Course Code **18EC3T1**	**SIGNALS AND SYSTEMS**	**L**	**T**	**P**	**C**
	Maximum expected contact hours : **64**	**3**	**1**	**--**	**3**

PURPOSE	
This fundamental course will enable the students to learn the concepts of continuous and discrete time signal analysis in frequency and time domain	
1	Analysis of signals and systems
2	Representation of signals using Fourier series and Fourier transform and their properties
3	Time - Domain and Frequency Domain aspects of signals and systems
4	Concept of convolution and correlation
5	Sampling and types of sampling
6	Laplace transform of signals;
7	Z-Transform of sequences and their properties
COURSE OUTCOMES	
1	Trigonometric and exponential Fourier series representation of periodic signals
2	Fourier transform of signals
3	Convolution and correlation of functions
4	Sampling Process
5	Laplace transforms, ROC for Laplace Transform
6	Z-Transform of discrete sequences and ROC for Z –Transform
7	Perform time and frequency domain analysis of various continuous and discrete time signals and systems
8	Develop solutions to stable and causal systems
9	Solve engineering problems critically in the area of signal processing

UNIT-I

Introduction: Definitions of signals and systems, representations of signals and applications of signals and systems. Elementary signals: Unit Impulse, Unit Step Functions, Exponential and Sinusoidal Signals. Classification of Continuous Time and Discrete Time Signals, compare to Continuous Time and Discrete Time Signals. Basic operations on signals, Classification of Continuous Time and DiscreteTime Systems, Basic System Properties, Linear Time-Invariant Systems, DiscreteTime LTI Systems.

Signal Analysis : Analogy between vectors and signals, Orthogonal signal space, Signal approximation using orthogonal functions, Mean square error, Closed or complete set of orthogonal functions, Orthogonality in complex functions. .

UNIT-II

Fourier Series And Fourier Transforms and Sampling:

Fourier Series: Representation of Fourier series, Continuous time periodic signals, properties of Fourier series, Dirichlet's conditions, Trigonometric Fourier series and Exponential Fourier series, Complex Fourier spectrum, Fourier series representation of periodic signals using symmetry ,Relation between Trigonometric Fourier series and Complex Fourier series

Fourier Transforms : Deriving Fourier transform from Fourier series, Fourier transform of impulse, step, ramp, Signum, exponential signals, aperiodic and periodic signals. Properties of Fourier transform, Introduction to Hilbert Transform , Compare to Fourier Series to Fourier Transforms.

Sampling: Representation of a Continuous time signal by its samples, Sampling theorem, reconstruction of a signal from its samples, different sampling techniques, Effect of under sampling: aliasing.

UNIT III

Signal Transmission through Linear Systems: Linear system, impulse response, Response of a linear system, Linear Time Invariant (LTI) system, Linear Time Variant (LTV) system, Transfer function of a LTI system, Filter characteristics of linear systems, Distortion less transmission through a system, Signal bandwidth, system bandwidth, Ideal LPF, HPF and BPF characteristics, Causality and Poly-Wiener criterion for physical realization, relationship between bandwidth and rise time.

UNIT-IV

Convolution & Correlation of Signals: Concept of convolution in time domain and frequency domain, Graphical representation of convolution, Convolution property of Fourier transform. Introduction of Cross correlation and auto correlation of functions, Relation between convolution and correlation, Detection of periodic signals in the presence of noise by correlation, Extraction of signal from noise by filtering, Problem Solving.

UNIT-V

Laplace Transforms: Laplace transform of impulse, step, ramp, Signum, exponential signals, aperiodic and periodic signals. Region of Convergence for Laplace transforms, Inverse Laplace transform, relation between Fourier and Laplacetransform, Properties of the Laplace transform, Laplace transform and ROC for various classes of signals, Problem Solving.

UNIT-VI

Z-Transforms: Z-transform of discrete impulse, step, ramp, exponential signals. Region of Convergence for the Z-transform, The Inverse Z-transform, relation between Fourier and Z-transform, Properties of the Z-transform, Z-transform and ROC for various classes of signals.

TEXT BOOKS :

1. Signals, Systems & Communications – B PLathi, 2nd edition, BS Publications,2003.
2. Signals and Systems – A V Oppenheim, ASWillsky and S HNawab, 2nd edition, PHI,1997.
3. Signals and Systems – Narayan Iyer and K SatyaPrasad,1st edition, Cenage Publications,2011.

REFERENCES :

1. Signals & Systems - Simon Haykin and Van Veen,2ndedition,Wiley Publications, 1999.
2. Signals & Systems - AAnand Kumar, 2nd edition, PHI, 2011.
3. Signals & Systems - K R Rajeswari and B V Rao,2nd edition, PHI, 2014.
4. Fundamentals of Signals and Systems - Michel J Robert, MGH International Edition, 2008.

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Course Code 18EC3T2	ELECTRONIC DEVICES AND CIRCUITS	L	T	P	C
	Maximum expected contact hours : **64**	**3**	**1**	**--**	**3**

PURPOSE: The student will be able to learn electronic circuits and amplifiers

	INSTRUCTIONAL COURSE OBJECTIVES:
1	The basic concepts of semiconductor physics are to be reviewed
2	Study the physical phenomena such as conduction, transport mechanism and electrical characteristics of different diodes.
3	Conversion of AC to DC
4	Working and operation of BJT and FET and their characteristics are discussed
5	Transistor biasing and its significance and quiescent point or operating point is explained
6	small signal low frequency transistor amplifier circuits using BJT, FET in different configurations
COURSE OUTCOMES: At the end of the course the student will be able to	
1	Understand the principle involved in CRT & measure various parameters of a signal.
2	Able to design small applications based on diodes
3	Design a DC power supply for the given specifications.
4	Understand the working principle of transistor
5	Apply necessary transistor configuration for the give specifications
6	Able to design and analyse the small signal low frequency transistor amplifier circuits using BJT, FET in different configurations.

UNIT – I: CONDUCTION IN SEMICONDUCTORS AND ELECTRONIC BALLISTICS

Types of materials – Insulators, Semiconductors, metals; charge densities in a semiconductor; electrons and holes in Intrinsic semiconductor; Electrical properties of Ge and Si; The Hall effect; conductivity modulation; generation and recombination of charges; Diffusion; Drift and Diffusion Currents

UNIT – II: JUNCTION – DIODE CHARACTERISTICS

P-N junction – equilibrium PN junction, Reverse-biased, Forward-biased; diode current equation: V-I characteristics; Effect of temperature on PN junction diode.Construction, Working, Characteristics – Zener Diode, Varactor Diode, Tunnel Diode, Photo Diode, LED, SCR, UJT and applications.

UNIT – III: Rectifiers and Filters

Operation and characteristics of rectifiers – Half wave, center – tapped transformer Full wave, Bridge rectifier. Filters – Capacitive, L – Section, π – section. Compare filters. Zener diode as voltage regulator.

UNIT – IV: TRANSISTOR CHARACTERISTICS

BJT: Junction transistor, transistor current components, transistor equation, transistor configurations, transistor as an amplifier, and characteristics of transistor in Common Base, Common Emitter and Common Collector configurations, Ebers-Moll model of a transistor, punch through/ reach through effect

FET:FET types, construction, operation, characteristics,MOSFET-types, construction, operation, characteristics, comparison between JFET and MOSFET.

UNIT – V: TRANSISTOR BIASING AND THERMAL STABILIZATION

Need for biasing, operating point, load line analysis, BJT biasing- methods, basic stability, fixedbias, collector to base bias, self-bias, Stabilization against variations in V_{BE}, I_c, and β, Stability factors, (S, S', S''), Bias compensation, Thermal runaway, Thermal stability.FET Biasing- methods and stabilization.

UNIT- VI: SMALL SIGNAL LOW FREQUENCY TRANSISTOR AMPLIFIER MODELS:

BJT: Two port network, Transistor hybrid model, determination of h-parameters, conversion of h-parameters, generalized analysis of transistor amplifier model using h-parameters, Comparison of transistor amplifiers.

FET: Generalized analysis of small signal model, comparison of FET amplifiers.

Text Books:

1. Electronic Devices and Circuits- J. Millman, C. Halkias, Tata Mc-Graw Hill, Second Edition.
2. Integrated Electronics- Jacob Millman, C. Halkies, C.D.Parikh, Tata Mc-Graw H ill, 2009.

References:

1. Electronic Devices and Circuits-K. Satya Prasad, VGS Book Links.
2. Electronic Devices and Circuits-Salivahanan, Kumar, Vallavaraj, Tata Mc- Graw Hill, Second Edition
3. Electronic Devices and Circuits – Bell, Oxford

Course Code 18EC3T3	PROBABILITY THEORY AND RANDOM PROCESS	L	T	P	C
	Maximum expected contact hours : **64**	**3**	**1**	**--**	**3**

PURPOSE: This fundamental course will enable the students to learn basic concepts in random variables and random processes for applications such as random signals, linear systems etc in communication engineering.

	INSTRUCTIONAL COURSE OBJECTIVES:
1	Concept of random variables, various distributions and their characteristics.
2	Multiple random variables and their features.
3	Temporal and spectral characteristics of random process.
4	Noise and their characteristics.
	COURSE OUTCOMES
1	Use the various standard distributions for analysis of random signals.
2	Recognize the use of multidimensional random variables in signal processing application
3	Estimate the time and spectral characteristics of random process.
4	Identify the sources of noise and their characteristics in real time systems.

UNIT- I

Probability: Probability introduced through Sets and Relative Frequency, Probability Definitions and Axioms, Joint Probability, Conditional Probability, Total Probability, Baye`s Theorem, and Independent Events

THE RANDOM VARIABLE: Introduction, Definition of a Random Variable, Conditions for a Function to be a Random Variable, Discrete, Continuous and Mixed Random Variables, Distribution and Density functions, Properties, Different distributions-Binomial, Poisson, Uniform, Exponential, Rayleigh, Gaussian.

UNIT- II

OPERATION ON ONE RANDOM VARIABLE – EXPECTATIONS : Introduction, Expected Value of a Random Variable, Function of a Random Variable, Moments about the Origin, Central Moments, Variance and Skew, Chebychev's Inequality, Characteristic Function, Moment Generating Function, Transformations of a Random Variable: Monotonic Transformations for a Continuous Random Variable, Non monotonic Transformations of Continuous Random Variable.

UNIT- III

MULTIPLE RANDOM VARIABLES : Vector Random Variables, Joint Distribution Function, Properties of Joint Distribution, Marginal Distribution Functions, Conditional Distribution and Density, Statistical Independence, Sum of Two Random Variables, Sum of Several Random Variables, Central Limit Theorem: Unequal Distribution, Equal Distributions.

OPERATIONS ON MULTIPLE RANDOM VARIABLES: Joint Moments about the Origin, Joint Central Moments, Joint Characteristic Functions, and Jointly Gaussian Random Variables: Two Random Variables case, N Random Variables case, Properties, Transformations of Multiple Random Variables, and Linear Transformations of Gaussian Random Variables.Correlation and Linear regression

UNIT- IV

RANDOM PROCESSES – TEMPORAL CHARACTERISTICS: The Random Process Concept, Classification of Processes, Deterministic and Nondeterministic Processes, Distribution and Density Functions, Concept of Stationarity and Statistical Independence. First-Order Stationary Processes, Second- Order and Wide-Sense Stationarity, Nth-order and Strict-Sense Stationarity, Time Averages and Ergodicity, Autocorrelation Function and its Properties, Cross-Correlation Function and its Properties, Covariance Functions, Gaussian Random Processes, Poisson Random Process.

UNIT- V

RANDOM PROCESSES – SPECTRAL CHARACTERISTICS: The Power Spectrum: Properties, Relationship between Power Spectrum and Autocorrelation Function, the Cross-Power Density Spectrum, Properties, Relationship between Cross-Power Spectrum and Cross-Correlation Function.

UNIT- VI

LINEAR SYSTEMS WITH RANDOM INPUTS: Random Signal Response of Linear Systems: System Response – Convolution, Mean and Mean-squared Value of System Response, Autocorrelation Function of Response, Cross-Correlation Functions of Input and Output, Spectral Characteristics of System Response: Power Density Spectrum of Response, Cross-Power Density Spectra of Input and Output, Band pass, Band-Limited and Narrowband Processes, Properties, Modeling of Noise Sources: Resistive (Thermal) Noise Source, Arbitrary Noise Sources, Effective NoiseTemperature, Average Noise Figure, Average Noise Figure of cascadednetworks.

