

Estd: 2009

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**PRIYADARSHINI INSTITUTE OF SCIENCE AND TECHNOLOGY FOR WOMEN**

(Approved by AICTE, New Delhi and Affiliated to JNTUH Hyderabad)

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### III YEAR I SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1	EC501PC	Microcontrollers	3	1	0	4
2	EC502PC	IoT Architectures and Protocols	3	0	0	3
3	EC503PC	Control Systems	3	1	0	4
4	SM504MS	Business Economics & Financial Analysis	3	0	0	3
5		Professional Elective – I	3	0	0	3
6	EC505PC	Microcontrollers Laboratory	0	0	2	1
7	EC506PC	IoT Architectures and Protocols Laboratory	0	0	2	1
8	EN508HS	Advanced English Communication Skills Laboratory	0	0	2	1
9	*MC510	Intellectual Property Rights	3	0	0	0
		<b>Total Credits</b>	<b>18</b>	<b>2</b>	<b>6</b>	<b>20</b>

### III YEAR II SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1	EC601PC	Antennas and Wave Propagation	3	0	0	3
2	EC602PC	Digital Signal Processing	3	0	0	3
3	EC603PC	CMOS VLSI Design	3	0	0	3
4		Professional Elective - II	3	0	0	3
5		Open Elective – I	3	0	0	3
6	EC604PC	Digital Signal Processing Laboratory	0	0	2	1
7	EC605PC	CMOS VLSI Design Laboratory	0	0	2	1
8	EC606PC	Advanced Communication Laboratory	0	0	2	1
9	EC607PC	Industry Oriented Mini Project/ Internship	0	0	4	2
10	*MC609	Environmental Science	3	0	0	0
		<b>Total Credits</b>	<b>18</b>	<b>0</b>	<b>10</b>	<b>20</b>

**EC501PC: MICROCONTROLLERS****B.Tech. III Year I Semester**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**Prerequisite:** Nil**Course Objectives:**

1. To familiarize the architecture of microprocessors and micro controllers
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 completing this course, the student will be able to

1. Known the internal architecture, organization and assembly language programming of 8086 processors.
2. Known the internal architecture, organization and assembly language programming of 8051/controllers
3. Learn the interfacing techniques to 8086 and 8051 based systems.
4. Known the internal architecture of ARM processors and basic concepts of advanced ARM processors.

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

**UNIT -I**

**8086 Architecture:** 8086 Architecture-Functional diagram, Register Organization, Memory Segmentation, Programming Model, Memory addresses, Physical Memory Organization, Architecture of 8086, Signal descriptions of 8086, 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 Counters

**UNIT -III**

**I/O And Memory Interface:** 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, TMH, 2<sup>nd</sup> Edition 2006.
2. Andrew N SLOSS, Dominic SYMES, Chris WRIGHT -ARM System Developers guide, Elsevier, 2012

**REFERENCE BOOKS:**

1. Kenneth. J. Ayala-The 8051 Microcontroller, Cengage Learning, 3<sup>rd</sup> Ed, 2004.
2. D. V. Hall -Microprocessors and Interfacing, TMGH, 2<sup>nd</sup> Edition, 2006.
3. K. Uma Rao, Andhe Pallavi-The 8051 Microcontrollers, Architecture and Programming and Applications, Pearson, 2009.
4. Donald Reay-Digital Signal Processing and Applications with the OMAP- L138 Experimenter, WILEY 2012.

**EC502PC: IOT ARCHITECTURES AND PROTOCOLS****B.Tech. III Year I Semester**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Prerequisite:** Nil**Course Objectives:**

1. To provide the basic knowledge on IoT.
2. To explain the different components and Architectures from M2M to IoT.
3. To provide knowledge on different protocols of IoT.
4. To impart knowledge on implementations of different protocols of IoT.

**Course Outcomes:** After completion of this course the student will able to

1. Explore the Evolution of IoT, its Growth and Applications.
2. Know the components of IoT and Compare the various architectures of IoT.
3. Acquire the knowledge on data management of IoT.
4. Establish the knowledge on various IoT protocols like Data link, Network, Transport, Session, Service layers.

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

**UNIT- I****IOT introduction:**

Introduction and definition of IoT, Evolution of IoT, IoT growth, Application areas of IoT, Characteristics of IoT, IoT stack, Enabling technologies, IoT levels, IoT sensing and actuation, Sensing types, Actuator types.

**UNIT - II****IOT and M2M:**

M2M to IoT – A Basic Perspective– Introduction, Differences and similarities between M2M and IoT, SDN and NFV for IoT, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, international driven global value chain and global information monopolies.

**IOT Architecture:**

IoT Architecture components, Comparing IoT Architectures, A simplified IoT Architecture, core IoT functional stack, IoT data management and compute stack

**UNIT- III****IOT Data link layer and Network layer protocols:**

PHY/MAC Layer (3GPP MTC, IEEE 802.11, IEEE 802.15), Wireless HART, Z Wave, Bluetooth Low Energy, Zigbee Smart Energy, DASH7 - Network Layer-IPv4, IPv6, 6LoWPAN, 6TiSCH, ND, DHCP, ICMP, RPL, CORPL, CARP

**UNIT- IV****Transport and Session layer protocols:**

Transport Layer (TCP, MPTCP, UDP, DCCP, SCTP)-(TLS, DTLS) – Session Layer HTTP, CoAP, XMPP, AMQP, MQTT

**UNIT- V****Service layer protocols and Security:**

Service Layer -oneM2M, ETSI M2M, OMA, BBF – Security in IoT Protocols – MAC 802.15.4 6LoWPAN, RPL, Application Layer.

**TEXT BOOKS:**

1. Sudip Misra, Anandarup Mukherjee, Arijit Roy -Introduction to IOT, Cambridge University Press.
2. David Hanes, Gonzalo salgueiro, Patrick Grossetete, Rob barton, Jerome henry-IoT Fundamentals Networking Technologies, Protocols and Usecases for IoT”, Cisco Press.

