

III Year			I Semester				
S. No.	Course Type	Course Code	Course Title	Periods Per Week			Credits
				L	T	P	
1	PCC	EC501PC	Microprocessors & Microcontrollers	3	1	0	4
2	ESC	CS502ES	Data Communications and Networks	3	1	0	4
3	ESC	EE503ES	Control Systems	3	1	0	4
4	HSMC	SM504MS	Business Economics & Financial Analysis	3	0	0	3
5	PEC		Professional Elective - I	3	0	0	3
6	PCC	EC505PC	Microprocessors & Microcontrollers Lab	0	0	3	1.5
7	PCC	EC506PC	Data Communications and Networks Lab	0	0	3	1.5
8	HSMC	EN508HS	Advanced English Communication Skills Lab	0	0	2	1
9	MC	MC509	Intellectual Property Rights	3	0	0	0
10	MC	MC510EC	Fundamentals of Cyber Security	3	0	0	0
11	MC	MC511EC	Internship in industry	0	0	0	0
Total				21	3	8	22

III Year			II Semester				
S. No.	Course Type	Course Code	Course Title	Periods Per Week			Credits
				L	T	P	
1	PCC	EC601PC	Antennas and Propagation	3	1	0	4
2	PCC	EC602PC	Digital Signal Processing	3	1	0	4
3	PCC	EC603PC	VLSI Design	3	1	0	4
4	PEC		Professional Elective - II	3	0	0	3
5	OEC		Open Elective - I	3	0	0	3
6	PCC	EC604PC	Digital Signal Processing Lab	0	0	3	1.5
7	PCC	EC605PC	e – CAD Lab	0	0	3	1.5
8	PCC	EC606PC	Scripting Languages Lab	0	0	2	1
9	MC	MC601EC	Numerical Ability & Reasoning	3	0	0	0
10	MC	MC602EC	Fundamentals of Artificial Intelligence	3	0	0	0
Total				21	3	8	22

Note: *MC =Satisfactory/Unsatisfactory

***Open Elective** – Students should take Open Electives from List of Open Electives Offered by Other Departments / Branches Only.
These are the list of open electives offered by our branch to other branches

IV Year				I Semester			
S. No.	Course Type	Course Code	Course Title	Periods Per Week			Credits
				L	T	P	
1	PCC	EC701PC	Microwave and Optical Communications	3	0	0	3
2	PEC		Professional Elective - III	3	0	0	3
3	PEC		Professional Elective - IV	3	0	0	3
4	OEC		Open Elective - II	3	0	0	3
5	HSMC	SM701MS	Professional Practice, Law & Ethics	2	0	0	2
6	PROJ	EC703PC	Project Phase-1	0	0	6	3
7	PCC	EC704PC	Microwave and Optical Communications Lab	0	0	2	1
8	PROJ	EC705PC	Industry Oriented Mini Project	0	0	0	2
9	PROJ	EC706PC	Seminar	0	0	2	1
Total				14	0	10	21

NOTE: Industrial Oriented Mini Project/ Summer Internship is to be carried out during the summer vacation between 6th and 7th semesters. Students should submit report of Industrial Oriented Mini Project/ Summer Internship for evaluation.

IV Year				II Semester			
S. No	Course Type	Course Code	Course Title	Periods Per We			Credits
				L	T	P	
1	OEC		Open Elective - III	3	0	0	3
2	PEC		Professional Elective - V	3	0	0	3
3	PEC		Professional Elective - VI	3	0	0	3
4	PROJ	EC801PC	Project Phase -2	0	0	14	7
Total				9	0	14	16

Professional Elective –I

EC511PE	Error Correcting Codes
EC512PE	Mobile Communications and Networks
EC513PE	Electronic Measurements and Instrumentation

Professional Elective–II

EC611PE	Speech Processing
EC612PE	EMI & EMC
EC613PE	Embedded System Design

Professional Elective –III

EC711PE	Digital Image Processing
EC712PE	Radar Systems
EC713PE	Artificial Neural Networks

Professional Elective–IV

EC721PE	Adaptive Signal Processing
EC722PE	Satellite Communications
EC723PE	Internet of Things

Professional Elective–V

EC811PE	Global Navigation Satellite Systems
EC812PE	Wireless Sensor Networks
EC813PE	Test and Testability

Professional Elective–VI

EC821PE	System on Chip Architecture
EC822PE	Television Engineering
EC823PE	Low Power VLSI Design

***Open Elective** – Students should take Open Electives from List of Open Electives Offered by Other Departments/Branches Only.