Text Books:

1. Probability, Random Variables & Random Signal Principles - Peyton Z. Peebles,TMH, 4tth Edition, 2001.
2. Probability, Random Variables and Stochastic Processes – Athanasios Papoulis and S.Unnikrishna Pillai, PHI, 4th Edition, 2002.

Reference Books:

1. Communication Systems – 3rd Edition Simon Haykin, TMH, 1995.
2. Probability Theory and Stochastic Processes – B. Prabhakara Rao, BS Publications
3. Probability and Random Processes with Application to Signal Processing – HenryStark and John W. Woods, Pearson Education, 3rd Edition.

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Course Code 18EC3T4	SWITCHING THEORY AND LOGIC DESIGN	L	T	P	C
	Maximum expected contact hours : **64**	4	--	--	3

PURPOSE: This fundamental course will able to learn Switching Theory and Logic design provide Mathematical foundations and tools for Digital System Design.

INSTRUCTIONAL COURSE OBJECTIVES:

1	TO learn the basic technique for the design of digital circuits and fundamental concepts used in design of digital systems
2	To understand common forms of number representation in digital electronic circuits and to be able to convert between different representation
3	To implement simple logic operations using combinational logic circuits
4	To design combinational logic circuits
5	To design sequential logic circuits
6	To study some of the Programmable Logic Devices and their use in realization switching functions.

COURSE OUTCOMES: After going through this course the student will be able to

1	Be able to manipulate numeric information in different forms eg. Different bases, signed integers, various courses such as ASCII, Gray and BCD
2	Be able to manipulate simple Boolean expressions using the theorem and postulates of Boolean Algebra and minimize combinational circuits.
3	Be able to design various logic gates starting from simple ordinary gates to complex programmable logic devices and arrays.
4	Be able to use concepts of Boolean Algebra for the analysis and design of various combinational logic circuits
5	Be able to use concepts of Boolean Algebra for the analysis and design of various sequential logic circuits
6	Be able to use concepts of Finite State Machines.

UNIT – IREVIEW OF NUMBER SYSTEMS & CODES:

i)Representation of numbers of different radix, conversation from one radix to another radix, r-1's ompliments and r's compliments of signed members, problem solving.

ii)4 bit codes, BCD, Excess-3, 2421, 84-2-1 9's compliment code etc.,

ii)Logic operations and error detection & correction codes; Basic logic operations -NOT, OR, AND, Universal building blocks, EX-OR, EX-NOR - Gates, Standard SOP and POS, Forms, Gray code, error detection, error correction codes (parity checking, even parity, odd parity, Hamming code) NAND-NAND and NOR-NOR realizations.

UNIT – II: MINIMIZATION TECHNIQUES

Boolean theorems, principle of complementation & duality, De-Morgan theorems, minimization of logic functions using Boolean theorems, minimization of switching functions using K-Map up to 6 variables, tabular minimization, problem solving (code-converters using K-Map etc..).

UNIT – III: COMBINATIONAL LOGIC CIRCUITS DESIGN

Design of Half adder, full adder, half subtractor, full subtractor, applications of full adders, 4-bit binary subtractor, adder-subtractor circuit, BCD adder circuit, Excess 3 adder circuit, look-a-head adder circuit, Design of decoder, demultiplexer, 7 segment decoder, higher order demultiplexing, encoder, multiplexer, higher order multiplexing, realization of Boolean functions using decoders and multiplexers, priority encoder, 4-bit digital comparator.

UNIT – IV: INTRODUCTION OF PLD's

PROM, PAL, PLA-Basics structures, realization of Boolean function with PLDs, programming tables of PLDs, merits & demerits of PROM, PAL, PLA comparison, realization of Boolean functions using PROM, PAL, PLA, programming tables of PROM, PAL, PLA.

UNIT – V: SEQUENTIAL CIRCUITS I

Classification of sequential circuits (synchronous and asynchronous); basic flip-flops, truth tables and excitation tables (nand RS latch, nor RS latch, RS flip-flop, JK flip-flop, T flip-flop, D flip-flop with reset and clear terminals). Conversion from one flip-flop to flip-flop. Design of ripple counters, design of synchronous counters, Johnson counter, ring counter. Design of registers - Buffer register, control buffer register, shift register, bi-directional shift register, universal shift register.

UNIT – VI: SEQUENTIAL CIRCUITS II

Finite state machine; Analysis of clocked sequential circuits,state diagrams, state tables, reduction of state tables and state assignment, design procedures. Realization of circuits using various flip-flops. Meelay to Moore conversion and vice-versa.

TEXT BOOKS:

Switching Theory and Logic Design by Hill and Peterson Mc-Graw Hill TMH edition.

Switching Theory and Logic Design by A. Anand Kumar

Digital Design by Mano PHI.

REFERENCE BOOKS:

Modern Digital Electronics by RP Jain, TMH

Fundamentals of Logic Design by Charles H. Roth Jr, Jaico Publishers

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Course Code 18MB3T5A	MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS	L	T	P	C
	Maximum expected contact hours : **64**	3	1	- -	3

PURPOSE: Student can learn the Management skills and Financial analysis

INSTRUCTIONAL COURSE OBJECTIVES	
1.	To understand the concept of Managerial Economics
2.	Methods of Pricing in the different market structures
3.	Business organization and the concept of Business Cycles
4.	Preparation of Financial Statement
5.	The techniques used to evaluate Capital Budgeting proposals.
COURSE OUTCOMES	
1.	Know about the importance of Managerial economics.
2.	Understand the market condition and it's Pricing strategies.
3.	Understand the Business conditions.
4.	Know about financial statements
5.	Know the importance of capital budgeting in business.

UNIT-I :Introduction to Managerial Economics and demand Analysis:
Definition of Managerial Economics –Scope of Managerial Economics and its relationship with other subjects – Concept of Demand, Types of Demand, Determinants of Demand- Demand schedule, Demand curve, Law of Demand and its limitations- Elasticity of Demand, Types of Elasticity of Demand and Measurement- Demand forecasting and Methods of forecasting..

UNIT – II :Production and Cost Analyses:
Concept of Production function- Cobb-Douglas Production function- Leontief production function - Law of Variable proportions-Isoquants and Isocosts and choice of least cost factor combination-Concepts of Returns to scale and Economies of scale-Different cost concepts: opportunity costs, explicit and implicit costs- Fixed costs, Variable Costs and Total costs –Cost –Volume-Profit analysis-Determination of Breakeven point(simple problems)- Managerial significance and limitations of Breakeven point.

UNIT – III :Introduction to Markets, Theories of the Firm & Pricing Policies:
Market Structures: Perfect Competition, Monopoly, Monopolistic competition and Oligopoly – Features – Price and Output Determination – Managerial Theories of firm: Marris and Williamson's models – other Methods of Pricing: Average cost pricing, Limit Pricing, Market Skimming Pricing, Internet Pricing: Flat Rate Pricing, Usage sensitive pricing and Priority Pricing.

UNIT – IV :Types of Business Organization and Business Cycles:
Features and Evaluation of Sole Trader, Partnership, Joint Stock Company – State/Public Enterprises and their forms – Business Cycles : Meaning and Features – Phases of Business Cycle.

UNIT – V :Introduction to Accounting & Financing Analysis:
Introduction to Double Entry Systems – Preparation of Financial Statements-Analysis and Interpretation of Financial Statements-Ratio Analysis

UNIT – VI : Capital and Capital Budgeting: Capital Budgeting: Meaning of Capital-Capitalization-Meaning of Capital Budgeting-Time value of money- Methods of appraising Project profitability: Traditional Methods(pay back period,accounting rate of return) and modern methods(Discounted cash flow method, Net Present Value method, Internal Rate of Return Method and Profitability Index)

TEXT BOOKS:

1. Dr. N. AppaRao, Dr. P. Vijay Kumar: 'Managerial Economics and Financial Analysis', Cengage Publications, New Delhi – 2011
2. Dr. A. R. Aryasri – Managerial Economics and Financial Analysis, TMH 2011
3. Prof. J.V.Prabhakararao, Prof. P. Venkatarao. 'Managerial Economics and Financial Analysis', Ravindra Publication.

REFERENCES:

1. V. Maheswari: Managerial Economics, Sultan Chand.2014
2. Suma Damodaran: Managerial Economics, Oxford 2011.
3. VanithaAgarwal: Managerial Economics, Pearson Publications 2011.

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Course Code 18CS3T5C	CLOUD COMPUTING-1	L	T	P	C
	Maximum expected contact hours : **64**	4	--	--	3
	Prerequisites : **Knowledge in computer**				

PURPOSE :	
1	To get familiar with basics of the Internet Programming
2	To acquire knowledge and skills for creation of web site
3	To gain ability to develop responsive web applications
4	To train the fundamental concepts of database management system, database modeling and design, Relational Data Modeling
COURSE OUTCOMES	
1	Implement interactive web page(s) using HTML, CSS
2	Design a responsive web site using HTML5 and CSS3.
3	Perform project planning, analysis, design, implementation and testing in group / as an individual for any real time information system with all realistic constraints.
4	Solve issues of information systems using the learnt database principles.

Unit 1 : Introduction to Web

Introduction to Computers and the Internet, Introduction, The Internet in Industry and Research, HTML5, CSS3, Evolution of the Internet and World Wide Web, Web Basics, Multitier Application Architecture, Client-Side Scripting versus Server-Side Scripting

Unit 2 : HTML

HTML Introduction- HTML Elements, HTML Attributes, HTML Headings, HTML Paragraphs, HTML Formatting, HTML Fonts, HTML Styles, HTML Links, HTML Images, HTML Tables, HTML Lists, HTML Forms, Internal Linking, meta Elements, New HTML5 Form input Types, input and datalist Elements and autocomplete Attribute, Page-Structure Elements, HTML5 Audio, HTML5 Video

Unit 3: CSS

CSS Introduction, CSS Syntax, Inline Styles, Embedded Style Sheets, Conflicting Styles, Linking External Style Sheets,

1. Positioning Elements: Absolute Positioning, z-index, Positioning Elements: Relative Positioning, span, CSS Selectors, CSS Color, CSS background, CSS Fonts, CSS Text, CSS Links, CSS Lists, CSS Tables, CSS Box Model, CSS Margin, CSS Padding, CSS Border, Text Shadows, Rounded Corners, Box Shadows, CSS Outline, CSS Cursors, CSS Overflow, CSS Display, CSS Visibility, CSS Position, CSS Layers, CSS Float, CSS Alignment, CSS Pseudo-classes, CSS Pseudo-elements CSS Opacity

Unit 4 : DATABASE SYSTEMS DATA MODELING AND RELATIONAL MODEL

DATABASE SYSTEMS

History and motivation for database systems; components of database systems; DBMS functions; database architecture and data independence.

Data modeling: conceptual models; object -oriented model;

RELATIONAL MODEL

Relational data model; relational algebra, relational calculus

Unit 5 : SQL & NORMALIZATION

Relational data model; Database query languages: Overview of database languages; SQL-DDL, DML, DCL,TCL Commands, The Form of Basic SQL Query, Examples on Basic SQL Queries Integrity Constraints, Set operations, Aggregate Operators, Joins, Nested Queries, Triggers Purpose of Normalization or schema refinement, concept of functional dependency, normal forms based on functional dependency(1NF, 2NF and 3 NF), concept of surrogate key, Boyce-codd normal form(BCNF)

Unit-6: CLOUD COMPUTING

Computing,High Performance Computing,Parallel Computing,Distributed Computing,Grid Computing,Cluster Computing,Mobile Computing,Massively Parallel Computing,Network Computing,Service Oriented Architecture,Definition of Cloud,History Of Cloud,Virtualization,Cloud Computing ,Deployment Models,Service Models

TEXT BOOKS

1. A. Silberschatz, H. F. Korth & S. Sudershan, Database system concepts, McGraw Hill, 6th Edition 2010.
2. R. Elmasri & S. B. Navathe, Fundamentals of database systems, Addison Wesley, 6th Edition, 2011.
3. Internet & World Wide Web How to Program, 5/e- Paul J. Deitel, Harvey M. Deitel, Abbey Deitel- Prentice Hall India
4. Programming the World Wide Web (8th ed)- ROBERT W. SEBESTA, Pearson

Reference Books:

1. C. J. Date, An introduction to database systems, Addison Wesley,8 Edition, 2003.

2. H. Garcia et al., Database system implementation, Prentice Hall,2

Course Code	CYBER SECURITY - I	L	T	P	C
18CS3T5E	Maximum expected contact hours : **64**	4	--	--	3
	Prerequisites : **Knowledge in computer**				

PURPOSE :	
1	Introduction to Scripting Language
2	Exposure to various problems solving approaches of computer science
COURSE OUTCOMES	
1	with Making Software easily right out of the box
2	Experience an interpreted Language
3	To build software for real needs
4	Prior Introduction to testing software

Unit I : Introduction

History of Python, Need of Python Programming, Applications Basics of Python Programming, Python in statistics context, Python in machine learning context, Python in Cyber security context,installation in windows/linux/mac, Using the REPL(Shell), Running Python Scripts, Variables, Assignment,Keywords, InputOutput, Indentation.Types - Integers, Strings, Booleans; Operators,Control Flow- if, if-elif-else, for, while, break, continue

Unit II : Data Structures and Functions

Lists - Operations, Slicing, Methods; Tuples, Sets, Dictionaries, Sequences. Comprehensions
Defining Functions, Calling Functions, Passing Arguments, Keyword Arguments, Default
Arguments, Variable-length arguments, Anonymous Functions, Fruitful Functions (Function Returning Values), Scope of the Variables in a Function - Global and Local Variables.