**REFERENCE BOOKS:**

1. Cunopfister-Getting started with the internet of things, O Reilly Media, 2011
2. Francis daCosta,-Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”, 1 st Edition, Apress Publications.
3. Arshdeep Bahga, Vijay Madiseti -Internet of Things A Hands-on approach, Universities Press
4. Shiram K Vasudevan, RMD Sundaram, Abhishek S Nagarajan-Internet of things, John Wiley and Sons.
5. Massimo Banzi, Michael Shiloh Make: Getting Started with the Arduino, Shroff Publisher/Maker Media Publishers

**EC503PC: CONTROL SYSTEMS****B.Tech. III Year I Semester**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**Prerequisite:** Linear Algebra and Calculus, Ordinary Differential Equations and Multivariable Calculus Laplace Transforms, Numerical Methods and Complex variables

**Course objectives:**

1. To understand the different ways of system representations such as Transfer function representation and state space representations and 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

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

1. Model the linear-time-invariant systems using transfer function and state-space representations.
2. Understand the concept of stability and its assessment for linear-time invariant systems.
3. Design simple feedback controllers.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	-	2	1	-	-	-	-	1
CO2	3	2	3	2	-	2	1	-	-	-	-	1
CO3	3	3	3	2	-	2	1	-	-	-	-	1

**UNIT - I**

**Introduction to Control Problem:** Industrial Control examples. Mathematical models of physical systems. Control hardware and their models. Transfer function models of linear time-invariant systems. Feedback Control: Open-Loop and Closed-loop systems. Benefits of Feedback. Block diagram algebra.

**UNIT - II**

**Time Response Analysis of Standard Test Signals:** Time response of first and second order systems for standard test inputs. Application of initial and final value theorem. Design specifications for second-order systems based on the time-response. Concept of Stability. Routh-Hurwitz Criteria. Relative Stability analysis. Root-Locus technique. Construction of Root-loci.

**UNIT - III**

**Frequency-Response Analysis:** Relationship between time and frequency response, Polar plots, Bode plots. Nyquist stability criterion. Relative stability using Nyquist criterion – gain and phase margin. Closed-loop frequency response.

**UNIT - IV**

**Introduction to Controller Design:** Stability, steady-state accuracy, transient accuracy, disturbance rejection, insensitivity and robustness of control systems. Root-loci method of feedback controller design. Design specifications in frequency-domain. Frequency-domain methods of design. Application of Proportional, Integral and Derivative Controllers, Lead and Lag compensation in designs. Analog and Digital implementation of controllers.

**UNIT - V**

**State Variable Analysis and Concepts of State Variables:** State space model. Diagonalization of State Matrix. Solution of state equations. Eigen values and Stability Analysis. Concept of controllability

and observability. Pole-placement by state feedback. Discrete-time systems. Difference Equations. State-space models of linear discrete-time systems. Stability of linear discrete-time systems.

**TEXT BOOKS:**

1. M. Gopal, -Control Systems: Principles and Design, McGraw Hill Education, 1997.
2. B. C. Kuo, -Automatic Control System, Prentice Hall, 1995.

**REFERENCE BOOKS:**

1. K. Ogata=Modern Control Engineering, Prentice Hall, 1991.
2. I. J. Nagrath and M. Gopal-Control Systems Engineering, New Age International, 2009.

**SM504MS: BUSINESS ECONOMICS AND FINANCIAL ANALYSIS****B.Tech. III Year I Semester****L T P C**  
**3 0 0 3****Course Objective:**

1. To learn the basic business types, impact of the economy on Business and Firms specifically.
2. To analyze the Business from the Financial Perspective.

**Course Outcome:** The students will understand

1. The various Forms of Business and the impact of economic variables on the Business.
2. The Demand, Supply, Production, Cost, Market Structure, Pricing aspects are learnt.
3. The firm's financial position by analysing
4. The Financial Statements of a Company.

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

**UNIT – I****Introduction to Business and Economics:**

**Business:** Structure of Business Firm, Theory of Firm, Types of Business Entities, Limited Liability Companies, Sources of Capital for a Company, Non-Conventional Sources of Finance.

**Economics:** Significance of Economics, Micro and Macro Economic Concepts, Concepts and Importance of National Income, Inflation, Money Supply in Inflation, Business Cycle, Features and Phases of Business Cycle. Nature and Scope of Business Economics, Role of Business Economist, Multidisciplinary nature of Business Economics.

**UNIT - II****Demand and Supply 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: Characteristics of Good Demand Forecasting, Steps in Demand Forecasting, Methods of Demand Forecasting.

**Supply Analysis:** Determinants of Supply, Supply Function & Law of Supply.

**UNIT - III****Production, Cost, Market Structures & Pricing:**

**Production Analysis:** Factors of Production, Production Function, Production Function with one variable input, two variable inputs, Returns to Scale, Different Types of Production Functions.

**Cost analysis:** Types of Costs, Short run and Long run Cost Functions.

**Market Structures:** Nature of Competition, Features of Perfect competition, Monopoly, Oligopoly, Monopolistic Competition.

**Pricing:** Types of Pricing, Product Life Cycle based Pricing, Break Even Analysis, Cost Volume Profit Analysis.

**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, 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).  
Introduction to Fund Flow and Cash Flow Analysis (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.

**REFERENCE BOOKS:**

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.

**EC511PE: COMPUTER ORGANIZATION & OPERATING SYSTEMS (PE-I)****B.Tech. III Year I Semester**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Course Objectives:**

1. To understand the structure of a computer and its operations.
2. To understand the RTL and Micro-level operations and control in a computer.
3. Understanding the concepts of I/O and memory organization and operating systems.