These are the list of open electives offered by our branch to other branches

Open Elective - 1
Fundamentals of Internet of Things

Open Elective - 2
Electronic Sensors

Open Elective - 3
Measuring Instruments

EC501PC:MICROPROCESSORSANDMICROCONTROLLERS

B. Tech. III Year I Semester

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P		CIA	SEE	Total
EC501PC	PCC	3	1	-	4	30	70	100

Prerequisite: Nil

Course Objectives:

- To develop an understanding of the functionality of microprocessors; Assembly language programming and interfacing techniques.
- To provide knowledge on functionality of microcontrollers; Assembly language programming and interfacing techniques.
- To develop an understanding of the operations and Programming of ARM Processor
- To study the basic concepts of Advanced ARM processors (A, R, M profile) and their applications.

- **Course Outcomes:** Upon completing this course, the student will be able to
- Understand the 8086 μ p architecture, its operation and apply the knowledge of instruction set & assembler directives to write Programs using MASM.
- Understand the 8051 μ c architecture, its operation and apply the knowledge of instruction set to design applications.
- Apply the knowledge of 8051 μ c and Communication protocols to interface I/O devices.
- Understand the ARM processor internal architecture, apply the knowledge of instruction set to design applications.
- Understand the ARM CORTEX and OMAP Processor architecture and their applications.

Unit: I **8086Architecture**

8086Architecture:8086Architecture-Functional diagram, Register Organization, Memory Segmentation, Programming Model, Memory addresses, Physical Memory Organization, rchitectureof8086,Signal descriptionsof8086,interruptsof8086.

Instruction Set and Assembly Language Programming of 8086: Instruction formats, Addressing modes, Instruction Set,AssemblerDirectives,Macros,andSimpleProgramsinvolvingLogical,BranchandCall Instructions, Sorting, String Manipulations.

Unit: II **Introduction to Microcontrollers & 8051 Real Time Control**

Introduction to Microcontrollers: Overview of 8051 Microcontroller, Architecture, I/O Ports, Memory Organization, Addressing Modes and Instructionsetof8051.

8051 Real Time Control: Programming Timer Interrupts, Programming External Hardware Interrupts, Programming the Serial Communication Interrupts,Programming8051TimersandCounters

Unit: III **I/O And Memory Interface, Serial Communication and Bus Interface**

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 CommunicationInterfaces-RS232,USB.

Unit: IV **ARM Architecture**

ARM Architecture: ARM Processor fundamentals, ARM Architecture – Register, CPSR, Pipeline, exceptions and interrupts interrupt vectortable,ARMinstructionset– Dataprocessing,Branchinstructions,loadstoreinstructions,Softwareinterruptinstructions,Programstatusregisterinstructions,loadingconstants,Conditionalexecution,IntroductiontoThumbinstructions.

Unit: V **Advanced ARM Processors**

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

Text Books:

1. Advanced Microprocessors and Peripherals – A. K. Ray and K. M. Bhurchandani, TMH, 2nd Edition 2006.
2. ARM System Developers Guide, Andrew SLOSS, Dominic SYMES, Chris WRIGHT, Elsevier, 2012

Reference Books:

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

Web References:

1. <https://www.arm.com/>
2. <https://www.intel.com/content/www/us/en/homepage.html>
3. https://onlinecourses.nptel.ac.in/noc20_ee42/preview
4. <https://ict.iitk.ac.in/courses/microprocessors-and-microcontrollers/>
5. <https://en.wikipedia.org/wiki/Microcontroller>
<https://nptel.ac.in/courses/108/105/108105102/>

E-Text Books:

1. <https://nptel.ac.in/courses/108/103/108103157/>
2. <https://nptel.ac.in/courses/106/105/106105193/>
<https://www.pdfdrive.com/arm-microprocessor-systems-cortex-m-architecture-programming-and-interfacing-e157100364.html>