Modules: Creating modules, import statement, from. Import statement, Python packages, Introduction to PIP, Installing Packages via PIP, Using Python Packages - decorators, collections, generators File I/O: File opening, reading, writing, appending, merging, processing

Unit III : OOP in Python&Brief Tour of the Standard Library

Classes, 'self variable', Methods, Constructor Method, Inheritance, Overriding Methods, Data hiding, Error and Exceptions: Difference between an error and Exception, Handling Exception, try except block, Raising Exceptions, User Defined Exceptions Advanced Python

Objects : numbers, strings, lists, tuples, dictionaries

Pandas: introduction, installation, Jupyter notebook, loading CSN, JSON, text, excel files, set header row, set column names, updating, deleting columns,rows, Numpy: introduction, installation, numpy arrays, image and video processing with Open CV : displaying, sizing, resizing images, face detection, video capture, Interactive data visualization : Bokeh, Bokeh with pandas, web scrapping

Unit IV : COMPUTER NETWORKS

Computer networks Introduction, Types of computer networks, OSI reference model and its layered tasks, TCP/IP reference model and its layered tasks, **Physical layer -** introduction, Data transfer in physical layer, Devices in physical layer, Analog and Digital data, Analog and digital signals, **Data Link layer** - Framing - bit stuffing, character stuffing, Flow and error control mechanisms – introduction, Stop and Wait protocol, Go Back N, Selective Repeat protocol, Error Detection/ Error Correction codes – introductiom, Hamming code, CRC, Check Sum, Multiple access methods, Switching, **Network layer** – introduction, Host to Host or End to End delivery, Class-full address, Class-less address, IPV4 addressing mechanism, IPV6 addressing mechanism, Public and private IP addresses, **Routers,Routing algorithms** – introduction,Shortest Path routing algorithm, Distance vector routing algorithm,

Unit II : Data Structures and Functions

Lists - Operations, Slicing, Methods; Tuples, Sets, Dictionaries, Sequences. Comprehensions
Defining Functions, Calling Functions, Passing Arguments, Keyword Arguments, Default
Arguments, Variable-length arguments, Anonymous Functions, Fruitful Functions (Function Returning Values), Scope of the Variables in a Function - Global and Local Variables.

Modules: Creating modules, import statement, from. Import statement, Python packages, Introduction to PIP, Installing Packages via PIP, Using Python Packages - decorators, collections, generators File I/O: File opening, reading, writing, appending, merging, processing

Unit III : OOP in Python&Brief Tour of the Standard Library

Classes, 'self variable', Methods, Constructor Method, Inheritance, Overriding Methods, Data hiding, Error and Exceptions: Difference between an error and Exception, Handling Exception, try except block, Raising Exceptions, User Defined Exceptions. Advanced Python Objects : numbers, strings, lists, tuples, dictionaries Pandas: introduction, installation, Jupyter notebook, loading CSN, JSON, text, excel files, set header row, set column names, updating,

deleting columns,rows, Numpy: introduction, installation, numpy arrays, image and video processing with Open CV : displaying, sizing, resizing images, face detection, video capture, Interactive data visualization : Bokeh, Bokeh with pandas, web scrapping.

IV : COMPUTER NETWORKS

Computer networks Introduction, Types of computer networks, OSI reference model and its layered tasks, TCP/IP reference model and its layered tasks, **Physical layer -** introduction, Data transfer in physical layer, Devices in physical layer, Analog and Digital data, Analog and digital signals, **Data Link layer** - Framing - bit stuffing, character stuffing, Flow and error control mechanisms – introduction, Stop and Wait protocol, Go Back N, Selective Repeat protocol, Error Detection/ Error Correction codes – introductiom, Hamming code, CRC, Check Sum, Multiple access methods, Switching, **Network layer** – introduction, Host to Host or End to End delivery, Class-full address, Class-less address, IPV4 addressing mechanism, IPV6 addressing mechanism, Public and private IP addresses, **Routers,Routing algorithms** – introduction,Shortest Path routing algorithm, Distance vector routing algorithm,

Transport Layer- introduction, Process to Process delivery, UDP(User Datagram Protocol), TCP(Transmission Control Protocol), SCTP(Stream Control Transmission Protocol), Congestion Control policies, **Application Layer**– introduction, Domain Name System(DNS), World Wide Web(WWW), Uniform Resource Locator(URL), Hyper Text Transfer Protocol(HTTP), File Transfer Protocol(FTP)

Unit V : ETHICAL HACKING

Introduction to ethical hacking, Information security overview, Information security threats and attack vectors, Hacking concepts, Ethical hacking concepts, information security controls, penetration testing concepts, information security laws and standards, **Footprinting and Reconnaissance** – Footprinting concepts, footprinting through search engines, foot printing through web services, footprinting through social networking sites, website footprinting, email footprinting, competitive intelligence, whois footprinting, DNS footprinting, network footprinting, footprinting through social engineering, footprinting tools, footprinting countermeasures, footprinting penetratoion testing

Unit VI :

Scanning Networks – network scanning concepts, scanning tools, scanning beyond IDS and firewall, banner grabing, draw network diagrams, scanning pen testing, **Enumeration –**Enumeration concepts, NetBIOS Enumeration, SNMP enumeration, LDAP numeration, NTP enumeration, SMTP and DNS enumeration, other enumeration techniques, enumeration counter

measures, enumeration pen testing, **Vulnerability analysis –** vulnerability assessment concepts, vulnerability assessment solutions, vulnerability scoring systems, vulnerability assessment tools, vulnerability assessment reports

TEXT BOOKS

1. Python Programming:A Modern Approach, Vamsi Kurama, Pearson
2. LearningPython, MarkLutz, Orielly
3. introduction to Data Communications and Networking by B. Fourouzen, 4 edition
4. computer networks 4 edition. Tanenbaum

ReferenceBooks:

1. Think Python,Allen Downey, Green TeaPress
2. CorePython Programming, W.Chun, Pearson.
3. Introduction to Python, Kenneth A.Lambert, Cengage

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Course Code	DATA ANALYTICS-1	L	T	P	C
18CS3T5B	Maximum expected contact hours : **64**	4	--	--	3
	Prerequisites : **Knowledge in computer**				

PURPOSE :	
1	Data Science with R. Acquire practical skills for visualizing, transforming, and modeling data in R. Learn data exploration, data visualization, predictive analytics, and descriptive analytics techniques. Create the highest quality analysis

COURSE OUTCOMES	
1	List motivation for learning a programming language
2	Access online resources for R and import new function packages into the R workspace
3	Import, review, manipulate and summarize data-sets in R
4	Explore data-sets to create testable hypotheses and identify appropriate statistical tests

UNIT-1: Regression

Introduction to Statistics**, Data Preprocessing**: Importing dataset, Handling missing data, Categorical data, Splitting the dataset into Training set and Test set, Feature Scaling, **Regression:** Simple Linear Regression, Multiple Linear Regression, Polynomial Regression, Support Vector Regression (SVR), Decision Tree Regression, Random Forest Regression, **Regression model evaluation:** R-Squared Intuition, Adjusted R-Squared Intuition, Interpreting Linear Regression Coefficients **Classification** Classification: Logistic Regression, K-Nearest Neighbors (K-NN), Support Vector Machines (SVM), Kernel SVM, Naïve Bayes, Decision Tree Classification, Random Forest Classification,

UNIT-2: Association rules and Deep learning

Evaluating Classification Models: False Positives & False Negatives, Confusion Matrix, Accuracy Paradox, CAP Curve, CAP Curve Analysis. **Clustering:** K-Means Clustering, Hierarchical Clustering. **Associate Rule Learning:** Apriori, ECLAT, **Reinforcement Learning:** Upper Confidence Bound, Thompson Sampling, Natural Language Processing, **Deep Learning:** Artificial Neural Networks, Convolutional Neural Networks, **Dimensionality Reduction**: Principal Component Analysis (PCA), Kernel PCA, Linear Discriminant Analysis (LDA), **Model Selection & Boosting**: Model Selection, XG Boost.

UNIT-3:

Introduction: What is R-Evaluation of R-R features-R Applications-R in statistical context-R in Machine learning context-R installation on windows/MAC/Linux-Development environment overview-R SDK and R studio-**R Basics:** Introduction-Arithmetic in R-Variables-Variable assignment-Finding variables-Basic data types. **Introduction to vectors**-Vector operations-Matrices and arrays as vectors-Declarations-Comparison operators-Vector indexing and selecting-Vector recycling and repetition-Vector functions-NA and NULL values-Subscripts and generating sequence-Generating random numbers and sampling-Help in R and R studio.

UNIT-4:

R Matrices: Introduction-Creating a Matrix-Matrix arithmetic-Matrix operations-Matrix selection and Indexing-Factors and categorical matrices. **R Arrays:** Introduction-Array arithmetic-Array indexing. **R Data Frames:** Introduction-Data frame basics-Data frame indexing and selection-Data frame operations-Merging data frames-Applying functions on data frames. **R Lists:** List introduction-List operations-List indexing-Adding and deleting list elements-Functions on lists-Recursive lists.

UNIT-5:

Data input and output in R- Introduction-CSV files with R-Excel files with R-SQL with R-Web scraping with R. **R Programming:** programming basics-Logical operators-If else and else if statements-while loop-FOR loop-Functions-Tables-Strings

UNIT-6

R Packages: Installing and loading packages-Built-in package list and purpose explanation. **Advanced R Programming:** Introduction-Built-in R features-apply-Math functions-Regular expressions-Dates and time stamp. **Data Manipulation with R:** Introduction-DPLYR-Pipe operator-TIDYR. **Visualization with R:** ggplot2-Histograms-scatter plots-Bar plots-Box plots-2 variable ploting-coordinates and facing-Themes. **Interactive visualization with Plotly:** Introduction-plotly and ggplot2.

Reference Books:

1. R for Every one by Jared P Lander
2. The Art of R programming by Norman Matloff

3. R Cook Book by Paul Teetor
4. Hands on Programming with R by Garrett Gloremund
5. R programming for Data Science by Roger Peng
6. Data manipulation with R by Jaynal Abedin

Course Code 18EC3T6	NETWORK THEORY	L	T	P	C
	Maximum expected contact hours : **64**	**3**	**1**	**--**	**3**

PURPOSE: This course introduces the elements of linear Network and their analysis. Classical methods of design using frequency response.

INSTRUCTIONAL COURSE OBJECTIVES	
1	To prepare the students to have a basic knowledge in the analysis of Electric Networks
2	To solve the given circuit with various theorems and methods.
3	To analyse the various three phase circuits star and delta connections.
4	To distinguish between tie set and cut set methods for solving various circuits.
5	To design various types of filters.
6	To relate various two port parameters and transform them.
COURSE OUTCOMES	
1	Will able to articulate in working of various components of a circuit.
2	Will be familiar with ac and dc circuits solving.
3	Will be ready with the most important concepts like mesh and nodal analysis.
4	Ability to Solve Circuits using Tree, Node, Branch ,Cut set ,Tie Set Methods.
5	Ability to measure Three phase voltages and current, active, reactive powers
6	Ability to convert Three phase Star to Three phase Delta circuits and Vice-Versa.

UNIT – I:Introduction to Electrical Circuits : Network elements classification, Electric charge and current, Electric energyand potential, Resistance parameter – series and parallel combination, Inductance parameter – series and parallelcombination, Capacitance parameter – series and parallel combination. Energy sources: Ideal, Non-ideal,Independent and dependent sources, Source transformation, Kirchoff's laws, Mesh analysis and Nodal analysisproblem solving with resistances only including dependent sources also. Star-Deltaconversion, problem solving

Network Topology: Definitions of branch, node, tree, planar, non-planar graph, incidence matrix, basic tie setschedule, basic cut set schedule.