**Course Outcomes:** After completion of this course the student will able to

1. Visualize the organization of different blocks in a computer.
2. Utilize the micro-level operations to control different units in a computer.
3. Implement Operating systems in a computer.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1	1	2	1	1	1	-	1	-	1
CO2	3	2	1	1	2	1	1	1	-	1	-	1
CO3	3	2	1	1	2	1	1	1	-	1	-	1

**UNIT - I**

**Basic Structure of Computers:** Computer Types, Functional Unit, Basic operational Concepts Bus Structures, Software, Performance, Multiprocessors and Multi Computers, Data Representation, Fixed Point Representation, Floating – Point Representation.

**Register Transfer Language and Micro Operations:** Register Transfer Language, Register Transfer Bus and Memory Transfers, Arithmetic Micro Operations, Logic Micro Operations, Shift Micro Operations, Arithmetic Logic Shift Unit, Instruction Codes, Computer Registers Computer Instructions – Instruction Cycle, Memory – Reference Instructions, Input – Output and Interrupt, STACK Organization, Instruction Formats, Addressing Modes, DATA Transfer and Manipulation, Program Control, Reduced Instruction Set Computer.

**UNIT - II**

**Micro Programmed Control:** Control Memory, Address Sequencing, Microprogram Examples, Design of Control Unit, Hard Wired Control, Microprogrammed Control

**The Memory System:** Basic Concepts of Semiconductor RAM Memories, Read-Only Memories, Cache Memories Performance Considerations, Virtual Memories Secondary Storage, Introduction to RAID.

**UNIT - III**

**Input-Output Organization:** Peripheral Devices, Input-Output Interface, Asynchronous Data Transfer Modes, Priority Interrupt, Direct Memory Access, Input –Output Processor (IOP), Serial Communication; Introduction to Peripheral Components, Interconnect (PCI) Bus, Introduction to Standard Serial Communication Protocols like RS232, USB, IEEE 1394.

**UNIT - IV**

**Operating Systems Overview:** Overview of Computer Operating Systems Functions, Protection and Security, Distributed Systems, Special Purpose Systems, Operating Systems Structures-Operating System Services and Systems Calls, System Programs, Operating Systems Generation

**Memory Management:** Swapping, Contiguous Memory Allocation, Paging, Structure of The Page Table, Segmentation, Virtual Memory, Demand Paging, Page-Replacement Algorithms, Allocation of Frames, Thrashing Case Studies - UNIX, Linux, Windows

**Principles of Deadlock:** System Model, Deadlock Characterization, Deadlock Prevention, Detection and Avoidance, Recovery from Deadlock.

**UNIT - V**

**File System Interface:** The Concept of a File, Access Methods, Directory Structure, File System Mounting, File Sharing, Protection.

**File System Implementation:** File System Structure, File System Implementation, Directory Implementation, Allocation Methods, Free-Space Management.

**TEXT BOOKS:**

1. Carl Hamacher, Zvonks Vranesic, Safea Zaky - Computer Organization, 5<sup>th</sup> Edition, McGraw Hill.
2. M. Moris Mano -Computer Systems Architecture, 3<sup>rd</sup> Edition, Pearson
3. Abraham Silberchatz, Peter B. Galvin, Greg Gagne -Operating System Concepts, 8<sup>th</sup> Edition, John Wiley.

**REFERENCE BOOKS:**

1. William Stallings- Computer Organization and Architecture, 6<sup>th</sup> Edition, Pearson
2. Andrew S. Tanenbaum -Structured Computer Organization, 4<sup>th</sup> Edition, PHI
3. Sivaraama Dandamudi - Fundamentals of Computer Organization and Design, Springer Int. Edition.
4. Stallings -Operating Systems – Internals and Design Principles, 6<sup>th</sup> Edition, Pearson Education, 2009.
5. Modern Operating Systems, Andrew S Tanenbaum 2<sup>nd</sup> Edition, PHI.
6. Principles of Operating Systems, B.L. Stuart, Cengage Learning, India Edition.

**EC512PE: DATA COMMUNICATIONS AND COMPUTER NETWORKS (PE-I)****B.Tech. III Year I 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. Know the Categories and functions of various Data communication Networks
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
5. Know the Functioning of various Application layer Protocols.

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

**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 Retransmission 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 802.11 Frame

**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 Demultiplexing, 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.

**TEXT BOOKS:**

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

**REFERENCE BOOKS:**

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

**EC513PE: ELECTRONIC MEASUREMENTS AND INSTRUMENTATION (PE-I)****B.Tech. III Year I Semester**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Prerequisite:** Basic Electrical and Electronics Engineering**Course Objectives:**

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

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

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

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

**UNIT - I**

**Block Schematics of Measuring Systems:** Performance Characteristics, Static Characteristics, Accuracy, Precision, Resolution, Types of Errors, Gaussian Error, Root Sum Squares formula, Dynamic Characteristics, Repeatability, Reproducibility, Fidelity, Lag; Measuring Instruments: DC Voltmeters, D'Arsonval Movement, DC Current Meters, AC Voltmeters and Current Meters, Ohmmeters, Multimeters, Meter Protection, Extension of Range, True RMS Responding Voltmeters, Specifications of Instruments.

**UNIT - II**

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

**UNIT - III**

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

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

**UNIT - IV**

**Transducers:** Classification, Strain Gauges, Bounded, unbounded; Force and Displacement Transducers, Resistance Thermometers, Hotwire Anemometers, LVDT, Thermocouples, Synchros,

Special Resistance Thermometers, Digital Temperature sensing system, Piezoelectric Transducers, Variable Capacitance Transducers, Magneto Strictive Transducers, gyroscopes, accelerometers.

**UNIT - V**

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

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

**TEXT BOOKS:**

1. Modern Electronic Instrumentation and Measurement Techniques: A.D. Helbins, W. D. Cooper: PHI 5<sup>th</sup> Edition 2003.
2. Electronic Instrumentation: H. S. Kalsi – TMH, 2<sup>nd</sup> Edition 2004.

