
5. Create designs using the advanced features of Verilog HDL and be able to write code effectively.

	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	3			3								3	2
CO2		2	3		3								2	3
CO3		3	3		2								3	3
CO4	3		3		3								2	3
CO5	3		2		3								3	2

UNIT–I:

Introduction To VLSI Design: Introduction, conventional approach to digital design, VLSI/ASIC design flow, Role of HDL.

Introduction To Verilog: Verilog as HDL, Emergence of HDLs, Capabilities of Verilog HDL, Levels of Design Description, Hierarchical Modeling Concepts.

Language Constructs and Conventions: Introduction, Keywords, Identifiers, White Space Characters, Comments, Numbers, Strings, Logic Values, Strengths, Data Types, Scalars, Vectors and Arrays, Memories, System Tasks, Modules and Ports.

UNIT–II:

Gate Level Modeling: Introduction, Gate Types - AND/OR Gates, BUF/NOT Gates, Tri-state Gates, Array of Instances of Gate Primitives, Net Delays and Gate Delays, Rise, Fall and Turn-off Delays, Min/Type/Max Values, Delay Examples, Strengths and Contention Resolution, Verilog Design Examples Using Gate Level Modeling.

UNIT–III:

Data Flow Modeling: Introduction, Continuous Assignments, Delays, Expressions, Operands and Operators, Operator Types, Verilog Design Examples Using Data Flow Modeling.

Switch Level Modeling: Introduction, Switch-Modeling Elements - MOS Switches, CMOS Switches, Bidirectional Switches, Resistive Switches, Delay Specification on switches, Verilog Design Examples Using Switch Level Modeling.

UNIT-IV:

Behavioral Modeling: Introduction, Structures Procedures- Initial and Always Statements, Procedural Assignments, Timing Controls, Conditional Statements, Multi-way Branching, Loops, Sequential and Parallel Blocks, Generate Blocks, Procedural Continuous Assignments, Test Benches, Verilog Design Examples Using Behavioral Modeling.

UNIT–V:

Tasks, Functions and User Defined Primitives: Parameters, Path delays, Compiler Directives, Functions, and Tasks, Differences between Tasks and Functions, UDP Basics, Combinational UDPs, Sequential UDPS.

TEXTBOOKS

1. T.R.Padmanabhan, B.Bala Tripura Sundari (2004), “Design through Verilog HDL, Wiley & Sons Education”, IEEE Press, USA.
2. Samir Palnitkar (2013), “Verilog HDL-A Guide to Digital Design and Synthesis”, 2nd Edition, Pearson Education, NewDelhi, India.

REFERENCEBOOKS

1. Michael D.Ciletti (2005)," Advanced Digital Design with Verilog HDL", Prentice Hall of India, NewDelhi.
2. Stephen. Brown, Zvonko Vranesic (2005), "Fundamentals of Logic Design with Verilog", Tata Mc Graw Hill, India.
3. J.Bhaskar (2003), "A Verilog Primier",2nd edition, BS Publications, India.

B.TECH. ELECTRONICS & COMMUNICATION ENGINEERING

CELLULAR AND MOBILE COMMUNICATIONS (D46PE2)

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

Pre-Requisite: Antennas and Communications

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

By the end of the course, the student will be able to:

1. Use knowledge to understand mobile cellular systems and their impairments caused by multipath fading channel.
2. Differentiate between co-channel and non-co-channel interferences and analyze their impact on system performance.
3. Analyze and optimize cell coverage for signal and traffic to enhance network performance.
4. Analyze the concepts of frequency management and channel assignment.
5. Analyze various types of handoff in maintaining seamless connectivity and maximizing network capacity.