UNIT – II:Steady State Analysis of A.C Circuits : Definitions of terms associated with periodic functions: Time period, Angular velocity and frequency, RMS value, Average value, Form factor and peak factor- problem solving, Phaseangle, Phasor representation, Addition and subtraction of phasors, mathematical representation of sinusoidalquantities, explanation with relevant theory, problem solving. Principal of Duality with examples.Response to sinusoidal excitation - pure resistance, pure inductance, pure capacitance, impedance concept, phase angle, series R-L, R-C, R-L-C circuits problem solving. Complex impedance and phasor notation for R-L, R-C, R-L-C problem solving using mesh and nodal analysis,problem solving.

UNIT – III: Coupled Circuits : Coupled Circuits: Self inductance, Mutual inductance, Coefficient of coupling, analysis ofcoupled circuits, Natural current, Dot rule of coupled circuits, Conductively coupled equivalent circuits-problemsolving.

Resonance: Introduction, Definition of Q, Series resonance, Bandwidth of series resonance, Parallel resonance,Condition for maximum impedance, current in anti resonance, Bandwidth of parallel resonance, general caseresistancepresent in both branches, anti resonance at all frequencies.

UNIT – IV: Network Theorems: Thevinin's, Norton's, Milliman's, Reciprocity, Compensation, Substitution, Superposition,Max Power Transfer, Tellegens- problem solving using dependent sources also.

UNIT – V :Two-port networks : Relationship of two port networks, Z-parameters, Y-parameters, Transmission line parameters, h-parameters, Inverse h-parameters, Inverse Transmission line parameters, Relationship betweenparameter sets, Parallel connection of two port networks, Cascading of two port networks, series connection of twoport networks, problem solving including dependent sources also.

UNIT – VI :Transients : First order differential equations, Definition of time constants, R-L circuit, R-C circuit with DCexcitation, Evaluating initial conditions procedure, second order differential equations, homogeneous, nonhomogenous,problem solving using R-L-C elements with DC excitation and AC excitation, Response as related tos-plane rotation of roots. Solutions using Laplace transform method.

Text Books

Network Analysis ,Van Valkenburg, Prentice Hall of India, 3rd Edition, 2000.
Network Analysis by K.Satya Prasad and S Sivanagaraju, Cengage Learning
Electric Circuit Analysis by Hayt and Kimmarle, TMH

Reference Books

1. Network lines and Fields by John. D. Ryder 2nd edition, Asia publishing house.
2. Basic Circuit Analysis by DR Cunninghan, Jaico Publishers.

3. Network Analysis and Filter Design by Chadha, Umesh Publications.

Course Code 18EC3L1	ELECTRONIC DEVICES AND CIRCUITS LAB	L	T	P	C
	Maximum expected contact hours : **16 Weeks**	--	--	3	1

PURPOSE The students can study the characteristics of electronic components and measuring instruments. They can analyze the characteristics PN, Zener diode, design rectifiers with and without filters, analyze transistor characteristics, study frequency response of amplifiers, measure frequency, phase of signals.

INSTRUCTIONAL COURSE OBJECTIVES	
1	To identify various components and testing of active devices.
2	To study and operation of multimeters, function generators ,regulated power supplies and CRO To know the characteristics of various active devices
3	To study frequency response amplifier
COURSE OUTCOMES	
1	After Completion of the course the student is able to Apply various devices to real time problems
2	Compute frequency response of various amplifiers

Part A: (Only for viva-voce Examination)

ELECTRONIC WORKSHOP PRACTICE (in 3 lab sessions):

1. Identification, Specification, testing of R,L,C components (color codes), Potentiometers (SPDT, DPDT, and DIP), Coils, Gang Condensers, Relays, Bread Board, PCB's
2. Identification, Specification, testing of Active devices: Diodes, BJT, Low power JFET's, MOSFET's, Power Transistors, LED's, LCD's, SCR, UJT
3. Study and operation of: i. Multimeters (Analog and Digital) ii. Function Generator iii. Regulated Power Supplies iv. CRO

Part B: (For Laboratory Examination – Minimum of 12 experiments)

1. Forward and Reverse Bias V-I characteristics of PN junction Diode.
2. Zener diode V-I characteristics and Zener diode as voltage regulator.
3. Half Wave rectifier, with and without filters
4. Full wave rectifier with and without filters.
5. Input and output Characteristics of a BJT in CE configuration and calculation of h-parameters.
6. Input and output Characteristics of a BJT in CB configuration and calculation of h-parameters.
7. FET characteristics in CS configuration.
8. Design of self-bias circuit
9. Frequency response of CE Amplifier.
10. Frequency response of CC Amplifier.
11. Frequency response of CS FET Amplifier.
12. SCR characteristics.
13. UJT characteristics.
14. Wien bridge oscillator
15. RC Phase shift Oscillators

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Course Code 18EC3L2	Network Theory Lab	L	T	P	C
	Maximum expected contact hours : 14 weeks	--	--	3	1
	Prerequisites : **Knowledge in Electrical circuits & motors**				

PURPOSE: This fundamental course will enable the students to learn the concepts of dc and ac circuits & basic knowledge about motors.

	INSTRUCTIONAL COURSE OBJECTIVES
1	To determine resonance frequency, Q-factor of RLC network.
2	To analysis time response of first orders RC/RL network for non-sinusoidal inputs.
3	To estimate parameters of two port networks
4	To understand the concept network theorems in network reduction of electrical networks
5	To determine efficiency of dc shunt machine with actual loading.
6	To analyse performance of 3 phase induction motor
7	To understand the significance of regulation of an alternators through synchronous impedance method
	COURSE OUTCOMES
1	Able to analyse RLC circuits and understand resonant frequency and Q-factor.
2	Able to determine first order RC/RL networks of periodic non- sinusoidal waveforms.
3	Able to apply network theorems to analyze the electrical network.
4	Able to describe the performance of dc shunt machine.
5	Able to investigate the performance of 1-phase transformer.
6	Able to perform tests on 3-phase induction motor and alternator to determine their performance characteristic

PART – A

Any five experiments are to be conducted from each part

1. Series and Parallel Resonance – Timing, Resonant frequency, Bandwidth and Q-factor determination for RLC network.
2. Time response of first order RC/RL network for periodic non-sinusoidal inputs – time constant and steady state error determination.
3. Two port network parameters – Z-Y Parameters, chain matrix and analytical verification.
4. Verification of Superposition and Reciprocity theorems.
5. Verification of maximum power transfer & compensation theorem. Verification on DC, verification on AC with Resistive and Reactive loads.
6. Experimental determination of Thevenin's and Norton's equivalent circuits and verification by direct test.

PART – B

1. Magnetization characteristics of D.C. Shunt generator. Determination of critical field resistance.
2. Speed control of D.C. Shunt motor by Armature & flux control methods
3. Brake test on DC shunt motor. Determination of performance characteristics.
4. OC & SC tests on Single-phase transformer (Predetermination of efficiency and regulation at given power factors and determination of equivalent circuit).
5. Swinburne's test on dc shunt machine.
6. Brake test on 3-phase Induction motor (performance characteristics).
7. Regulation of alternator by synchronous impedance method

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Course Code 18EC4T1	Electromagnetic Theory and Transmission Lines	L	T	P	C
	Maximum expected contact hours : **64**	**3**	**1**	**--**	**3**

PURPOSE: students can learn the fundamentals in electromagnetic and transmissions lines

	INSTRUCTIONAL COURSE OBJECTIVES
1	To provide the basic concepts of Electric and Magnetic fields.
2	To understand the Maxwell's equations and applying boundary conditions to the different material interfaces.
3	To conceptualize the wave propagation characteristics for different media.
4	To learn the basic parameters of Transmission lines.

	COURSE OUTCOMES
1	Apply the basic concepts of Electric and Magnetic fields in static and time varying conditions.
2	Apply Maxwell's equations to solve equations of EM fields.
3	Apply wave propagation characteristics and power calculations in applications like antennas.
4	Design a loss/distortion less transmission system.
5	Calculate reflection coefficient, VSWR etc. using smith chart

Unit I - Steady State Electric Field:
Coulomb‟s Law and Field Intensity, Electric Field due to Continuous Charge Distributions, Electric Flux Density, Gauss‟s Law, Applications of Gauss Law, Electric Potential, Relation Between E and V, Potential and Field of Electric Dipole, Energy Density in Electrostatic Fields, Convection and Conduction Currents, Dielectric Constant, Isotropic and Homogeneous Dielectrics, Continuity Equation, Relaxation Time, Poisson‟s and Laplace‟s Equations, Capacitance.

Unit II – Steady State Magnetic Field:
Biot - Savart‟s Law, Ampere‟s circuit law, Applications of Ampere‟s law, Magnetic flux density, Maxwell‟s equations for static EM fields, Magnetic Vector and Scalar potentials, Force due to magnetic field, Magnetic dipole, Magnetic Energy.

Unit III - Maxwell's Equations:
Magnetic Induction and Faraday‟s Law, The Equation of Continuity for Time Varying Fields, Inconsistency of Ampere‟s Law, Maxwell‟s Equations, Conditions at a Boundary Surface, The Wave Equation for a Conducting Medium, Solution for Free-Space Conditions, Uniform Plane-Waves and their Propagation.

UNIT – IV: EM Waves
Sinusoidal Time Variations, Conductors and Dielectrics, Polarization, Reflection by a Perfect Conductor-Normal Incidence, Reflection by a Perfect Conductor-Oblique Incidence, Reflection by a Perfect Dielectric -Normal Incidence, Reflection by a Perfect Insulator - Oblique Incidence, Poynting‟s Theorem.

Unit V - Transmission Lines – I:
Types, Parameters, Transmission Line Equations, Primary & Secondary Constants, Expressions for Characteristic Impedance, Propagation Constant, Phase and Group Velocities, Infinite Line Concepts, Lossless/Low Loss Characterization, Distortion – Condition for Distortion less and Minimum Attenuation, Loading - Types of Loading, Illustrative Problems.

Unit VI - Transmission Lines – II:
Input Impedance Relations, SC and OC Lines, Reflection Coefficient, VSWR, UHF Lines as Circuit Elements: λ /4, λ/2, λ/8 Lines – Impedance Transformations, Significance of Zmin and Zmax Smith Chart – Configuration and Applications, Single and Double Stub Matching, Illustrative Problems.

Text books:

1. Mathew N O Sadiku, "Elements of Electromagnetics", Oxford External Press, 2003, 3rd edition(Units-I, II)
2. E C Jordan and K G Balmain, "Electromagnetic Waves and Radiating Systems", PHI 2003(Units - III, IV)

Reference books:

1. Joseph A Edminister, "Theory and Problems of Electromagnetics", 2nd edition, Schaum‟s Outline Series, McGraw Hill, 1993
2. W H Hayt , "Engineering Electromagnetics", TMH, 1997
3. J. D. Kraus, "Electromagnetics", 5th edition, McGraw Hill l, 1999.
4. Engineering Electromagnetics, " Nathan Ida", Springer (India) Pvt. Ltd., New Delhi , 2nd edition, 2005.

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Course Code 18ECT4T2	Electronic Circuit Analysis	L	T	P	C
	Maximum expected contact hours : **64**	**3**	**1**	**--**	**3**

PURPOSE: This fundamental course will enable the students to learn the concepts of amplifiers and oscillator circuits.

	INSTRUCTIONAL COURSE OBJECTIVES
1	Familiarize with Small signal high frequency BJT transistor amplifier Hybrid-π equivalent circuit and the expressions for conductances and capacitances are derived.
2	Familiarize with Cascading of single stage amplifiers is discussed. Expressions for overall voltage gain are derived.
3	The concept of feedback is introduced. Effect of negative feedback on amplifier characteristics is explained and necessary equations are derived.
4	Familiarize with Basic principle of oscillator circuits is explained and different oscillator circuits are given with their analysis.
5	Power amplifiers Class A, Class B, Class C, Class AB and other types of amplifiers are analyzed.
6	Different types of tuned amplifier circuits are analyzed.
	COURSE OUTCOMES
1	Design and analysis of small signal high frequency transistor amplifier using BJT and FET.
2	Design and analysis of multi stage amplifiers using BJT and FET and Differential amplifier using BJT
3	Derive the expressions for frequency of oscillation and condition for oscillation of RC and LC oscillators and their amplitude and frequency stability concept.
4	Know the classification of the power and tuned amplifiers and their analysis with performance comparison.