CS502ES: DATA COMMUNICATIONS AND NETWORKS

B. Tech. III Year I Semester

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P		CIA	SEE	Total
EC501PC	PC	3	1	-	4	30	70	100

Prerequisite: Digital Communications

Course Objectives:

- To introduce the Fundamentals of data communication networks
- To demonstrate the Functions of various protocols of Data link layer.
- To demonstrate Functioning of various Routing protocols.
- To introduce the Functions of various Transport layer protocols.
- To understand the significance of application layer protocols

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

- Know the Categories and functions of various Data communication Networks
- Design and analyze various error detection techniques.
- Demonstrate their mechanism of routing the data in network layer
- Know the significance of various Flow control and Congestion control Mechanisms
- Know the Functioning of various Application layer Protocols.

Unit: I Introduction to Data Communications

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

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

The Network Layer: Introduction, Forwarding and Routing, Network Service Models, Virtual Circuit and Datagram Networks- Virtual-Circuit Networks, Datagram Networks, Origin 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

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 Cost of Congestion, Approaches to Congestion Control

Unit: V Application Layer

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- SMTP, 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. Computer Networking A Top-Down Approach–Kurose James F, Keith W, 6thEdition,Pearson.
2. DataCommunicationsandNetworkingBehrouzA.Forouzan4thEditionMcGraw-HillEducation

Reference Books:

1. DatacommunicationandNetworks-BhusanTrivedi,Oxforduniversitypress,2016
2. Computer Networks-- AndrewSTanenbaum,4thEdition,PearsonEducation
UnderstandingCommunicationsandNetworks,3rdEdition,W.A.Shay,CengageLearning

EE503ES:CONTROLSYSTEMS

B. Tech. III Year I Semester

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P		CIA	SEE	Total
EE503ES	ESC	L	T	P	C	CIA	SEE	Total
		3	1	-	4	30	70	100

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

Course Objectives:

- To understand the different ways of system representation such as Transfer function representation and state space representations and to assess the system dynamic response
- To assess the system performance using time domain analysis and methods for improving it
- To assess the system performance using frequency domain analysis and techniques for improving the performance
- To design various controllers and compensators to improve system performance

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

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

Unit: I Introduction to Control Problem

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 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

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

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 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 control ability and observability. Pole-placement by state feedback. Discrete-time systems. Difference Equations. State-space model for 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								
Course Code	Category	Hours/Week			Credits	Maximum Marks		
SM504MS	HSMC	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100
Prerequisite: Nil								
Course Objectives:								
<ul style="list-style-type: none"> ➤ To learn the basic business types, impact of the economy on Business and Firmsspecifically. To analyze the Business from the Financial Perspective 								
Course Outcomes: Upon completing this course, the student will be able to								
<ul style="list-style-type: none"> ➤ The students will understand the various Forms of Business and the impact of economic variables on the Business. The Demand, Supply, Production, Cost, Market Structure, Pricing aspects are learnt. The Students can study the firm’s financial position by analysing the Financial Statements of a Company. 								
Unit: I	Introduction to Business and Economics							
<p>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.</p> <p>Economics:SignificanceofEconomics, MicroandMacroEconomicConcepts, ConceptsandImportance of National Income, Inflation, Money Supply and Inflation, Business Cycle, Features and Phases of Business Cycle. Nature and Scope of Business Economics, Role of Business Economist, Multidisciplinary nature Business Economics.</p>								
Unit: II	Demand and Supply Analysis							
<p>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.</p> <p>Supply Analysis: Determinants of Supply, Supply Function and Law of Supply.</p>								
Unit: III	Production, Cost, Market Structures & Pricing							
<p>Production Analysis: Factors of Production, Production Function, Production Function with one variableinput, two variable inputs, Returns to Scale, Different Types of Production Functions.</p> <p>Cost analysis: Types of Costs, Short run and Long run Cost Functions.</p> <p>Market Structures: Nature of Competition, Features of Perfect competition, Monopoly, Oligopoly, Monopolistic Competition.</p> <p>Pricing: Types of Pricing, Product Life Cycle based Pricing, Break Even Analysis, Cost Volume Profit Analysis.</p>								
Unit: IV	Financial Accounting							
<p>Financial Accounting: Accounting concepts and Conventions, Accounting Equation, Double-Entry system of Accounting, Rules for maintaining Books of Accounts, Journal, Posting toLedger,PreparationofTrialBalance,ElementsofFinancialStatements,PreparationofFinalAccounts.</p>								
Unit: V	Financial Analysis through Ratios							
<p>FinancialAnalysissthroughRatios:ConceptofRatioAnalysis,Importance,LiquidityRatios,Turnover Ratios, Profitability Ratios, Proprietary Ratios, Solvency, Leverage Ratios – Analysis and Interpretation(simple problems).</p>								