	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												2
CO3		3												2
CO4		3												2
CO5		3												2

UNIT – I:

Introduction to Cellular Mobile Radio Systems: Limitations of Conventional Mobile Telephone Systems, Basic Cellular Mobile System, First, Second, Third and Fourth Generation Cellular Wireless Systems, Performance Criteria, Uniqueness of Mobile Radio Environment Fading - Time Dispersion Parameters, Coherence Bandwidth, Doppler Spread and Coherence Time, Operation Of Cellular Systems & Hexagonal Shaped Cells.

Fundamentals of Cellular Radio System Design: Concept of Frequency Reuse, Co- Channel Interference, Co-Channel Interference Reduction Factor, Desired C/I From a Normal Case in a Omni Directional Antenna System, System Capacity, Trunking and Grade of Service, Improving Coverage and Capacity in Cellular Systems- Cell Splitting, Sectoring, Microcell Zone Concept, Umbrella Cell Approach.

UNIT – II:

Co-Channel Interference: Introduction to Co-Channel Interference, Measurement Of Real Time Co-Channel Interference, Design of Antenna System, Diversity Techniques-Space Diversity, Polarization Diversity, Frequency Diversity, Time Diversity.

Non-Co-Channel Interference: Adjacent Channel Interference, Near End Far End Interference, Cross Talk, Effects on Coverage and Interference by Power Decrease, Antenna Height Decrease, Effects of Cell Site Components.

UNIT – III:

Cell Coverage for Signal and Traffic: Signal Reflections in Flat And Hilly Terrain, Effect of Human Made Structures, Phase Difference Between Direct and Reflected Paths, Constant Standard Deviation, Straight Line Path Loss Slope, General Formula for Mobile Propagation Over Water and Flat Open Area, Near and Long Distance Propagation, Path Loss From a Pointto Point Prediction Model in Different Conditions, Merits of Lee Model.

Cell Site and Mobile Antennas: Omni Directional and Directional Antennas, Space Diversity Antennas, Umbrella Pattern Antennas, Minimum Separation of Cell Site Antennas, Mobile Antennas, High Gain Antennas.

UNIT – IV:

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

UNIT – V:

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

TEXT BOOKS

1. W.C.Y. Lee, Mc Graw Hill, "Mobile Cellular Telecommunications" –, 2nd Edn. 1989.
2. Theodore. S. Rapport, "Wireless Communications" - Pearson Education, 2nd Edn. 2002.
3. Dalal, "Wireless communication and networks", oxford university press.

REFERENCE BOOKS

1. Gordon L. Stuber,"Principles of Mobile Communications"–, Springer International, 2nd Edn. 2001.
2. Simon Haykin, Michael Moher, "Modern Wireless Communications" -, Pearson Education, 2005.
3. Asrar U. H .Sheikh, "Wireless Communications Theory and Techniques", Springer, 2004.
4. Vijay Garg , "Wireless Communications and Networking" , Elsevier Publications, 2007.
5. Andrea Goldsmith," Wireless Communications"–, Cambridge University Press, 2005.

B.TECH. ELECTRONICS & COMMUNICATION ENGINEERING

ADVANCED MICROCONTROLLERS (D46PE2)

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

COURSE OBJECTIVES:

1. Explore the architecture and instruction set of ARM processor.
2. To provide a comprehensive understanding of various programs of ARM Processors.

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

1. Analyze the selection criteria of ARM processors by understanding the functional level trade off issues.
2. Analyze the ARM instruction set and Thumb instruction set.
3. Illustrate the technical details of ARM Cortex M processors.
4. Operate ASM level program using the instruction set.
5. Generalize floating point operations using Cortex 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	3	2											2	
CO2	3	2											2	
CO3	3	2											2	
CO4	3	2											2	
CO5	3	2										2	2	

UNIT-I:

ARM Embedded Systems: RISC design philosophy, ARM design philosophy, embedded system hardware, embedded system software.

ARM Processor Fundamentals: Registers, Current Program Status Register, Pipeline, Exceptions Interrupts and Vector Table, Core Extensions, Architecture Revisions, ARM Processor Families.