**REFERENCE BOOKS:**

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

**EC505PC: MICROCONTROLLERS LABORATORY****B.Tech. III Year I Semester**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

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

1. Write assembly language programs and implement on 8086.
2. Write assembly language programs and implement on 8051
3. Interface the I/O devices with 8051 micro controllers
4. Perform experiments on Cortex-M3 development boards using GNU tool- chain

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	-	-	-	-	-	-	1
CO2	3	3	3	3	3	-	-	-	-	-	-	1
CO3	3	3	3	3	3	-	-	-	-	-	-	1
CO4	3	3	3	3	3	-	-	-	-	-	-	1

**Cycle 1: Using 8086 Processor Kits and/or Assembler**

- Assembly Language Programs to 8086 to Perform
  1. Arithmetic, Logical, String Operations on 16 Bit and 32-Bit Data.
  2. Bit level Logical Operations, Rotate, Shift, Swap and Branch Operations.

**Cycle 2: Using 8051 Microcontroller Kit**

- Introduction to IDE
  1. Assembly Language Programs to Perform Arithmetic (Both Signed and Unsigned) 16 Bit Data Operations, Logical Operations (Byte and Bit Level Operations), Rotate, Shift, Swap and Branch Instructions
  2. Time delay Generation Using Timers of 8051.
  3. Serial Communication from / to 8051 to / from I/O devices.
  4. Program Using Interrupts to Generate Square Wave 10 KHZ Frequency on P2.1 Using Timer 0 8051 in 8 bit Auto reload Mode and Connect a 1 HZ Pulse to INT1 pin and Display on Port 0. Assume Crystal Frequency as 11.0592 MHZ

**Cycle 3: Interfacing I/O Devices to 8051**

1. 7 Segment Display to 8051.
2. Matrix Keypad to 8051.
3. Sequence Generator Using Serial Interface in 8051.
4. 8-bit ADC Interface to 8051.
5. Triangular Wave Generator through DAC interfaces to 8051.

**Cycle 4: Experiments to be carried out on Cortex-M3 development boards and using GNU tool-chain**

1. Blink an LED with software delay, delay generated using the SysTick timer.
2. System clock real time alteration using the PLL modules.
3. Control intensity of an LED using PWM implemented in software and hardware.
4. Control an LED using switch by polling method, by interrupt method and flash the LED once every five switch presses.

**EC506PC: IOT ARCHITECTURE AND PROTOCOLS LABORATORY****B.Tech. III Year I Semester**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

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

1. Utilize the different sensors like room temperature, DHT, Humidity etc.,
2. Interface the sensors and processor for transmission of data.
3. Capture the images and process it on Arduino/NodeMCU/Raspberry Pi.
4. know the utilization of various protocols like I2c, UART communication etc.,

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
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

**List of Experiments:**

1. Demonstrate blinking of an LED at every 5 seconds and to control the brightness of an LED.
2. Read Humidity and Room Temperature using DHT sensor and display the readings.
3. Send the recorded values of Temperature/Humidity to the Internet via GSM module using Arduino/NodeMCU/Raspberry Pi.
4. Demonstrate Interfacing NodeMCU/Raspberry Pi with the Cloud using REST API and MQTT protocol.
5. Demonstrate Switching lights on /off remotely using Arduino/NodeMCU/Raspberry Pi.
6. Voice-based Home Automation for switching lights on/off using Google Assistant, IFTTT and MQTT.
7. Interfacing DHT11 sensor with Raspberry pi/equivalent and upload temperature and humidity values to the cloud.
8. Design an obstacle detection unit using ultrasonic sensor.
9. Capture images from web camera using Raspberry Pi/equivalent and apply filters in increase image quality.
10. Access a remote computer from Raspberry Pi and display the remote screen.
11. Design an automatic water sprinkler based on soil moisture using Arduino/NodeMCU/Raspberry Pi.
12. Design an RFID based attendance system using Arduino/NodeMCU/Raspberry Pi.
13. Write an arduino program to demonstrate interrupts
14. Write an arduino program to demonstrate UART communication protocol
15. Write an arduino program to demonstrate I2C communication protocol
16. Write an arduino program to demonstrate SPI communication protocol

**EN508HS: ADVANCED ENGLISH COMMUNICATION SKILLS LABORATORY****B.Tech. III Year I Semester**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**1. Introduction**

The introduction of the Advanced English Communication Skills Lab is considered essential at the B.Tech 3<sup>rd</sup> 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:

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

**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, Answering Strategies - Interview Through Tele-conference & Video-conference - Mock Interviews.

**4. Minimum Requirement:**

The Advanced English Communication Skills (AECS) Laboratory shall have the following infrastructural facilities 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.

- **TOEFL & GRE** (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)
- **Oxford Advanced Learner's Dictionary**, 10<sup>th</sup> Edition
- **Cambridge Advanced Learner's Dictionary**
- **DELTA's key to the Next Generation TOEFL Test: Advanced Skill Practice.**
- **Lingua TOEFL CBT Insider**, by Dreamtech

**6. Books Recommended:**

1. Rizvi, M. Ashraf (2018). *Effective Technical Communication*. (2<sup>nd</sup> 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*. (5<sup>th</sup> 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*. (4<sup>TH</sup> 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*. Oxford University Press.
10. Goleman, Daniel. (2013). *Emotional Intelligence: Why it can matter more than IQ*. Bloomsbury Publishing.

**\*MC510: INTELLECTUAL PROPERTY RIGHTS****B.Tech. III Year I Semester**

L	T	P	C
3	0	0	0

**Course Objectives:**

- Significance of intellectual property and its protection
- Introduce various forms of intellectual property

**Course Outcomes:**

- Distinguish and Explain various forms of IPRs.
- Identify criteria to fit one's own intellectual work in particular form of IPRs.
- Apply statutory provisions to protect particular form of IPRs.
- Appraise new developments in IPR laws at national and international level

**UNIT – I**

**Introduction to Intellectual property:** Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.

**UNIT – II**

**Trade Marks:** Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting, and evaluating trade mark, trade mark registration processes.