Text Books:

1. D.D.Chaturvedi,S.L.Gupta,BusinessEconomics-TheoryandApplications,InternationalBookHouse Pvt.Ltd.2013.
2. Dhanesh K Khatri, Financial Accounting, Tata Mc–GrawHill,2011.
3. Geethika Ghosh, Piyali Gosh, PurbaRoyChoudhury,ManagerialEconomics,2e,TataMcGrawHill Education Pvt.Ltd.2012.

Reference Books:

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

EC511PE: ERROR CORRECTING CODES

B. Tech. III Year I Semester								
Course Code	Category	Hours/Week			Credits	Maximum Marks		
EC511PE	PEC	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100
Prerequisite: Digital Communications								
Course Objectives:								
<ul style="list-style-type: none"> ➤ To acquire the knowledge in measurement of information and errors. ➤ To study the generation of various code methods used in communications. ➤ To study the various application of codes. 								
Course Outcomes: Upon completing this course, the student will be able to								
<ul style="list-style-type: none"> ➤ Able to transmit and store reliable data and detect errors in data through coding. ➤ Able to understand the designing of various codes like block codes, cyclic codes, convolution codes, turbo code and space codes. 								
Unit: I	Coding for Reliable Digital Transmission and storage, Linear Block Codes							
<p>Coding for Reliable Digital Transmission and storage: Mathematical model of Information, A Logarithmic Measure of Information, Average and Mutual Information and Entropy, Types of Errors, Error Control Strategies.</p> <p>Linear Block Codes: Introduction to Linear Block Codes, Syndrome and Error Detection, Minimum Distance of a Block code, Error-Detecting and Error-correcting Capabilities of a Block code, Standard array and Syndrome Decoding, Probability of an undetected error for Linear Codes over a BSC, Hamming Codes. Applications of Block codes for Error control in data storage system</p>								
Unit: II	Cyclic Codes							
<p>Cyclic Codes: Description, Generator and Parity-check Matrices, Encoding, Syndrome Computation and Error Detection, Decoding, Cyclic Hamming Codes, Shortened cyclic codes, Error-trapping decoding for cyclic codes, Majority logic decoding for cyclic codes.</p>								
Unit: III	Convolutional Codes							
<p>Convolutional Codes: Encoding of Convolutional Codes, Structural and Distance Properties, maximum likelihood decoding, Sequential decoding, Majority-logic decoding of Convolution codes. Application of Viterbi Decoding and Sequential Decoding, Applications of Convolutional codes in ARQ system.</p>								
Unit: IV	Turbo Codes							
<p>Turbo Codes: LDPC Codes- Codes based on sparse graphs, Decoding for binary erasure channel, Log-likelihood algebra, Brief propagation, Product codes, Iterative decoding of product codes, Concatenated convolutional codes- Parallel concatenation, The UMTS Turbo code, Serial concatenation, Parallel concatenation, Turbo decoding</p>								
Unit: V	Space-Time Codes							
<p>Space-Time Codes: Introduction, Digital modulation schemes, Diversity, Orthogonal space- Time Block codes, Alamouti's schemes, Extension to more than Two Transmit Antennas, Simulation Results, Spatial Multiplexing: General Concept, Iterative APP Preprocessing and Per-layer Decoding, Linear Multilayer Detection, Original BLAST Detection, QLD decomposition and Interface Cancellation, Performance of Multi-Layer Detection Schemes, Unified Description by Linear Dispersion Codes.</p>								

Text Books:

1. Error Control Coding-Fundamentals and Applications–ShuLin, DanielJ. Costello, Jr, Prentice Hall, Inc.
2. Error Correcting Coding Theory-Man Young Rhee- 1989,McGraw-Hill

Reference Books:

1. Error CorrectingCodingTheory-ManYoungRhee-1989,McGraw– HillPublishing,19
2. Digital Communications-Fundamental and Application-Bernard Sklar, PE.
3. Digital Communications-John G. Proakis, 5thed., 2008, TMH.
4. Introduction to Error Control Codes-Salvatore Gravano-oxford
5. ErrorCorrectionCoding–MathematicalMethodsandAlgorithms–ToddK.Moon,2006, Wiley India.
6. Information Theory, Coding and Cryptography–RanjanBose,2nd Edition,2009,TMH.

EC512PE: MOBILE COMMUNICATIONS AND NETWORKS

B. Tech. III Year I Semester

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P		CIA	SEE	Total
EC512PE	PE	3	-	-	3	30	70	100

Prerequisite: 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 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. The student will be able to understand Co-Channel and Non-Co-Channel interferences.
3. Understand impairments due to multipath fading channel and 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. Know the difference between cellular and Adhoc Networks and design goals of MAC Layer protocol.

Unit: I	Introduction to Cellular Mobile Radio Systems, Fundamentals of Cellular Radio System Design
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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, Non Co-Channel Interference
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Co-Channel Interference: Measurement of Real Time Co-Channel Interference, Design of Antenna System, Antenna Parameter and their effects, diversity techniques-spacediversity, polarization diversity, frequency diversity, time diversity.

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

Unit: III	Cell Coverage for Signal and Traffic, Frequency Management and Channel Assignment
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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 free 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
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Handoffs and Dropped Calls: Handoff Initiation, types of Handoff, Delaying Handoff, advantages of hand off, Power Difference Handoff, Forced Handoff, Mobile Assisted and Soft Handoff, Intersystem hand off, Introduction to Dropped Call Rates and their Evaluation.

Unit: V**Ad Hoc Wireless Networks**

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. Mobile Cellular Telecommunications-W.C.Y. Lee, McGraw Hill,2nd Edn.,1989.
2. Wireless Communications-Theodore.S. Rapport, Pearson Education, 2ndEdn., 2002.

Reference Books:

1. AdHoc Wireless Networks: Architectures and Protocols- C.Sivaram Murthy and B.S.Manoj, 2004,PHI.
2. Modern Wireless Communications- Simon Haykin, Michael Moher, PearsonEducation,2005.
3. Wireless Communications and Networking, Vijay Garg, ElsevierPublications,2007.
4. Wireless Communications-Andrea Goldsmith, Cambridge UniversityPress,2005.

EC513PE:ELECTRONICMEASUREMENTSANDINSTRUMENTATION

B. Tech. III Year I Semester

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P		CIA	SEE	Total
EC513PE	PEC	3	-	-	3	30	70	100

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 bridge 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.

Unit: I Block Schematics of Measuring Systems

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

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, Special Purpose Oscilloscopes

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:

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, Magnetostrictive Transducers, gyroscopes, accelerometers.

Unit: V Bridges, Measurement of Physical Parameters

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 5th Edition 2003.
2. Electronic Instrumentation: H. S. Kalsi – TMH, 2nd Edition 2004.

Reference Books:

1. Electrical and Electronic Measurement and Measuring Instruments – AK 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: MICROPROCESSORS AND MICROCONTROLLERS LAB

B. Tech. III Year I Semester

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
EC505PC	PC	-	-	3	1.5	30	70	100

Prerequisite:

Course Objectives:

1. To develop an understanding of the Assembly language programming on an 8086 Microprocessor.
2. To develop an understanding of the interfacing techniques with 8086 Microprocessor.
3. To develop an understanding of Assembly language programming using Keil IDE on 8051 μ c.
4. To develop an understanding of the interfacing techniques with 8051 Microcontroller.