UNIT-I: Small Signal High Frequency Transistor Amplifier models: BJT: Transistor at high frequencies, Hybrid- π common emitter transistor model, Hybrid π conductances, Hybrid π capacitances, validity of hybrid π model, determination of high-frequency parameters in terms of low-frequency parameters , CE short circuit current gain, current gain with resistive load, cut-off frequencies, frequency response and gain bandwidth product. FET: Analysis of common Source and common drain Amplifier circuits at high frequencies.

UNIT-II: Multistage Amplifiers : Classification of amplifiers, methods of coupling, cascaded transistor amplifier and its analysis, analysis of two stage RC coupled amplifier, high input resistance transistor amplifier circuits and their analysis-Darlington pair amplifier, Cascode amplifier, Boot-strap emitter follower, Analysis of multi stage amplifiers using FET, Differential amplifier using BJT.

UNIT –III: Feedback Amplifiers : Feedback principle and concept, types of feedback, classification of amplifiers, feedback topologies, Characteristics of negative feedback amplifiers, Generalized analysis of feedback amplifiers, Performance comparison of feedback amplifiers, Method of analysis of feedback amplifiers.

Unit-IV: Oscillators: Oscillator principle, condition for oscillations, types of oscillators, RC-phase shift and Wein bridge oscillators with BJT and FET and their analysis, Generalized analysis of LC Oscillators, Hartley and Colpitt's oscillators with BJT and FET and their analysis, Frequency and amplitude stability of oscillators.

UNIT-V: Power Amplifiers: Classification of amplifiers, Class A power Amplifiers and their analysis, Harmonic Distortions, Class B Push-pull amplifiers and their analysis, Complementary symmetry push pull amplifier, Class AB power amplifier, Class-C power amplifier, Thermal stability and Heat sinks, Distortion in amplifiers.

UNIT-VI: Tuned Amplifiers : Introduction, Q-Factor, small signal tuned amplifier, capacitance single tuned amplifier, double tuned amplifiers, effect of cascading single tuned amplifiers on band width, effect of cascading double tuned amplifiers on band width, staggered tuned amplifiers, stability of tuned amplifiers, wideband amplifiers.

Text Books:

1. Integrated Electronics- J. Millman and C.C. Halkias, Tata Mc Graw-Hill, 1972.
2. Electronic Devices and Circuits- Salivahanan, N.Suressh Kumar, A. Vallavaraj, TATA McGraw Hill, Second Edition

Reference Books:

1. Electronic Circuit Analysis and Design – Donald A. Neaman, Mc Graw Hill.
2. Electronic Devices and Circuits Theory – Robert L. Boylestad and Louis Nashelsky, Pearson/Prentice Hall, Tenth Edition.
3. Electronic Circuit Analysis-B.V.Rao,K.R.Rajeswari, P.C.R.Pantulu,K.B.R.Murthy, Pearson Publications.
4. Microelectronic Circuits-Sedra A.S. and K.C. Smith, Oxford University Press, Sixth Edition.

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Course Code 18EC4T3	ANALOG & DIGITAL COMMUNICATION	L	T	P	C
	Maximum expected contact hours : **64**	**3**	**1**	**--**	**3**

PURPOSE: This fundamental course will enable the students to learn the concepts, types of analog and digital communication

	INSTRUCTIONAL COURSE OBJECTIVES
1	Familiarize with the fundamentals of analog communication systems
2	Familiarize with various techniques for analog modulation and demodulation of signals
3	Familiarize with Basic concepts of Frequency Modulation
4	Develop the ability to classify and understand various functional blocks of radio transmitters and receivers
5	Distinguish the figure of merits of various analog modulation methods
6	Familiarize with basic techniques for generating and demodulating various pulse modulated signals
	COURSE OUTCOMES
1	Differentiate various Analog modulation and demodulation schemes and their spectral characteristics
2	Analyze noise characteristics of various analog modulation methods
3	Analyze various functional blocks of radio transmitters and receivers
4	Design simple analog systems for various modulation techniques.

UNIT I

AMPLITUDE MODULATION: Introduction to communication system, Need for modulation, Frequency Division Multiplexing , Amplitude Modulation, Definition, Time domain and frequency domain description, single tone modulation, power relations in AM waves, Generation of AM waves, square law Modulator, Switching modulator, Detection of AM Waves; Square law detector, Envelope detector.

UNIT II

DSB & SSB MODULATION: Double side band suppressed carrier modulators, time domain and frequency domain description, Generation of DSBSC Waves, Balanced Modulators, Ring Modulator, Coherent detection of DSB-SC Modulated waves, COSTAS Loop. Frequency domain description, Frequency discrimination method for generation of AM SSB Modulated Wave, Time domain description, Phase discrimination method for generating AM SSB Modulated waves. Demodulation of SSB Waves, Vestigial side band modulation **concept and applications**. Frequency description, Generation of VSB Modulated wave, Time domain description, Envelope detection of a VSB Wave pulse Carrier, Comparison of AM Techniques, Applications of different AM Systems.

UNIT III

ANGLE MODULATION : Basic concepts, Frequency Modulation: Single tone frequency modulation, Spectrum Analysis of Sinusoidal FM Wave, Narrow band FM, Wide band FM, Constant Average Power, Transmission bandwidth of FM Wave - Generation of FM Waves, Direct FM, Detection of FM Waves: Balanced Frequency discriminator, Zero crossing detector, Phase locked loop, Comparison of FM & AM.

UNIT IV

TRANSMITTERS & RECEIVERS: Radio Transmitter - Classification of Transmitter, AM Transmitter, Effect of feedback on performance of AM Transmitter, FM Transmitter – Variable reactance type and phase modulated FM Transmitter, frequency stability in FM Transmitter. **Radio Receiver** - Receiver Types - Tuned radio frequency receiver, Superhetrodyne receiver, RF section and Characteristics - Frequency changing and tracking, Intermediate frequency, AGC, FM Receiver,Comparison with AM Receiver, Amplitude limiting. Communication Receivers, extensions of superheterodyne principle and additional circuits.

UNIT V

NOISE : Review of noise and noise sources, noise figure**,** Noise in Analog communication Systems, Noise in DSB& SSB System, Noise in AM System, Noise in Angle Modulation Systems, Threshold effect in Angle Modulation System, Pre-emphasis & de-emphasis

UNIT VI

PULSE MODULATION: Time Division Multiplexing,, Types of Pulse modulation, PAM (Single polarity, double polarity) PWM: Generation & demodulation of PWM, PPM, Generation and demodulation of PPM, TDM Vs FDM

Text Books:

1. Principles of Communication Systems – H Taub & D. Schilling, Gautam Sahe, TMH, 2007 3rd Edition.
2. Communication Systems – B.P. Lathi, BS Publication, 2006.

Reference Books

1. Principles of Communication Systems - Simon Haykin, John Wiley, 2nd Ed.,.
2. Electronics & Communication System – George Kennedy and Bernard Davis, TMH 2004.
3. Communication Systems– R.P. Singh, SP Sapre, Second Edition TMH, 2007.
4. Fundamentals of Communication Systems - John G. Proakis, Masond, Salehi PEA, 2006.

5. Electronic Communication systems – Tomasi, Pearson.

Course Code 18EC4T4	PULSE AND DIGITAL CIRCUITS	L	T	P	C
	Maximum expected contact hours : **64**	**4**	**--**	**--**	**3**

PURPOSE: Pulse and digital circuits is designed to cater to the needs of undergraduates students of electronics and communication engineering

	INSTRUCTIONAL COURSE OBJECTIVES
1	To explain the complete response of R-C and R-L-C transient circuits.
2	To explain clippers, clampers, switching characteristics of transistors and sampling gates.
3	To construct various multi vibrators using transistors, design of sweep circuits and sampling gates.
4	To discuss and realize logic gates using diodes and transistors.
5	To know the methods of generating voltage sweep waveforms
6	To know the concepts of TTL, ECL,NMOS and CMOS logic families
	COURSE OUTCOMES
1	Understand the applications of diode as integrator, differentiator, clippers, and clamper circuits.
2	Learn various switching devices such as diode, transistor, SCR. Difference between logic gates and sampling gates
3	Design multivibrators for various applications, synchronization techniques and sweep circuits.
4	Realizing logic gates using diodes and transistors.
5	Understanding of time and frequency domain aspects.
6	Importance of clock pulse and its generating techniques.

UNIT I

LINEAR WAVESHAPING: High pass, low pass RC circuits, their response for sinusoidal, step, pulse, square, ramp and exponential inputs. RC network as differentiator and integrator, double differentiator Attenuators , its applications in CRO probe, RL and RLC circuits and their response for step input, Ringing circuit.

UNIT II

NON-LINEAR WAVE SHAPING : Diode clippers, Transistor clippers, clipping at two independent levels, Transfer characteristics of clippers, Emitter coupled clipper; Clamping operation, clamping circuits using diode with different inputs, Clamping circuit theorem, practical clamping circuits, effect of diode characteristics on clamping voltage, Transfer characteristics of clampers.

UNIT III

SWITCHING CHARACTERISTICS OF DEVICES:, piecewise linear diode characteristics, Diode as a switch ,Break down voltage consideration of diode, Design and analysis of Transistor as a switch, , Design of transistor switch, transistor-switching times.

Bistable Multivibrator: Analysis And Design of Fixed Bias, Self Bias Bistable Multi Vibrator, Collector Catching Diodes, Commutating Capacitors, Triggering of Binary Circuits, Emitter Coupled Bistable Multivibrator (Schmitt Trigger).

UNIT IV

Monostable Multivibrator: Analysis and Design of Collector Coupled Monostable Multi vibrator, Triggering of Monostable Multivibrator, Applications of Monostable Multivibrator.

Astable Multivibrator: Analysis and Design of Collector Coupled Astable Multivibrator, Application of Astable Multivibrator as a Voltage to Frequency Converter.

UNIT V

VOLTAGE TIME BASE GENERATORS:

General features of a time base signal, Methods of generating time base waveform Exponential Sweep Circuits, constant current bias circuit, Negative Resistance Switches, basic principles in Miller and Bootstrap time base generators, Transistor Miller time base generator, Transistor Bootstrap time base generator.

UNIT VI

LOGIC FAMILIES & SAMPLING GATES:

LOGIC FAMILIES: Diode Logic, Transistor Logic, Diode-Transistor Logic, Transistor-Transistor Logic, Emitter Coupled Logic, AOI Logic, Comparison of Logic Families.

SAMPLING GATES: Basic Operating Principles of Sampling Gates, Diode Unidirectional Sampling Gate and Two-Diode Bi-Directional Sampling Gate, Four-Diode gates, Six-Diode Gates, Reduction of Pedestal in Sampling Gates, Applications of Sampling Gates. Transistorized bidirectional sampling gates

Text Books:

1.Millman's Pulse, Digital and Switching Waveforms –J. Millman, H. Taub and Mothiki S. Prakash Rao, 2 Ed., 2008, McGraw Hill.

2.Pulse, Switching and Digital Circuits – David A. Bell, 5th edition 2015, OXFORD University Press

Reference Books :

1. Pulse and Digital Circuits -Venkata Rao K, Rama Sudha K, Manmadha rao G, Pearson, 2010

2.Pulse and Digital Circuits – A. Anand Kumar, 2005, PHI.

Course Code 18EC4L1	PULSE AND DIGITAL CIRCUITS LAB	L	T	P	C
	Maximum expected contact hours : **16 Weeks**	--	--	3	2

PURPOSE : students can able to learn the pulse and digital circuits

	INSTRUCTIONAL COURSE OBJECTIVES
1	To understand the working nonlinear circuits for different input waveforms.
2	To familiarize the students with functional verification of various digital circuits

	COURSE OUTCOMES
1	Design different RC differentiator and integrator circuits.
2	Understand the application of clippers, clampers and Multivibrator.
3	Familiarize with the various basic and universal logic gates.
4	Understand the functionality of various combinational digital circuits.

List of Experiments: minimum 10 Experiments has to do

1. Analysis, design and test low pass and high pass RC circuits for the given cut-off frequency.
2. Analysis, design and test Clipper circuits.
3. Analysis, design and test Clamper circuits.
4. Design of Astable Multivibrator for the given specifications.
5. Design of Mono stable Multivibrator for the given specifications.
6. Identify stable states in Bistable Multivibrator.
7. Implement the given logic expression by using universal GATES.
8. Design and verify truth table of full adder using two half adders.
9. Implement the given logic expression by using multiplexer.
10. Transistor as a switch.
11. Study of Logic Gates & Some applications.
12. Study of Flip-Flops & some applications.
13. Sampling Gates.
14. Schmitt Trigger.
15. UJT Relaxation Oscillator.
16. Bootstrap sweep circuit.