**UNIT – III**

**Law of copyrights:** Fundamental of copyright law, originality of material, rights of reproduction, rights to perform the work publicly, copyright ownership issues, copyright registration, notice of copyright, International copyright law.

**Law of patents:** Foundation of patent law, patent searching process, ownership rights and transfer

**UNIT – IV**

**Trade Secrets:** Trade secret law, determination of trade secret status, liability for misappropriations of trade secrets, protection for submission, trade secret litigation.

Unfair competition: Misappropriation right of publicity, false advertising.

**UNIT – V**

New development of intellectual property: new developments in trade mark law; copyright law, patent law, intellectual property audits.

International overview on intellectual property, international – trade mark law, copyright law, international patent law, and international development in trade secrets law.

**TEXT BOOK:**

1. Intellectual property right, Deborah. E. Bouchoux, Cengage learning.

**REFERENCE BOOK:**

1. Intellectual property right – Unleashing the knowledge economy, prabuddha ganguli, Tata McGraw Hill Publishing company Ltd.

**EC601PC: ANTENNAS AND WAVE PROPAGATION****B.Tech. III Year II Semester**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-requisite:** Electromagnetic Theory and Transmission Lines**Course Objectives:** The course objectives are:

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 analyze the characteristics and design relations of UHF, VHF and Microwave Antennas.
3. To identify the antenna array requirements, to determine the characteristics of ULAs and estimate the patterns of BSA, EFA, and Binomial Arrays.
4. To understand the concepts and set-up requirements for microwave measurements, and familiarize with the procedure to enable antenna measurements.
5. To define and distinguish between different phenomenon of wave propagation (ground wave, space wave and sky wave), their frequency dependence, and estimate their characteristics, identifying their profiles and parameters involved.

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

1. Explain the mechanism of radiation, definitions of different antenna characteristic parameters and establish their mathematical relations.
2. Characterize the antennas based on frequency, configure the geometry and establish the radiation patterns of VHF, UHF and Microwave antennas and also antenna arrays.
3. Specify the requirements for microwave measurements and arrange a setup to carry out the antenna far zone pattern and gain measurements in the laboratory.
4. Classify the different wave propagation mechanisms, determine the characteristic features of different wave propagations, and estimate the parameters involved.

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

**UNIT - I****Antenna Basics:** Basic Antenna Parameters – Patterns, Beam Area, Radiation Intensity, Beam Efficiency, Directivity-Gain-Resolution, Antenna Apertures, Effective Height.

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. Loop Antennas - Small Loop, Comparison of Far Fields of Small Loop and Short Dipole, Radiation Resistances and Directivities of Small Loops (Qualitative Treatment).**UNIT - II****Antenna Arrays:** Point Sources – Definition, Patterns, arrays of 2 Isotropic Sources - Different Cases, Principle of Pattern Multiplication, Uniform Linear Arrays – Broadside Arrays, Endfire Arrays, EFA with Increased Directivity, Derivation of their Characteristics and Comparison, BSAs with Non-uniform Amplitude Distributions – General Considerations and Binomial Arrays.

**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 - III:**

**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 Monofilar Helical Antenna in Axial and Normal Modes, Horn Antennas – Types, Fermat's Principle, Optimum Horns, Design Considerations of Pyramidal Horns.

**UNIT - IV**

**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, Flat Sheet and Corner Reflectors, Paraboloidal Reflectors – Geometry, Pattern Characteristics, Feed Methods, Reflector Types – Related Features.

**UNIT - V**

**Wave Propagation -** Definitions, Categorizations and General Classifications, Different Modes of Wave Propagation, Ray/Mode Concepts,

**Ground Wave Propagation** –Plane Earth Reflections, Space and Surface Waves, Wave Tilt, Curved Earth Reflections.

**Space Wave Propagation** –Field Strength Variation with Distance and Height, Effect of Earth's Curvature, Absorption, Super Refraction, M-Curves and Duct Propagation, Scattering Phenomena, Troposphere Propagation.

**Sky Wave Propagation** –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, 4th ed., (Special Indian Edition), TMH, New Delhi, 2010.
2. E.C. Jordan and K.G. Balmain -Electromagnetic Waves and Radiating Systems, PHI, 2nd ed., 2000.

**REFERENCE BOOKS:**

1. C.A. Balanis - Antenna Theory, 3<sup>rd</sup> Edition. John Wiley & Sons, 2005.
2. K.D. Prasad, Satya Prakashan - Antennas and Wave Propagation, Tech India Publications, New Delhi, 2001.
3. Keith henney - Radio Engineering Handbook, 3<sup>rd</sup> edition TMH.
4. John Leonidas Volakis -Antenna Engineering Handbook, 3<sup>rd</sup> edition, 2007

**EC602PC: DIGITAL SIGNAL PROCESSING****B.Tech. III Year II Semester**

L	T	P	C
3	0	0	3

**Prerequisite:** Signals and Systems**Course Objectives:**

1. To provide background and fundamental material for the analysis and processing of digital signals.
2. To understand the fast computation of DFT and appreciate the FFT processing.
3. To study the designs and structures of digital (IIR and FIR) filters and analyze and synthesize for a given specifications.
4. To acquaint in Multi-rate signal processing techniques and finite word length effects.

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

1. Explore the LTI system characteristics and Multirate signal processing.
2. Establish the inter-relationship between DFT and various transforms.
3. Design a digital filter for a given specification.
4. Demonstrate the various filter structures and effects of round off errors.