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

- Understand and apply the knowledge of addressing modes, instruction set & assembler directives of 8086 to perform arithmetic operations, sorting String programs using MASM.
- Design & test the function of Stepper motor and 8255 by interfacing with 8086.
- Understand and apply the knowledge of addressing modes, instruction set of 8051 to perform arithmetic, logical & bit manipulation programs using Keil.
- Able to verify the operation of timer/counter/UART/interrupt handler in 8051.

List of Experiments:

Cycle 1: Using 8086 Processor Kits and/or Assembler (6 Weeks)

1. Assembly Language Programs to perform Arithmetic, Logical, and String Operations.
2. Assembly Language Programs to perform Rotate, Shift, Swap and Branch Operations.
3. Interfacing stepper motor, ADC & DAC to 8086.

Cycle 2: Using Keil IDE- (5 weeks)-

1. Assembly Language Programs to Perform Arithmetic, Logical Operations.
2. Assembly Language Programs to perform Rotate, Shift, Swap and Branch Instructions
3. Time delay Generation Using Timers of 8051.
4. UART operation (Serial communication) in 8051.
5. Program and verify interrupt handling in 8051.

Cycle 3: Interfacing I/O Devices to 8051 (5 Weeks)

1. Interfacing LCD to 8051
2. Interfacing Matrix Keyboard to 8051
3. Interfacing 8-bit ADC to 8051.
4. Interfacing DAC to 8051.

List of Equipment Required:

1. Computer Systems(Intel) with Windows 7 or higher Operating System
2. MASM611 Software (Open source)
3. Keil μ Vision IDE Software (Open Source)
4. 8086 μ p kits, stepper motor interfacing module, 8051 μ c kits, LCD interfacing module, Matrix Keyboard interfacing module, ADC interfacing module, DAC interfacing module.

Text Books:

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

Reference Books:

1. Microprocessors and Interfacing, D. V. Hall, MGH, 2nd Edition 2006.2. Introduction to Embedded Systems, Shibu K.V, MHE, 2009
2. The 8051 Microcontrollers, Architecture and Programming and Applications -K.UmaRao, Andhe Pallavi, Pearson, 2009.

Web References:

1. <https://www.arm.com/>
2. <https://www.intel.com/content/www/us/en/homepage.html>
3. https://online.courses.nptel.ac.in/noc20_ee42/preview
4. <https://ict.iitk.ac.in/courses/microprocessors-and-microcontrollers/>
5. <https://en.wikipedia.org/wiki/Microcontroller>
6. <https://nptel.ac.in/courses/108/103/108103157/>
7. <https://nptel.ac.in/courses/106/105/106105193/>

E-Text Books:

1. <https://nptel.ac.in/courses/108/103/108103157/>
 2. <https://nptel.ac.in/courses/106/105/106105193/>
- <https://www.pdfdrive.com/arm-microprocessor-systems-cortex-m-architecture-programming-and-interfacing-e157100364.html>

EC506PC: DATA COMMUNICATIONS AND NETWORKS LAB

B. Tech. III Year I Semester

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P		CIA	SEE	Total
EC506PC	PC							
		-	-	3	1.5	30	70	100

Note:

- A. Minimum of 12 Experiments have to be conducted
- B. All the Experiments may be Conducted using Network Simulation software like NS-2, NSG-2.1 and WireSHARK/equivalent software.

Note: For Experiments 2 to 10 Performance may be evaluated through simulation by using the parameters Throughput, Packet Delivery Ratio, Delay etc

List of Experiments:

1. Writing a TCL Script to create two nodes and links between nodes
2. Writing a TCL Script to transmit data between nodes
3. Evaluate the performance of various LANT topologies
4. Evaluate the performance of Drop Tail and RED queue management schemes
5. Evaluate the performance of CBQ and FQ Scheduling Mechanisms
6. Evaluate the performance of TCP and UDP Protocols
7. Evaluate the performance of TCP, New Reno and Vegas
8. Evaluate the performance of AODV and DSR routing protocols
9. Evaluate the performance of AODV and DSDV routing protocols
10. Evaluate the performance of IEEE 802.11 and IEEE 802.15.4
11. Evaluate the performance of IEEE 802.11 and SMAC
12. Capturing and Analysis of TCP and IP Packets
13. Simulation and Analysis of ICMP and IGMP Packets
14. Analyze the Protocols SCTP, ARP, Net BIOS, IPXVINES
15. Analysis of HTTP, DNS and HCP Protocols