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Course Code 18EC4L3	ELECTRONIC CIRCUIT ANALYSIS LAB	L	T	P	C
	Maximum expected contact hours : **16 Weeks**	--	--	3	2

PURPOSE: To Familiarize with Basic principle of amplifiers and oscillators

INSTRUCTIONAL COURSE OBJECTIVES:

1	Frequency response of single stage and multi stage amplifiers.
2	Working of Power amplifier.
3	How frequency response varies by applying negative feedback on amplifiers.
4	Different frequency sinusoidal signal generation.

COURSE OUTCOMES:

1	Understand the effect of capacitors on frequency response of amplifier
2	Determine the efficiency of power amplifiers.
3	Generate Sinusoidal signals with different frequencies and know the difference between different Multivibrators.

List of Experiments :(Minimum of Ten Experiments has to be performed and same should be carried out using **multisim)**

1. Determination of fT of a given transistor.
2. Voltage-Series Feedback Amplifier
3. Current-Shunt Feedback Amplifier
4. RC Phase Shift/Wien Bridge Oscillator
5. Hartley/Colpitt's Oscillator
6. Two Stage RC Coupled Amplifier
7. Darlington Pair Amplifier
8. Bootstrapped Emitter Follower
9. Class A Series-fed Power Amplifier
10. Transformer-coupled Class A Power Amplifier
11. Class B Push-Pull Power Amplifier
12. Complementary Symmetry Class B Push-Pull Power Amplifier
13. Single Tuned Voltage Amplifier
14. Double Tuned Voltage Amplifier

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Course Code **18EC5T1**	**ANALOG IC APPLICATIONS**	**L**	**T**	**P**	**C**
	Maximum expected contact hours : **64**	**3**	**1**	**--**	**3**
	Prerequisites : **Knowledge of Integrated Circuits**				

PURPOSE: This fundamental course will enable the students to learn the concepts of Integrated circuits and Familiarize students with applications of various IC's.

INSTRUCTIONAL COURSE OBJECTIVES

1	To understand the different types of ICs and working principles of differential amplifiers.
2	To provide basic knowledge of op-amps
3	To describe the various linear and non linear applications of Op-amp.
4	To describe active filters and voltage regulators.
5	To develop various applications using IC 555 Timer ,PLL(IC 565)
6	Discuss the operation of the most commonly used D/A and A/D converters.

COURSE OUTCOMES

1	Understand the fundamentals of ICs and Remember the fundamental concepts of Differential amplifiers and Transistor current sources
2	Understand & learn the measuring techniques of performance parameters of OP-AMP
3	Learn the linear and non-linear applications of operational amplifiers.
4	Design different types of Active filters & understand voltage regulators
5	Apply the 555 Timer circuits and Phased Locked Loop for various applications.
6	Evaluate the performance of ADC and DAC.

UNIT I

Introduction: - Integrated Circuit Definition and their features, Classification, Package Types and Temperature ranges, Differences between Analog ICs and Digital ICs.

Differential Amplifiers: Classifications of differential amplifiers, DC and AC analysis of all

Differential amplifier Configurations, specifications of differential amplifiers, CMRR improve methods, DC Coupling and Cascade Differential Amplifiers.

UNIT-II:

Operational Amplifiers: Characteristics of OP-Amps, Op-amp Block Diagram, Level translator. IC 741 op-amp and its features, Power supply requirement to operate Op-amp IC741, Ideal and practical characteristics of Op-amp, DC and AC characteristics of Op-Amp, IC 741 Op-Amp specifications, Measurement of Input & Out put Off set voltages & currents, slew rate and CMRR.

UNIT III

LINEAR AND NON-LINEAR APPLICATIONS OF OP-AMPS: Linear Applications Of Op-Amps: Inverting and Non-inverting amplifier, Integrator and differentiator, Difference amplifier, Instrumentation amplifier, AC amplifier, AC Voltage follower,V to I, I to V converters.

Non-Linear Applications Of Op-Amps: Comparators, Schmitt trigger, Triangular and Square wave generators, Log and Anti log Amplifiers, Precision rectifiers.

UNIT IV

ACTIVE FILTERS, IC VOLTAGE REGULATORS: Active Filters: Design & Analysis of Butterworth active filters – 1st order, 2nd order LPF, HPF filters. Band pass, Band reject and all pass filters.IC Voltage Regulators: Fixed Voltage Regulators, IC723 General Purpose Regulator (BasicLow & High Voltage).

UNIT V

TIMERS & PHASE LOCKED LOOPS: Introduction to 555 timer, functional diagram, Monostable and Astable operations and applications, Schmitt Trigger; PLL - introduction, block schematic, principles and description of individual blocks, 565 PLL, Applications of PLL – frequency multiplication, frequency translation, AM, FM & FSK demodulators. Applications of VCO (566).

UNIT VI

DIGITAL TO ANALOG AND ANALOG TO DIGITAL CONVERTERS: Introduction, basic DAC techniques, weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, and IC 1408 DAC, Different types of ADCs –parallel Comparator type ADC, counter type ADC, Servo tracking ADC, successive approximation ADC and dual slope ADC.DAC andADC Specifications, Specifications AD 574 (12 bit ADC).

TEXT BOOKS

1.Ramakanth A. Gayakwad, Op-amps and Linear Integrated Circuits, PHI Publishers, 4th Edition.

REFERENCES

1. D. Roy choudhury, Linear Integrated Circuits, New Age International (P) Ltd.
2. M.H Rashid, "Microelectronic Circuits: Analysis and Design", PWS Publishing Company, 2nd Edition.
3. R.F. Coughlin and Fredrick Driscoll, Operational Amplifiers and Linear Integrated Circuits, PHI Publishers.

4. K. Lal Kishore, Operational Amplifiers and Linear Integrated Circuits, Pearson education Publishers.

Course Code 18EC5T3	CONTROL SYSTEMS	L	T	P	C
	Maximum expected contact hours : **64**	3	1	--	3
	Prerequisites : **Knowledge in Mathematics**				

PURPOSE: This course introduces the elements of linear control systems and their analysis. Classical methods of design using frequency response. The state space approach for design, modeling and analysis of simple PD,PID controllers.

	INSTRUCTIONAL COURSE OBJECTIVES
1	To learn the mathematical modeling of physical systems and to use block diagram algebra and signal flow graph to determine overall transferfunction
2	To analyze the time response of first and second order systems and improvement of performance by proportional plus derivative and proportional plus integralcontrollers
3	To investigate the stability of closed loop systems using Routh's stability criterion and the analysis by root locusmethod.
4	To present the Frequency Response approaches for the analysis of linear time invariant (LTI) systems using Bode plots, polar plots and Nyquist stabilitycriterion.
5	To discuss basic aspects of design and compensation of linear control systems using Bodeplots.
6	Ability to formulate state models and analyze the systems. To present the concepts of Controllability andObservability.
	COURSE OUTCOMES
1	Ability to derive the transfer function of physical systems and determination of overall transfer function using block diagram algebra and signal flowgraphs.
2	Capability to determine time response specifications of second order systems and to determine errorconstants.
3	Acquires the skill to analyze absolute and relative stability of LTI systems using Routh's stability criterion and the root locusmethod.
4	Capable to analyze the stability of LTI systems using frequency responsemethods.
5	Able to design Lag, Lead, Lag-Lead compensators to improve system performance from Bodediagrams.
6	Ability to represent physical systems as state models and determine the response. Understanding the concepts of controllability andobservability.

UNIT – I:
Mathematical Modeling Of Control Systems: Classification of control systems, Open Loop and closed loop control systems and their differences, Feed-Back Characteristics, transfer function of linear system, Differential equations of electrical networks, Translational and Rotational mechanical systems, Transfer Function of DC Servo motor - AC Servo motor- Synchro, transmitter and receiver - Block diagram algebra – Representation by Signal flow graph - Reduction using Mason's gain formula.

UNIT-II:
Time Response Analysis: Standard test signals: Time response of first and second order systems - Time domain specifications - Steady state errors and error constants – Effects of proportional derivative, proportional integral systems.

UNIT – III:
Stability and Rootlocus Technique: The concept of stability – Routh's stability criterion –limitations of Routh's stability –Root locus concept - construction of root loci (Simple problems)

UNIT–IV:
Frequency Response Analysis: Introduction to Frequency domain specifications-Bode diagrams- transfer function from the Bode Diagram-Phase margin and Gain margin-Stability Analysis from Bode Plots, Polar Plots, Nyquist Stability criterion.

UNIT–V
Classical Control Design Techniques: Lag, Lead, Lag-Lead compensators, design of compensators – using Bode plots.

UNIT–VI
State Space Analysis OfLti Systems: Concepts of state, state variables and state model, state space representation of transfer function, Diagonalization- Solving the time invariant state equations- State Transition Matrix and it's Properties – Concepts of Controllability and Observability.

Text Books:
Control Systems principles and design, M.Gopal, Tata McGraw Hill education Pvt Ltd., 4th Edition.
Automatic control systems, Benjamin C.Kuo, Prentice Hall ofIndia,2ndEdition.

Reference Books:
Modern Control Engineering, Kotsuhiko Ogata, Prentice Hall of India.
Control Systems, ManikDhanesh N, Cengage publications.
Control Systems Engineering,I.J.Nagarath and M.Gopal,NewageInternational Publications, 5th Edition.Control Systems Engineering, S.Palani,TataMcGraw HillPublications.

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Course Code 18EC5T4	ANTENNAS AND WAVE PROPAGATION	L	T	P	C
	Maximum expected contact hours : **64**	3	1	--	3
	Prerequisites : **Knowledge in EM waves, vector calculus**				

PURPOSE: This fundamental course will enable the students to learn the concepts of antenna parameters and signal propagation.

INSTRUCTIONAL COURSE OBJECTIVES: The student will be able to understand radiation of antenna and wave propagation
.

1	Radiation mechanism from antenna
2	The fundamentals of antenna theory.
3	Various antenna types including linear and planar micro strip configuration.
4	Antenna measurements
5	Various types of Radio wave propagation.

COURSE OUTCOMES: At the end of the course the student will be able to

1	Analyze a complete radio system, from the Transmitter to the Receiver end with reference to antenna.
2	Understand the basics of antennas
3	Use the various types of antennas in different applications
4	Analyze antenna measurements to assess antenna's performance
5	Understand the Radio wave propagation in atmosphere

UNIT – I: ANTENNA THEORY

Definition and function of Antenna, Radiation Mechanism, Current Distribution on a thin wire antenna, Isotropic Radiators, Antenna Parameters**:** Radiation Pattern, Radiation intensity, Directive gain, directivity, Power gain, Gain ,Radiation efficiency, Beam Width, Beam area, effective aperture, effective length, Relation between gain, effective Height, Antenna Temperature, Front - to-back Ratio, Illustrative problem.

UNIT-II: THIN LINEAR WIRE ANTENNAS

Radiation from Small Electric Dipole, Quarter Wave Monopole and Half Wave Dipole -Current Distributions. Field Components. Radiated Power, Radiation Resistance, Natural Current Distributions, Far Fields and Patterns of Thin Linear Centre-fed Antennas of Different Lengths. Illustrative Problems. net work theorems and their application to antennas. Loop Antennas - Introduction, Small Loop, Comparison of Far Fields of Small Loop and Short Dipole, Radiation Resistances and Directivities of Small and Large Loops (Qualitative Treatment).

UNIR-III: ANTENNA ARRAY ANALYSIS

Introduction to arrays, Types of arrays, 2 element array – different cases, N element uniform linear arrays – Broad Side, End – Fire Arrays, EFA with increased directivity, Patterns of Array of Non Isotropic Radiators, Method of pattern multiplication, concept of scanning arrays, Binominal Array, Effects of Uniform and Non-Uniform amplitude distributions, array with parasitic elements, folded dipoles and their characterstics, Yagi-Uda Antenna Illustrative problems.

UNIT-IV: VHF AND UHF ANTENNAS

Resonant Antennas, Non Resonant Antennas, Log-wire Antenna,Travelling wave antenna, V-Antenna, Inverted V-Antenna, Rhombic Antenna, Helical Antenna,Microstrip antenna.

UNIT-V: MICROWAVE ANTENNAS

Corner Reflector, Parabolic Reflector Antennas, Feed System, Horn Antenna, Lens Antenna, Micro strip Antenna.