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

**UNIT - I**

**Introduction:** Introduction to Digital Signal Processing: Discrete Time Signals & Sequences, conversion of continuous to discrete signal, Normalized Frequency, Linear Shift Invariant Systems, Stability, and Causality, linear differential equation to difference equation, Linear Constant Coefficient Difference Equations, Frequency Domain Representation of Discrete Time Signals and Systems

**Multirate Digital Signal Processing:** Introduction, Down Sampling, Decimation, Up sampling, Interpolation, Sampling Rate Conversion.

**UNIT - II**

**Discrete Fourier series:** Fourier Series, Fourier Transform, Laplace Transform and Z-Transform relation, DFS Representation of Periodic Sequences, Properties of Discrete Fourier Series, Discrete Fourier Transforms: Properties of DFT, Linear Convolution of Sequences using DFT, Computation of DFT: Over-Lap Add Method, Over-Lap Save Method, Relation between DTFT, DFS, DFT and Z-Transform.

**Fast Fourier Transforms:** Fast Fourier Transforms (FFT) - Radix-2 Decimation-in-Time and Decimation-in-Frequency FFT Algorithms, Inverse FFT.

**UNIT - III**

**IIR Digital Filters:** Analog filter approximations – Butterworth and Chebyshev, Design of IIR Digital Filters from Analog Filters, Step and Impulse Invariant Techniques, Bilinear Transformation Method, Spectral Transformations.

**UNIT - IV**

**FIR Digital Filters:** Characteristics of FIR Digital Filters, Frequency Response. Design of FIR Filters: Fourier Method, Digital Filters using Window Techniques, Frequency Sampling Technique, Comparison of IIR & FIR filters.

**UNIT - V**

**Realization of Digital Filters:** Applications of Z – Transforms, Solution of Difference Equations of Digital Filters, System Function, Stability Criterion, Frequency Response of Stable Systems, Realization of Digital Filters – Direct, Canonic, Cascade and Parallel Forms.

**Finite Word Length Effects:** Limit cycles, Overflow Oscillations, Round-off Noise in IIR Digital Filters, Computational Output Round Off Noise, Methods to Prevent Overflow, Trade Off Between Round Off and Overflow Noise, Measurement of Coefficient Quantization Effects through Pole-Zero Movement, Dead Band Effects.

**TEXT BOOKS:**

1. A. V. Oppenheim and R.W. Schaffer - Discrete Time Signal Processing, PHI, 2009
2. John G. Proakis, Dimitris G. Manolakis - Digital Signal Processing, Principles, Algorithms, and Applications, Pearson Education / PHI, 2007.

**REFERENCE BOOKS:**

1. Li Tan - Digital Signal Processing – Fundamentals and Applications, Elsevier, 2008
2. Robert J. Schilling, Sandra L. Harris - Fundamentals of Digital Signal Processing using MATLAB, Thomson, 2007
3. S. Salivahanan, A. Vallavaraj and C. Gnanapriya - Digital Signal Processing, TMH, 2009
4. Emmanuel C. Ifeachor and Barrie W. Jervis - Digital Signal Processing - A Practical approach, 2<sup>nd</sup> Edition, Pearson Education, 2009

**EC603PC: CMOS VLSI DESIGN**

**B.Tech. III Year II Semester**

**L T P C**  
**3 0 0 3**

**Prerequisite:** Electronic Circuit Analysis; Switching Theory and Logic Design

**Course Objectives:** The objectives of the course are to:

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

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

1. Acquire qualitative knowledge about the fabrication process of integrated circuits using MOS transistors.
2. Draw the layout of any logic circuit which helps to understand and estimate parasitic effect of any logic circuit
3. Design building blocks of data path systems, memories and simple logic circuits using PLA, PAL, FPGA and CPLD.
4. Explore 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	1	1	1	-	-	-	1	1
CO2	3	3	2	2	1	1	1	-	-	-	1	1
CO3	3	3	2	2	3	1	1	-	-	-	1	1
CO4	3	3	2	2	3	1	1	-	-	-	1	1

**UNIT - I**

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

**Basic Electrical Properties:** Basic Electrical Properties of MOS and BiCMOS Circuits:  $I_{ds}-V_{ds}$  relationships, MOS transistor threshold Voltage,  $g_m$ ,  $g_{ds}$ , 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, Transistors Layout Diagrams for NMOS and CMOS Inverters and Gates, Scaling of MOS circuits.

**UNIT - III**

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

**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:** Design Approach – PLA, PAL, Standard Cells FPGAs, CPLDs.

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

**TEXT BOOKS:**

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

**REFERENCE BOOKS:**

1. Ming-BO Lin - Introduction to VLSI Systems: A Logic, Circuit and System Perspective, CRC Press, 2011
2. John. P. Uyemura - CMOS logic circuit Design, Springer, 2007.
3. Wayne Wolf - Modern VLSI Design, 3<sup>rd</sup> Edition, Pearson Education, 1997.
4. K. Lal Kishore, V. S. V. Prabhakar -VLSI Design, I.K International, 2009.

**EC621PE: DIGITAL IMAGE PROCESSING (PE – II)****B.Tech. III Year II Semester**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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. Explore the fundamental relations between pixels and utility of 2-D transforms in image processor.
2. Articulate the enhancement, segmentation and restoration processes on an image.
3. Implement the various Morphological operations on an image
4. Utilize basic compression algorithms.

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

**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, 3<sup>rd</sup> 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, 2<sup>nd</sup> Ed, CRC Press, 2011
2. Rafael C. Gonzalez, Richard E Woods and Steven L. Eddings - Digital Image Processing using MATLAB, 2<sup>nd</sup> Edition, TMH, 2010.
3. Somka, Hlavac, Boyle-Digital Image Processing and Computer Vision –Cengage Learning (Indian edition) 2008.
4. Adrian low- Introductory Computer Vision Imaging Techniques and Solutions-,2<sup>nd</sup> Edition, BS Publication, 2008.