EN508HS: ADVANCED ENGLISH COMMUNICATION SKILLS LAB

C. Tech. III Year I Semester								
Course Code	Category	Hours/Week			Credits	Maximum Marks		
EN508HS	HSMC	L	T	P	C	CIA	SEE	Total
		-	-	2	1	30	70	100

1. INTRODUCTION:

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

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

- Gathering ideas and information to organize ideas relevantly and coherently.
- Engaging in debates.
- Participating in group discussions.
- Facing interviews.
- Writing project/ research reports / technical reports.
- Making or presentations.
- Writing formal letters.
- Transferring information from non-verbal to verbal texts and vice-versa.
- Taking part in social and professional communication.

Course Objectives:

1. OBJECTIVES:

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

- To improve the students' fluency in English, through a well-developed vocabulary and enable them to listen to English spoken at normal conversational speed by educated English speakers and respond appropriately in different socio-cultural and professional contexts.
- Further, they would be required to communicate their ideas relevantly and coherently in writing.
- To prepare all the students for their placements.

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

1. **Activities on Fundamentals of Inter-personal Communication and Building Vocabulary** – Starting a conversation – responding appropriately and relevantly – using the right body language
– Role Play in different situations & Discourse Skills – using visuals – Synonyms and antonyms, word roots, one-word substitutes, prefixes and suffixes, study of word origin, business vocabulary, analogy, idioms and phrases, collocations & usage of vocabulary.
2. **Activities on Reading Comprehension** – General Vs Local comprehension, reading for facts, guessing meanings from context, scanning, skimming, inferring meaning, critical reading & effective googling.
3. **Activities on Writing Skills** – Structure and presentation of different types of writing – *letter writing/Resumewriting/e-correspondence/Technical report writing* – planning for writing – improving one's writing.
4. **Activities on Presentation Skills** – Oral presentations (individual and group) through JAM sessions/seminars/PPTs and written presentation through posters/projects/reports/e-mails/assignments etc.
5. **Activities on Group Discussion and Interview Skills** – Dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and organization of ideas and rubrics for evaluation – Concept and process, pre-interview planning, opening strategies, answering strategies, interview through tele-conference & video-conference and Mock Interviews.

List of Equipment Required:

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 coustics.
 - Round Table swithmovablechairs
 - Audio-visualaids
 - LCD Projector
 - Public Address system
 - P –IV Processor, HardDisk –80GB, RAM–512MB Minimum, Speed–2.8GHZ
 - 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.

- Oxford Advanced Learner's Compass, 7th Edition
- DELTA' skey to the Next Generation TOEFL Test: Advanced Skill Practice.
- Lingua TOEFL CBT Insider, by Dreamtech
- TOEFL & GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)

Text Books:

1. Effective Technical Communication by M Asharaf Rizvi. McGraw Hill Education (India) Pvt. Ltd. 2nd Edition

Academic Writing: A Handbook for International Students by Stephen Bailey, Routledge, 5th Edition

Reference Books:

1. Learn Correct English – A Book of Grammar, Usage and Composition by Shiv K. Kumar and Hemalatha Nagarajan. Pearson 2007
2. Professional Communication by Aruna Koneru, McGraw Hill Education (India) Pvt. Ltd, 2016.
3. Technical Communication by Meenakshi Raman & Sangeeta Sharma, Oxford University Press 2009.
4. Technical Communication by Paul V. Anderson. 2007. Cengage Learning Pvt. Ltd. New Delhi.
5. English Vocabulary in Use series, Cambridge University Press 2008.
6. Handbook for Technical Communication by David A. McMurrey & Joanne Buckley. 2012. Cengage Learning.
7. Communication Skills by Leena Sen, PHIL earning Pvt Ltd., New Delhi, 2009.
8. Job Hunting by Colm Downes, Cambridge University Press 2008.
9. English for Technical Communication for Engineering Students, Aysa Vishwamohan, Tata McGraw-Hill 2009.