Antenna Measurements: Reciprocity in Antenna measurements – Near-field and Far-field – Measurements ranges - Measurement of different Antenna parameters- Directional pattern, Radiation resistance, Gain (Two Antenna, Three Antenna Methods), Directivity, Beam width, SLR, Polarization, Impedance, Radiation Efficiency, Aperture Efficiency.

UNIR-VI: WAVE PROPAGATION

Ground Wave Propagation: Characteristics, Parameters, Wave Tilt, Flat and Spherical Earth considerations. Frequency ranges and types of propagations

Sky Wave Propagation: Formation of Ionospheric Layers and their Characteristics, Mechanism of Reflection and Refraction, Critical Frequency, MUF & Skip Distance – Calculations for flat and spherical earth cases, Optimum Frequency, LUHF, Virtual Height, Ionospheric Abnormalities, Ionospheric Absorption.

Space Wave Propagation: Fundamental Equation for free space Propagation, Basic Transmission Loss Calculations. Space Wave Propagation Mechanism, LOS and Radio Horizon.

Tropospheric Wave Propagation: Radius of Curvature of path, Effective Earth's Radius, Effect of Earth's Curvature, Field Strength Calculations, Duct Propagation, Tropospheric Scattering.

TEXT BOOKS:

1. Antennas and Wave Propagation - J.D. Kraus, RJ. Marhefka and Ahmad S. Khan. TMH, New Delhi, 4'h ed., (Special
2. Electromagnetic Waves and Radiating Systems - E.C. Jordan and K.G. Bahrain. PHI, 2nd e d., 2000.

REFERENCE BOOKS:

1. Antenna Theory - C.A. Balanis, John Wiley & Sons, 3rd ed.. 2005.
2. Antennas and Wave Propagation - K.D. Prasad, Satya Prakashan, Tech India Publi., New Delhi, 2001.
3. Transmission and Propagation - E.V.D. Glazier and H.R.L. Lamont, The Services Text Book of Radio, vol. 5 Standard Publishers Distributors, Delhi.
4. Electronic and Radio Engineering - EE. Terman, McGraw-Hill, 4th edition, 1955.

Course Code **18EC5T5**	**DIGITAL SIGNAL PROCESSING**	**L**	**T**	**P**	**C**
	Maximum expected contact hours : **64**	**3**	**1**	**--**	**3**
	Prerequisites : **Knowledge in Mathematics**				

PURPOSE: This fundamental course will enable the students to learn how to Achieving noiseless signals by using different filters.

INSTRUCTIONAL COURSE OBJECTIVES: The student will be able to

1	Analyze the Discrete Time Signals and Systems
2	Know the importance of FFT algorithm for computation of Discrete Fourier Transform
3	Understand the various implementations of digital filter structures
4	Learn the FIR and IIR Filter design procedures
5	Know the need of Multirate Processing
6	Learn the concepts of DSP Processors

COURSE OUTCOMES: After going through this course the student will be able to

1	Apply the difference equations concept in the anayziation of Discrete time systems
2	Use the FFT algorithm for solving the DFT of a given signal
3	Design a Digital filter (FIR&IIR) from the given specifications
4	Realize the FIR and IIR structures from the designed digital filter
5	Use the Multirate Processing concepts in various applications
6	Apply the signal processing concepts on DSP Processor

UNIT I INTRODUCTION: Introduction to Digital Signal Processing: Discrete time signals & sequences, Classification of Discrete time systems , stability of LTI systems, Invert ability, Response of LTI systems to arbitrary inputs. Solution of Linear constant coefficient difference equations. Frequency domain representation of discrete time signals and systems. Review of Z-transforms, solution of difference equations using Z-transforms System function

UNIT II DISCRETE FOURIER SERIES & FOURIER TRANSFORMS: Properties of discrete Fourier series,DFS representation of periodic sequences, Discrete Fourier transforms: Properties of DFT, linear filtering methods based on DFT, Fast Fourier transforms (FFT) - Radix-2 decimation in time and decimation in frequency FFT Algorithms, Inverse FFT.

UNIT-III

DESIGN OF IIR DIGITAL FILTERS& REALIZATIONS: Analog filter approximations – Butter worth and Chebyshev, Design of IIR Digital filters from analog filters, Design Examples, Analog and Digital frequency transformations. Basic structures of IIR systems, Transposed forms

UNIT IV DESIGN OF FIR DIGITAL FILTERS & REALIZATIONS:

Characteristics of FIR Digital Filters, frequency response. Design of FIR Digital Filters using Window Techniques and Frequency Sampling technique, Comparison of IIR & FIR filters.

Basic structures of FIR systems, Lattice structures, Lattice-ladder structures .

UNIT V MULTIRATE DIGITAL SIGNAL PROCESSING: Introduction, Decimation , Interpolation Sampling rate conversion ,Implementation of sampling rate converters, *Applications – Sub-band Coding of Speech Signals ,Implementation of Digital Filter Banks, Trans-multiplexers.*

UNIT VI INTRODUCTION TO DSP PROCESSORS: Introduction to programmable DSPs: Multiplier and Multiplier Accumulator, Modified bus structures and memory access schemes in P-DSPs ,Multiple Access Memory,Multi ported memory, VLIW architecture, Pipelining, Special addressing modes, On-Chip Peripherals.

Architecture of TMS320C5X: Introduction, Bus Structure, Central Arithmetic Logic Unit, Auxiliary Register ALU,Index Register, Block Move Address Register, Parallel Logic Unit, Memory mapped registers, program controller,some flags in the status registers, On- chip memory, On-chip peripherals.

TEXT BOOKS:

1. Digital Signal Processing, Principles, Algorithms, and Applications: John G. Proakis, Dimitris G.Manolakis,Pearson Education / PHI, 2007.
2. Discrete Time Signal Processing – A.V.Oppenheim and R.W. Schaffer, PHI
3. Digital Signal Processors – Architecture, Programming and Applications,, B.Venkataramani, M.Bhaskar, TATAMcGraw Hill, 2002
4. Digital Signal Processing – K Raja Rajeswari, I.K. International Publishing House

Reference Books:

1. Digital Signal Processing: Andreas Antoniou, TATA McGraw Hill , 2006
2. Digital Signal Processing: MH Hayes, Schaum's Outlines, TATA Mc-Graw Hill, 2007.
3. DSP Primer - C. Britton Rorabaugh, Tata McGraw Hill, 2005.
4. Fundamentals of Digital Signal Processing using Matlab – Robert J. Schilling, Sandra L. Harris,Thomson, 2007.
5. Digital Signal Processing – Alan V. Oppenheim, Ronald W. Schafer, PHI Ed., 2006
6. Digital Signal Processing – Ramesh babu, Sci Tech publications

Course Code **18EC5L2**	**ANALOG IC APPLICATIONS LAB**	**L**	**T**	**P**	**C**
	Maximum expected contact hours : **14 Weeks**	--	--	**3**	**1**
	Prerequisites : Designing In Integrated Circuit Applications				

PURPOSE

This fundamental course will enable the students to learn the concepts of Integrated circuits and Familiarize students with applications of various IC's.

INSTRUCTIONAL COURSE OBJECTIVES

1	To understand the working of op-amps(IC 741,IC 555,IC 565,IC 566)
2	To design active filters and DACs using IC 741 OP-AMPS.
3	To Implement Multivibrators and Voltage Regulators using ICs.

COURSE OUTCOMES: At the end of the course, students will be able to

1	Build the basic applications of op-amp, VCO and PLL.
2	Design filters and DAC using IC 741 Op-Amp.
3	Implement Multivibrators and Voltage Regulators using ICs.

1. Study of OP AMPs – IC 741, IC 555, IC 565, IC 566, IC 1496 – functioning, parameters and Specifications.
2. OP AMP Applications – Adder, Subtractor, Comparator Circuits.
3. Integrator and Differentiator Circuits using IC 741.
4. Active Filter Applications – LPF, HPF (first order)
5. Active Filter Applications – BPF, Band Reject (Wideband) and Notch Filters.
6. Function Generator using OP AMPs.
7. IC 555 Timer – Monostable Operation Circuit.
8. IC 555 Timer – Astable Operation Circuit.
9. Schmitt Trigger Circuits – using IC 741 and IC 555.
10. IC 565 – PLL Applications.
11. IC 566 – VCO Applications.
12. Voltage Regulator using IC 723.
13. Three Terminal Voltage Regulators – 7805, 7809, 7912.
14. Digital to Analog Converter using Op-Amp IC 741.

Equipment required for Laboratories:

1. RPS
2. CRO
3. Function Generator
4. Multi Meters
5. IC Trainer Kits (Optional)
6. Bread Boards
7. Components:- IC741, IC555, IC565, IC1496, IC723, 7805, 7809, 7912 and other essential components.
8. Analog IC Tester

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Course Code 18EC5L3	DIGITAL SIGNAL PROCESSING LAB	L	T	P	C
	Maximum expected contact hours :14 WEEKS	--	--	3	1
	Prerequisites : **Knowledge in Mathematics**				

PURPOSE: This fundamental course will enable the students to learn how to Achieving noiseless signals by using different filters.

INSTRUCTIONAL COURSE OBJECTIVES: The student will be able to

1	Analyze the Discrete Time Signals and Systems
2	Know the importance of FFT algorithm for computation of Discrete Fourier Transform
3	Understand the various implementations of digital filter structures
4	Learn the FIR and IIR Filter design procedures
5	Know the need of Multirate Processing
6	Learn the concepts of DSP Processors

COURSE OUTCOMES: After going through this course the student will be able to

1	Apply the difference equations concept in the anayziation of Discrete time systems
2	Use the FFT algorithm for solving the DFT of a given signal
3	Design a Digital filter (FIR&IIR) from the given specifications
4	Realize the FIR and IIR structures from the designed digital filter
5	Use the Multirate Processing concepts in various applications
6	Apply the signal processing concepts on DSP Processor

1.To study the architecture of DSP chips – TMS 320C 5X/6X Instructions.
2.To verify linear convolution.
3.To verify the circular convolution.
4.To design FIR filter (LP/HP) using windowing technique
5.a) Using rectangular window
6.b) Using triangular window
7.c) Using Kaiser Window
8.To Implement IIR filter (LP/HP) on DSP Processors
9.N-point FFT algorithm.
10.MATLAB program to generate sum of sinusoidal signals.
11.MATLAB program to find frequency response of analog LP/HP filters.
12.To compute power density spectrum of a sequence.
13.To find the FFT of given 1-D signal and plot.

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Course Code 18EC5T6	PROFISSIONAL ETHICS AND HUMAN VALUES	L	T	P	C
	Maximum expected contact hours : **32**	**2**	**0**	**--**	**1**
	Prerequisites : **Knowledge in Ethics and values**				

PURPOSE:	
INSTRUCTIONAL COURSE OBJECTIVES	
1	To give basic insights and inputs to the student to inculcate Human values to grow as a responsible human beings with proper personality.
2	Professional Ethics instills the student to maintain ethical conduct and discharge their professional duties
COURSE OUTCOMES	
1	It gives a comprehensive understanding of a variety issues that are encountered by every professional in discharging professional duties. .
2	It provides the student the sensitivity and global outlook in the contemporary world to fulfill the professional obligations effectively

UNIT I: Human Values:
Morals, Values and Ethics – Integrity –Trustworthiness - Work Ethics – Service Learning – Civic Virtue – Respectfor others – Living Peacefully – Caring – Sharing – Honesty –Courage – Value Time – Co-operation – Commitment– Empathy – Self-confidence – Spirituality- Character.