**EC622PE: MOBILE COMMUNICATIONS AND NETWORKS (PE-II)****B.Tech. III Year II Semester****L T P C**  
**3 0 0 3****Prerequisites:** Analog and Digital Communications**Course Objectives:**

1. To provide the student with an understanding of the cellular concept, frequency reuse, hand-off strategies.
2. To provide the student with an understanding of Co-channel and Non-Co-Channel interferences.
3. To give the student an understanding of cell coverage for signal and traffic, diversity techniques and channel assignment
4. To give the student an understanding types of handoff.
5. To understand challenges and application of Adhoc wireless Networks.

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

1. Known the evolution of cellular and mobile communication system.
2. Explore the Co-Channel and Non-Co-Channel interferences.
3. Known how to overcome the different fading effects?
4. Familiar with cell coverage for signal and traffic, diversity, techniques, frequency management, Channel assignment and types of handoff.
5. Demonstrate the difference between cellular and Adhoc Networks and design goals of MAC Layer protocol.

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

**UNIT - I**

**Introduction to Cellular Mobile Radio Systems:** Limitations of Conventional Mobile Telephone Systems. Basic Cellular Mobile System, First, Second, Third and Fourth Generation Cellular Wireless Systems. Uniqueness of Mobile Radio Environment-Fading-Tie Dispersion Parameters, Coherence Bandwidth, Doppler Spread and Coherence Time.

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

**UNIT – II**

**Co-Channel Interference:** Measurement of Real Time Co-Channel Interference, Design of Antenna System, Antenna Parameters and their effects, diversity techniques-space diversity, polarization diversity, frequency diversity, time diversity.

**Non Co-Channel Interference:** Adjacent Channel Interference, Near end far end interference, cross talk, effects on coverage and interference by power decrease, antenna height decrease, effects of cell site components.

**UNIT – III**

**Cell Coverage for Signal and Traffic:** Signal Reflections in flat and Hilly Terrain, effects of Human Made Structures, phase difference between direct and reflected paths, constant standard deviation,

straight line path loss slope, general formula for mobile propagation over water and flat open area, near and long-distance propagation, path loss from a point to point prediction model in different conditions, merits of lee model.

**Frequency Management and Channel Assignment:** Numbering and Grouping, Setup Access and Paging Channels, Channel Assignments to Cell Sites and Mobile Units.

#### **UNIT - IV**

**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.

#### **UNIT - V**

**Ad Hoc Wireless Networks:** Introduction, Cellular and Ad Hoc wireless Networks, Applications and Ad Hoc Wireless Networks, Issues in Ad Hoc Wireless Networks, Ad Hoc Wireless Internet, MAC Protocols for Ad Hoc Wireless, Introduction, issues in designing AMAC Protocol for Ad Hoc wireless Networks, Design Goals of AMAC protocol for Ad Hoc Wireless Networks, Classification of MAC Protocols.

#### **TEXT BOOKS:**

1. W.C.Y. Lee - Mobile Cellular Telecommunications, 2<sup>nd</sup> edition, Mc Graw Hill, 1989.
2. Theodore. S. Rapport - Wireless Communications, 2<sup>nd</sup> edition, Pearson Education, 2002.

#### **REFERENCE BOOKS:**

1. C. Siva ram Murthy and B.S. Manoj - Ad Hoc Wireless Networks: Architectures and Protocols, PHI, 2004.
2. Simon Haykin, Michael Moher - Modern Wireless Communications, Pearson Education, 2005.
3. Vijay Garg - Wireless Communications and Networking, Elsevier Publications, 2007.
4. Andrea Goldsmith -Wireless Communications-, Cambridge University Press, 2005.

**EC623PE: EMBEDDED SYSTEM DESIGN (PE-II)****B.Tech. III Year II Semester**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Prerequisite:** Microprocessors and Microcontrollers; Computer Organization and Operating Systems**Course Objectives:**

1. To provide an overview of Design Principles of Embedded System.
2. To provide clear understanding about the role of firmware.
3. To understand the necessity of operating systems in correlation with hardware systems.
4. To learn the methods of interfacing and synchronization for tasking.

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

1. Familiarize the selection procedure of Processors in the embedded domain.
2. Design Procedure for Embedded Firmware.
3. Visualize the role of Real time Operating Systems in Embedded Systems.
4. Evaluate the Correlation between task synchronization and latency issues

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

**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), Memory: ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces.

**UNIT - III**

**Embedded Firmware:** Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, Real Time Clock, Watchdog Timer, Embedded Firmware Design Approaches and Development Languages.

**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, Methods to Choose an RTOS.

**TEXT BOOK**

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

**REFERENCE BOOKS:**

1. Raj Kamal - Embedded Systems, TMH.
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.

**EC604PC: DIGITAL SIGNAL PROCESSING LABORATORY****B.Tech. III Year II Semester**

L	T	P	C
0	0	2	1

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

**Note:** - Minimum of 12 experiments has to be conducted.

**List of Experiments:**

1. Generation of Sinusoidal Waveform / Signal based on Recursive Difference Equations
2. Histogram of White Gaussian Noise and Uniformly Distributed Noise.
3. To find DFT / IDFT of given DT Signal
4. To find Frequency Response of a given System given in Transfer Function/ Differential equation form.
5. Obtain Fourier series coefficients by formula and using FET and compare for half sine wave.
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.