Architecture of ARM Processors: Introduction to the ARM architecture

UNIT-II:

Introduction to the Arm Instruction Set: Data processing instructions, branch instructions, loadstore instructions, software interrupt instructions, program status register instructions, loading constants, ARMv5E extensions, Conditional execution.

Introduction to the Thumb Instruction Set: Thumb Register Usage, ARM-Thumb Interworking, Other Branch Instructions, Data Processing Instructions, Single-Register Load-Store Instructions, Multiple-Register Load-Store Instructions, Stack Instructions, Software Interrupt Instruction.

UNIT-III:

Technical Details of ARM Cortex M Processors: General information about Cortex-M3 and cortex M4 processors-Processor type, processor architecture, instruction set, block diagram, memory system, interrupt and exception support, Features of the cortex-M3 and Cortex-M4 Processors Performance, code density, low power, memory system, memory protection unit, interrupt handling, OS support and system level features, Cortex-M4 specific features, Ease of use, Debug support, Scalability, Compatibility.

UNIT-IV:

Instruction set of ARM Cortex M Background to the instruction set in ARM Cortex-M Processors, Comparison of the instruction set in ARM Cortex-M Processors, understanding the assembly language syntax, Use of a suffix in instructions, Unified assembly Language (UAL), Instruction set.

UNIT-V:

Cortex-M4-specific instructions, Barrel shifter, Accessing special instructions and special registers in Programming.

Floating Point Operations About Floating Point Data, Cortex-M4 Floating Point Unit (FPU)-overview, FP registers overview, CPACR register, Floating point register bank, FPSCR, FPU->FPCCR, FPU-> FPCAR, FPU->FPDSCR, FPU->MVFR0, FPU->MVFR1.

TEXTBOOKS:

1. Andrew N. SLOSS, Dominic SYMES, Chris WRIGHT, “ARM System Developer’s Guide Designing and Optimizing System Software”, Elsevier Publications, 2004.
2. Joseph Yiu, “The Definitive Guide to ARM Cortex-M3 and Cortex-M4 Processors”, Elsevier Publications, 3rd Ed.,

REFERENCES:

1. Steve Furber ,”Arm System on Chip Architectures” –, Edison Wesley, 2000.
2. David Seal, “ARM Architecture Reference Manual” –, Edison Wesley, 2000.

DIGITAL IMAGE PROCESSING (D46PE2)

B. Tech. VI Semester **L T P C**
3 0 0 3

Prerequisite: Digital Signal Processing

Course Objectives:

1. To provide a approach towards image processing and introduction about 2D transforms
2. To expertise about enhancement methods in time and frequency domain
3. To expertise about segmentation and compression techniques
4. To understand the Morphological operations on an image

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

1. Ability to apply knowledge of image processing techniques to explore the-fundamental relations between pixels and utility of 2-D transforms in image processer.
2. Able to analyse the concepts of Spatial and Frequency enhancements
3. Ability to apply knowledge of restoration processes on an image
4. Able to analyze image morphological and segmentation techniques
5. Ability to analyze image compression algorithms, the need of compression and evaluation of basic compression algorithms

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3												3	
CO2	2	3											3	
CO3	3												3	
CO4	2	3											3	
CO5	2	3											3	

UNIT-I:

Digital Image Fundamentals & Image Transforms: Digital Image Fundamentals, Sampling and Quantization, Relationship between Pixels.

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

UNIT-II:

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

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

UNIT -III:

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

UNIT -IV:

Image Segmentation: Detection of Discontinuities, Edge Linking And Boundary Detection, thresholding, Region Oriented Segmentation.

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

UNIT -V:

Image Compression: Redundancies and their Removal Methods, Fidelity Criteria, Image Compression Models, Huffman and Arithmetic Coding, Error Free Compression, Lossy Compression, Lossy and Lossless Predictive Coding, Transform Based Compression, JPEG 2000 Standards.