MC509: INTELLECTUAL PROPERTY RIGHTS

B. Tech. III Year I Semester								
Course Code	Category	Hours/Week			Credits	Maximum Marks		
MC509	MC	L	T	P	C	CIA	SEE	Total
		3	-	-	-	30	70	100
Unit: I	Introduction to Intellectual property							
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							
Trade Marks: Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting, and evaluating trademark, trademark registration processes.								
Unit: III	Law of copy rights, Law of patents							
Law of copy rights: Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copyright law. Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer								
Unit: IV	Trade Secrets, Unfair competition							
Trade Secrets: Trade secret law, determination of trade secret status, liability for misappropriation of trade secrets, protection for submission, trade secret litigation. Unfair competition: Misappropriation right of publicity, false advertising.								
Unit: V	New development of intellectual property, International overview on intellectual property							
New development of intellectual property: new developments in trade mark law; copy right law, patent law, intellectual property audits. International overview on intellectual property, international-trademark law, copyright law, international patent law, and international development in trade secrets law.								
Text Books:								
<ol style="list-style-type: none"> 1. Intellectual property right, Deborah. E. Bouchoux, Cengage Learning. 2. Intellectual property right—Unleashing the knowledge economy, Prabuddhaganguli, Tata McGraw Hill Publishing company Ltd. 								

MC510EC: FUNDAMENTALS OF CYBER SECURITY

B. Tech. III Year I Semester

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
MC510EC	MC	3	-	-	-	30	70	100

Prerequisite:

Course Objectives:

To familiarize various types of cyber-attacks and cyber-crimes • To give an overview of the cyber laws • To study the defensive techniques against these attacks

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

- Understand cyber-attacks, types of cybercrimes, cyber laws and also how to protect them self and ultimately the entire Internet community from such attacks.

Unit: I Introduction to Cyber Security

Introduction to Cyber Security: Basic Cyber Security Concepts, layers of security, Vulnerability, threat, Harmful acts, Internet Governance – Challenges and Constraints, Computer Criminals, CIA Triad, Assets and Threat, motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, Spectrum of attacks, Taxonomy of various attacks, IP spoofing, Methods of defense, Security Models, risk management, Cyber Threats-Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, etc., Comprehensive Cyber Security Policy.

Unit: II Cyberspace and the Law & Cyber Forensics

Cyberspace and the Law & Cyber Forensics: Introduction, Cyber Security Regulations, Roles of International Law. The INDIAN Cyberspace, National Cyber Security Policy. Introduction, Historical background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email, Digital Forensics Lifecycle, Forensics Investigation, Challenges in Computer Forensics, Special Techniques for Forensics Auditing.

Unit: III Cybercrime: Mobile and Wireless Devices

Cybercrime: Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.

Unit: IV Cyber Security: Organizational Implications, Cybercrime and Cyber terrorism

Cyber Security: Organizational Implications: Introduction, cost of cybercrimes and IPR issues, web threats for organizations, security and privacy implications, social media marketing: security risks and perils for organizations, social computing and the associated challenges for organizations. Cybercrime and Cyber terrorism: Introduction, intellectual property in the cyberspace, the ethical dimension of cybercrimes the psychology, mindset and skills of hackers and other cyber criminals

Unit: V Privacy Issues: Basic Data Privacy Concepts, Cybercrime: Examples and Mini-Cases

Privacy Issues: Basic Data Privacy Concepts: Fundamental Concepts, Data Privacy Attacks, Data linking and profiling, privacy policies and their specifications, privacy policy languages, privacy in different domains- medical, financial, etc. Examples: Official Website of Maharashtra Government Hacked, Indian Banks Lose Millions of Rupees, Parliament Attack, Pune City Police Bust Nigerian Racket, e-mail spoofing instances. Mini-Cases: The Indian Case of online Gambling, An Indian Case of Intellectual Property Crime, Financial Frauds in Cyber Domain.

Text Books:

1. Nina Godbole and SunitBelpure, Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley
2. B. B. Gupta, D. P. Agrawal, Haoxiang Wang, Computer and Cyber Security: Principles, Algorithm, Applications, and Perspectives, CRC Press, ISBN 9780815371335, 2018.

Reference Books:

1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.
2. Introduction to Cyber Security, Chwan-Hwa(john) Wu, J. David Irwin, CRC Press T&F Group.