**EC605PC: CMOS VLSI DESIGN LABORATORY****B.Tech. III Year II Semester**

L	T	P	C
0	0	2	1

**Note:** Any **SIX** of the following experiments from each part are to be conducted (Total 12)

**Part - I**

**All the following experiments have to be implemented using HDL**

1. Realize all the logic gates
2. Design of 8-to-3 encoder (without and with priority) and 2-to-4 decoder
3. Design of 8-to-1 multiplexer and 1-to-8 demultiplexer
4. Design of 4 bit binary to gray code converter
5. Design of 4 bit comparator
6. Design of Full adder using 3 modeling styles
7. Design of flip flops: SR, D, JK, T
8. Design of 4-bit binary, BCD counters (synchronous/ asynchronous reset) or any sequence counter
9. Finite State Machine Design

**Part - II**

**Layout, physical verification, placement & route for complex design, static timing analysis, IR drop analysis and crosstalk analysis for the following:**

1. Basic logic gates
2. CMOS inverter
3. CMOS NOR/ NAND gates
4. CMOS XOR and MUX gates
5. Static / Dynamic logic circuit (register cell)
6. Latch
7. Pass transistor
8. Layout of any combinational circuit (complex CMOS logic gate).

**EC605PC: ADVANCED COMMUNICATIONS LABORATORY****B.Tech. III Year II Semester**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**Note: Minimum Eight experiments should be conducted:**

1. Study the features of Network and spectrum analyzer
2. Simulate the Radiation pattern for different antennas using HFSS/ ADS/Matlab and compare the measurement using Network analyzer.
  - i. Dipole Antenna
  - ii. Horn antenna
  - iii. Microstrip Antenna etc.
3. Simulate the Radiation resistance for different antennas using HFSS/ ADS/ MATLAB and compare the measurement using Network analyzer.
  - i. Dipole Antenna
  - ii. Horn antenna
  - iii. Microstrip Antenna etc.
4. Plotting eye diagram for baseband signal using MATLAB and verifying using Network analyzer.
5. Plotting Constellation Diagram of QAM using MATLAB and verify using kit.
6. OFDM generation and detection using Simulink and verify using kit.
7. Generation of different types of signals using Vector Signal Generator
8. Modulation analysis on digital modulated single carrier signals using MATLAB.
9. Reading analog and digital sensors data using UART Using ICONT setup.
10. Collecting sensor values of remote nodes using RIME broadcasting Using ICONT setup.

**\*MC609: ENVIRONMENTAL SCIENCE****B.Tech. III Year II Semester**

L	T	P	C
0	0	2	1

**Course Objectives:**

1. Understanding the importance of ecological balance for sustainable development.
2. Understanding the impacts of developmental activities and mitigation measures
3. Understanding the environmental policies and regulations

**Course Outcomes:** Based on this course, the Engineering graduate will

1. understand /evaluate / develop technologies on the basis of ecological principles and environmental regulations which in turn helps in sustainable development

**UNIT - I**

**Ecosystems:** Definition, Scope and Importance of ecosystem. Classification, structure, and function of an ecosystem, Food chains, food webs, and ecological pyramids. Flow of energy, Biogeochemical cycles, Bioaccumulation, Biomagnification, ecosystem value, services and carrying capacity, Field visits.

**UNIT - II**

**Natural Resources: Classification of Resources:** Living and Non-Living resources, **water resources:** use and over utilization of surface and ground water, floods and droughts, Dams: benefits and problems. **Mineral resources:** use and exploitation, environmental effects of extracting and using mineral resources, **Land resources:** Forest resources, **Energy resources:** growing energy needs, renewable and non renewable energy sources, use of alternate energy source, case studies.

**UNIT - III**

**Biodiversity And Biotic Resources:** Introduction, Definition, genetic, species and ecosystem diversity. Value of biodiversity; consumptive use, productive use, social, ethical, aesthetic and optional values. India as a mega diversity nation, Hot spots of biodiversity. Field visit. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts; conservation of biodiversity: In-Situ and Ex-situ conservation. National Biodiversity act.

**UNIT - IV**

**Environmental Pollution and Control Technologies: Environmental Pollution:** Classification of pollution, **Air Pollution:** Primary and secondary pollutants, Automobile and Industrial pollution, Ambient air quality standards. **Water pollution:** Sources and types of pollution, drinking water quality standards. **Soil Pollution:** Sources and types, Impacts of modern agriculture, degradation of soil. **Noise Pollution:** Sources and Health hazards, standards, **Solid waste:** Municipal Solid Waste management, composition and characteristics of e-Waste and its management. **Pollution control technologies:** Wastewater Treatment methods: Primary, secondary and Tertiary. Overview of air pollution control technologies, Concepts of bioremediation. **Global Environmental Problems and Global Efforts:** Climate change and impacts on human environment. Ozone depletion and Ozone depleting substances (ODS). Deforestation and desertification. International conventions / Protocols: Earth summit, Kyoto protocol, and Montréal Protocol.

**UNIT - V**

**Environmental Policy, Legislation & EIA:** Environmental Protection act, Legal aspects Air Act- 1981, Water Act, Forest Act, Wild life Act, Municipal solid waste management and handling rules, biomedical waste management and handling rules, hazardous waste management and handling rules. EIA: EIA structure, methods of baseline data acquisition. Overview on Impacts of air, water, biological and Socio-economical aspects. Strategies for risk assessment, Concepts of Environmental Management Plan

(EMP). **Towards Sustainable Future:** Concept of Sustainable Development, Population and its explosion, Crazy Consumerism, Environmental Education, Urban Sprawl, Human health, Environmental Ethics, Concept of Green Building, Ecological Foot Print, Life Cycle assessment (LCA), Low carbon life style.

**TEXT BOOKS:**

1. Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission.
2. Environmental Studies by R. Rajagopalan, Oxford University Press.

**REFERENCE BOOKS:**

1. Environmental Science: towards a sustainable future by Richard T. Wright. 2008 PHL Learning Private Ltd. New Delhi.
2. Environmental Engineering and science by Gilbert M. Masters and Wendell P. Ela. 2008 PHI Learning Pvt. Ltd.
3. Environmental Science by Daniel B. Botkin & Edward A. Keller, Wiley INDIA edition.
4. Environmental Studies by Anubha Kaushik, 4<sup>th</sup> Edition, New age international publishers.
5. Text book of Environmental Science and Technology - Dr. M. Anji Reddy 2007, BS Publications.