TEXT BOOKS:

1. Rafael C. Gonzalez, Richard E. Woods, "Digital Image Processing"-, 3rd Edition, Pearson, 2008
2. S Jayaraman, S Esakkirajan, T Veerakumar,"Digital Image Processing"- - TMH, 2010.

REFERENCE BOOKS:

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

B.TECH. ELECTRONICS & COMMUNICATION ENGINEERING

DIGITAL SIGNAL PROCESSING LAB (D46PC22)

B.Tech. VI Semester **L/T/P/C**
0/0/2/1

COURSE OBJECTIVES:

1. Implement the basic algorithms of DFT, IDFT, FFT and IFFT.
2. Design FIR Filter with specific magnitude and phase requirements.
3. Design IIR Filter with specific magnitude and phase requirements.
4. Describe the basics of Multirate signal processing.
5. Design and implement digital filters on DSP processors.

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

CO1: Demonstrate the concepts of DSP and its applications using MATLAB software
CO 2: Analyse and observe Magnitude and Phase characteristics of a discrete time signal.
CO 3: Analyse and observe Magnitude and Phase characteristics of an IIR and FIR digital filter.
CO 4: Illustrate the basics of Multi rate signal processing.
CO 5: Demonstrate abilities towards DSP processor based implementation of DSP 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				3				3	2
CO2		3				3							3	2
CO3	3								3				3	3
CO4							3	3					3	2
CO5							3	3					3	2

Note:

The Programs shall be implemented in Software (Using MATLAB / Lab View / C Programming / Equivalent) and Hardware (Using TI / Analog Devices / Motorola / Equivalent DSP processors).

Minimum of 12 experiments to be conducted.

List of Experiments

1. Generation of Sinusoidal Waveform / Signal based on Recursive Difference Equations.
2. To find DFT / IDFT of given DT Signal.
3. To find circular convolution between two sequences.
4. 4.To find Frequency Response of a given System given in Transfer Function/ Differential equation form.
5. To find Inverse z-transform by using partial fraction expansion.
6. Implementation of FFT of given Sequence.
7. Determination of Power Spectrum of a given Signal(s).
8. Implementation of LP FIR Filter for a given Sequence/Signal.
9. Implementation of HP IIR Filter for a given Sequence/Signal
10. Generation of Narrow Band Signal through Filtering
11. Generation of DTMF Signals
12. Implementation of Decimation Process
13. Implementation of Interpolation Process
14. Implementation of I/D Sampling Rate Converters
15. Impulse Response of First order and Second Order Systems.

REFERENCES:

1.Jaydeep Chakravorthy,''Introduction to MATLAB Programming: Toolbox and Simulink",1/e, UniversityPress,2014.

B.TECH. ELECTRONICS & COMMUNICATION ENGINEERING

VLSI Design Lab (D46PC23)

B.Tech.VI Semester **L/T/P/C**
0/0/2/1

PRE REQUISITES: Digital

Electronics

COURSEOBJECTIVES:

1. To learn the HDL programming language.
2. To learn the simulation of basic gates using the HDL.
3. To learn the simulation of combinational and sequential circuits using HDL.
4. To learn the synthesis and layouts of analog and digital CMOS circuits.
5. To develop an ability to simulate and synthesize various digital circuits

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

1. Design and simulate the combinational and sequential logic circuits with the help of CAD tool.
2. Differentiate the various modeling styles of HDL code for combinational and sequential logic circuits.
3. Synthesize the various combinational and sequential logic circuits and test the program on FPGA.
4. Investigate the DC and transfer characteristics of CMOS inverter.
5. Design the universal gates using static CMOS inverter.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1					3	3						3	3	3
CO2					3	3						3	3	3
CO3					3	3						3	3	3
CO4					3	3						3	3	3
CO5					3	3						3	3	3

Note: Minimum six Experiments should be conducted from each part.

LISTOFEXPERIMENTS:

Design and implementation of the following CMOS digital/analog circuits using **Cadence /Mentor Graphics /Synopsys /Equivalent** CAD tools. The design shall include Gate-level design, Transistor-level design, Hierarchical design, Verilog HDL/VHDL design, Logic synthesis, Simulation and verification, Scaling of CMOS Inverter for different technologies, study of secondary effects (temperature, power supply and process corners), Circuit optimization with respect to area, performance and/or power, Layout, Extraction of parasitic and back annotation, modifications in circuit parameters and layout consumption, DC/transient analysis, Verification of layouts (DRC,LVS)

PART-A (E-CAD programs)

Programming can be done using any complier. Down load the programs on FPGA/CPLD boards and performance testing may be done using pattern generator (32 channels) and logic analyze apart from verification by simulation with any of the front end tools

1. HDL code to realize all the logic gates
2. Design of Full adder using 3 modeling styles
3. Design of 3-to-8 decoder using 2-to-4 decoder.
4. Design of 8-to-3 encoder
5. Design of 8-to-1 multiplexer and 1-to-8 de-multiplexer
6. Design of 4 bit binary to gray code converter
7. Design of 4 bit comparator
8. Design of flipflops: SR and D/J K andT
9. Design of 4-bit binary or BCD counters
10. Finite State Machine Design

PART-B (VLSICIRCUITDESIGN)

Introduction to layout design rules, Layout, physical verification, placement &route for complex design, static timing analysis, IR drop analysis and crosstalk analysis of the following:

1. CMOS inverter
2. CMOS NOR gate
3. CMOS NAND gate
4. CMOS AND/OR gate
5. CMOS XOR gate
6. Design of Half Adder
7. Design of a 2x1 multiplexer using transmission gates
8. Latch & Pass transistor
9. A6 –TSRAM bit cell
10. Analog Circuit simulation (AC analysis)–CS/CD amplifier.

B.TECH. ELECTRONICS & COMMUNICATION ENGINEERING
INTERNET of THINGS LAB (D46PC24))

B.Tech. VI Semester. **L T P C**

0/0/2/1

Course Objectives:

To understand the operation of different types embedded technologies like Raspberry pi,

1. Node MCU, Arduino.
2. To understanding the operation of different types of sensors implementation of sensor for IoT devices.

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

1. Ability to learning interfacing different sensors with Raspberry pi, Node MCU, Arduino and programing.
2. Gets the skill to program using python, C and C++ language which is used in many IoT devices.
3. Develop applications using basic sensors.
4. Design various IoT applications using pi, Node MCU.

	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	2	3	3	3	1	1					1		
CO2	3	2	3	3	3	1	1					1		
CO3	3	2	3	3	3	1	1					1		
CO4	3	2	3	3	3	1	1					1		

Note: Minimum of 10 experiments to completed out of 12 experiments.

List of Experiments:

1. Introduction to Arduino IDE Platform
2. Introduction to PI platform and Interfacing Sensors to Raspberry PI
3. Using raspberry pi
    a. Calculate the distance using a distance sensor.
    b. Basic LED functionality.

4. Flash an LED at a given on time and off time cycle, where the two times are taken from a file.
5. Flash an LED based on cron output (acts as an alarm).

6. Using Arduino
    a. Calculate the distance using a distance sensor.
    b. Basic LED functionality.
    c. Buzzer on/off using Flame /Gas/Tilt/sensor
7. Connection of Arduino board with ESP8266 wifi module
8. LDR to Vary the Light Intensity of LED Using Arduino
9. Sense the available networks using Arduino
10. Using Node MCU
    a. Calculate the distance using a distance sensor.
    b. Basic LED functionality.
    c. Calculate temperature using a temperature sensor.
11. Sending temperature, Humidity data from Node MCU to ThingSpeak/Arduino Cloud
12. Remotely Controlling devices from HTML Webpage using NodeMCU using local network.