UNIT: II: Principles for Harmony:
Truthfulness – Customs and Traditions -Value Education – Human Dignity – Human Rights – Fundamental Duties -Aspirations and Harmony (I, We & Nature) – Gender Bias - Emotional Intelligence – Salovey – Mayer Model – Emotional Competencies – Conscientiousness

UNIT III: Engineering Ethics and Social Experimentation:
History of Ethics - Need of Engineering Ethics - Senses of Engineering Ethics- Profession and Professionalism —
Self Interest - Moral Autonomy – Utilitarianism – Virtue Theory - Uses of Ethical Theories - Deontology- Types ofInquiry – Kohlberg's Theory - Gilligan's Argument –Heinz's Dilemma - Comparison with Standard Experiments —Learning from the Past –Engineers as Managers – Consultants and Leaders – Balanced Outlook on Law

UNIT IV: Engineers' Responsibilities towards Safety and Risk:
Concept of Safety - Safety and Risk – Types of Risks – Voluntary v/sInvoluntary Risk – Consequences - Risk Assessment – Accountability – Liability - Reversible Effects - Threshold Levels of Risk - Delayed v/sImmediate
Risk - Safety and the Engineer – Designing for Safety – Risk-Benefit Analysis-Accidents

UNIT VI: Global Issues

UNIT V: Engineers' Duties and Rights:
Concept of Duty - Professional Duties – Collegiality - Techniques for Achieving Collegiality – Senses of Loyalty - Consensus and Controversy - Professional and Individual Rights –Confidential and Proprietary Information - Conflict of Interest-Ethical egoism - Collective Bargaining – Confidentiality - Gifts and Bribes - Problem solving- Occupational Crimes- Industrial Espionage- Price Fixing-Whistle Blowing.Risk

References: Globalization and MNCs –Cross Culture Issues - Business Ethics – Media Ethics - Environmental Ethics
Endangering Lives - Bio Ethics - Computer Ethics - War Ethics – Research Ethics -Intellectual Property Rights

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Course Code 18EC6T1	MICROWAVE ENGINEERING	L	T	P	C
	Maximum expected contact hours : **64**	4	1	--	4
	Prerequisites : Knowledge in LECTROMAGNETICS				

PURPOSE:

INSTRUCTIONAL COURSE OBJECTIVES

6.	Concepts of microwaves.
7.	Operation of Microwave tubes
8.	Different Microwave solid state devices
9.	Working principle and Scattering matrix of different Waveguide components
10.	Microwave test bench setup for Microwave measurements.

COURSE OUTCOMES

6.	Know about the Microwave spectrum and applications of microwaves.
7.	Understand the operation and use of Microwave tubes.
8.	Understand the applications of semiconductor microwave devices.
9.	Derive the S-parameters of waveguide components
10.	Use a Microwave bench setup to measure the various microwave parameters.

UNIT I

MICROWAVE TRANSMISSION LINES: Introduction, Microwave Spectrum and Bands, Applications of Microwaves. Rectangular Waveguides – TE/TM mode analysis, Expressions for Fields, Characteristic Equation and Cut-off Frequencies, Filter Characteristics, Dominant and Degenerate Modes, Sketches of TE and TM mode fields in the cross-section, Mode Characteristics – Phase and Group Velocities, Wavelengths and Impedance Relations; Power Transmission and Power Losses in Rectangular Guide, Impossibility of TEM mode. Related Problems.

UNIT II

CIRCULAR WAVEGUIDES: Introduction, Nature of Fields, Characteristic Equation, Dominant and Degenerate Modes. Cavity Resonators– Introduction, Rectangular and Cylindrical Cavities, Dominant Modes and Resonant Frequencies, Q factor and Coupling Coefficients, Excitation techniques- waveguides and cavities, Related Problems.
MICROSTRIP LINES– Introduction, Zo Relations, Effective Dielectric Constant, Losses, Q factor.

UNIT III

MICROWAVE TUBES: Limitations and Losses of conventional tubes at microwave frequencies. Re-entrant Cavities, Microwave tubes – O type and M type classifications. O-type tubes :2 Cavity Klystrons – Structure, Velocity Modulation Process and Applegate Diagram, Bunching Process and Small Signal Theory –Expressions for o/p Power and Efficiency, Applications, Reflex Klystrons – Structure, Applegate Diagram and Principle of working, Mathematical Theory of Bunching, Power Output, Efficiency, Electronic Admittance; Oscillating Modes and o/p Characteristics, Electronic and Mechanical Tuning, Applications, Related Problems.

UNIT - IV

HELIX TWTS: Significance, Types and Characteristics of Slow Wave Structures; Structure of TWT and Suppression of Oscillations, Nature of the four Propagation Constants (Qualitative treatment). M-type Tubes Introduction, Cross-field effects, Magnetrons – Different Types, 8-Cavity Cylindrical Travelling Wave Magnetron – Hull Cut-off Condition, Modes of Resonance and PI-Mode Operation, Separation of PI-Mode, o/p characteristics.

UNIT V

WAVEGUIDE COMPONENTS AND APPLICATIONS - I: Coupling Mechanisms – Probe, Loop, Aperture types. Waveguide Discontinuities – Waveguide irises, Tuning Screws and Posts, Matched Loads. Waveguide Attenuators – Resistive Card, Rotary Vane types; Waveguide Phase Shifters – Dielectric, Rotary Vane types. Scattering Matrix– Significance, Formulation and Properties. S-Matrix Calculations for – 2 port Junction, E-plane and H-plane Tees, Magic

1. Professional Ethics by R. Subramaniam – Oxford Publications, New Delhi.
2. Ethics in Engineering by Mike W. **Martin** and Roland Schinzinger - Tata McGraw-Hill – 2003.
3. Professional Ethics and Morals by Prof.A.R.Aryasri, DharanikotaSuyodhana - Maruthi Publications.
4. Engineering Ethics by Harris, Pritchard and Rabins, Cengage Learning, New Delhi.
5. Human Values & Professional Ethics by S. B. Gogate, Vikas Publishing House Pvt. Ltd., Noida.
6. Engineering Ethics & Human Values by M.Govindarajan, S.Natarajan and V.S.SenthilKumar-PHI Learning Pvt. Ltd – 2009.
7. Professional Ethics and Human Values by A. Alavudeen, R.Kalil Rahman and M. Jayakumaran – University Science Press.
8. Professional Ethics and Human Values by Prof.D.R.Kiran-Tata McGraw-Hill - 2013
9. Human Values And Professional Ethics by Jayshree Suresh and B. S. Raghavan, S.Chand Publications

Tee, Hybrid Ring; Directional Couplers – 2Hole, Bethe Hole types, Ferrite Components– Faraday Rotation, S-Matrix Calculations for Gyrator, Isolator, Circulator, Related Problems.

UNIT VI

MICROWAVE SOLID STATE DEVICES: Introduction, Classification, Applications. TEDs – Introduction, Gunn Diode – Principle, RWH Theory, Characteristics, Basic Modes of Operation, Oscillation Modes. Avalanche Transit Time Devices – Introduction, IMPATT and TRAPATT Diodes – Principle of Operation and Characteristics.

MICROWAVE MEASUREMENTS: Description of Microwave Bench – Different Blocks and their Features, Precautions; Microwave Power Measurement – Bolometer Method. Measurement of Attenuation, Frequency, Q-factor, Phase shift, VSWR, Impedance Measurement.

TEXT BOOKS:

1. Microwave Devices and Circuits – Samuel Y. Liao, PHI, 3rd Edition, 1994.
2. Foundations for Microwave Engineering – R.E. Collin, IEEE Press, John Wiley, 2nd Edition, 2002.

REFERENCES:

1. Microwave Principles – Herbert J. Reich, J.G. Skalnik, P.F. Ordung and H.L. Krauss, CBS Publishers and
2. Distributors, New Delhi, 2004
3. Microwave Engineering- Annapurna Das and Sisir K.Das, Mc Graw Hill Education, 3rd Edition.
4. Microwave and Radar Engineering-M.Kulkarni, Umesh Publications, 3rd Edition.
5. Microwave Engineering – G S N Raju, I K International
6. Microwave and Radar Engineering – G Sasibhushana Rao Pearson
7.

Course Code **18EC6T2**	**Microprocessors and Microcontrollers**	**L**	**T**	**P**	**C**
	Maximum expected contact hours : **64**	**3**	**1**	**--**	**3**
	Prerequisites : Fundamentals of Digital Logic Design and Integrated Circuits				

PURPOSE: Microprocessor and microcontroller have become important building blocks in digital electronics design. It is important for student to understand the architecture of a microprocessor and its interfacing with various modules. 8086 microprocessor architecture, programming, and interfacing is dealt in detail in this course.

INSTRUCTIONAL COURSE OBJECTIVES	
1	Outline the internal architecture of 8086 microprocessor, concept of addressing Modes and instruction assembling.
2	Develop and Execute assembly level language program for 8086 and must be able to write assembly level program for any processor by studying its architecture.
3	Mode of operations and interfacing of memories and Devices
4	interfacing of programmable peripheral device and interfacing through it.
5	About advanced microprocessors
6	Microcontrollers architecture and modes, knowing about Advanced microcontrollers
COURSE OUTCOMES	
1	Understanding about basic microprocessors and architecture and programming
2	Understanding about pin configuration and memory interfacing
3	Interfacing of peripheral devices and programming
4	Understanding about interrupt structure of microprocessor
5	Understanding about types of advanced microprocessors
6	Interfacing and architecture of microcontrollers

UNIT I

An over view of 8085, Architecture of 8086 Microprocessor. Special functions of General purpose registers. 8086 flag register and function of 8086 Flags. Addressing modes of 8086. Instruction set of 8086. Assembler directives, simple programs, procedures, and macros.

Assembly language programs

Assembly language programs involving logical, Branch & Call instructions, sorting, evaluation of arithmetic expressions, string manipulation.

UNIT II: Pin diagram of 8086

Pin diagram of 8086-Minimum mode and maximum mode of operation. Timing diagram. Memory interfacing to 8086 (Static RAM & EPROM). Need for DMA. DMA data transfer Method. Interfacing with 8237/8257.

UNIT III: 8255 PPI

8255 PPI – various modes of operation and interfacing to 8086. Interfacing Keyboard,8279 Stepper Motor and actuators. D/A and A/D converter interfacing

UNIT IV: Interrupt structure of 8086

Interrupt structure of 8086. Vector interrupt table. Interrupt service routines. Introduction to DOS and BIOS interrupts. 8259 PIC , 8251USART

UNIT V: Advanced Micro Processors

Advanced Micro Processors - Introduction to 80286, Salient Features of 80386, Real and Protected Mode Segmentation & Paging, Salient Features of Pentium, Branch Prediction, Overview of RISC Processors ,salient features of 80486,Pentium processor.

UNIT VI: Microcontrollers

8051 Microcontroller and Its Programming: Architecture of micro controller-8051 Microcontroller memory organisation of 8051Mc,-counters and timers, serial communication- Addressing modes of 8051, Instructor set of 8051, Assembly Language/C Programming examples using 8051.

Advanced Microcontrollers

Introduction to PIC,PIC feactures ARM Core Architecture, Versions of ARM, Important Features.

TEXT BOOKS:

Text Books:

1. Advanced microprocessor and peripherals-A.K. Ray and K.M.Bhurchandi, 2nd edition, TMH, 2000.
2. Microcontrollers-Deshmukh, Tata Mc-Graw Hill Edition, 2004.
3. Microcontrollers Architecture, programming, interfacing and system Design-Raj kamal, Pearson Education, 2005.
4. Microprocessor Architecture, Programming, and Applications With the 8085- Ramesh S. Gaonkar- Prentice Hall PTR, 2002.

Reference Books:

1. Microprocessors Interfacing-Douglas V.Hall, 2nd edition, 2007.
2. The 8088 and 8086 Microprocessors- Walter A. Triebel, Avtar Singh, PHI, 4th Edition, 2003.
3. Micro computer system 8066/8088 family Architecture, programming and Design-By Liu and GA Gibson, PHI, 2nd Ed.
4. Microcontroller-Internals, Instructions, Programming and Interfacing by SubrataGhoshal, Pearson, 2010.

Course Code **18EC6T1**	**DIGITAL IC APPLICATIONS**	**L**	**T**	**P**	**C**
	Maximum expected contact hours : **64**	**3**	**--**	**--**	**3**
	Prerequisites : Knowledge on BJTs, MOSFET, Digital electronic circuits				

PURPOSE	
1	Concepts of Transistor logic, CMOS logic families and their interfacing
2	Concepts of VHDL for digital system design
3	Combinational digital ICs , its applications and their modelling using VHDL
4	Sequential digital ICs, its applications and their modelling using VHDL
5	Different types of Memories, CPLD, FPGA architectures
COURSE OUTCOMES	
1	Understand Transistor logic, CMOS logic families and their interfacing
2	Model Digital circuits using VHDL
3	Design combinational logic circuits using digital ICs and model using VHDL
4	Design sequential logic circuits using digital ICs and model using VHDL
5	Implement Digital Systems using CPLD, FPGA

UNIT – I

Bipolar Logic Families : Bipolar logic, Transistor logic-DTL,RTL, Low Power Schottky TTL NOR, Low Power Schottky TTL NAND, Emitter coupled logic-basic CML, 2 input OR/NOR gate, 10K ECL OR/NOR gate, Comparison of TTL logic families.

CMOS Logic Families : CMOS logic levels, CMOS inverter, NAND, NOR, AND, OR, AOI, OAI circuit diagrams using CMOS and function tables, CMOS steady state electrical behaviour, CMOS dynamic electrical behaviour, CMOS logic families- High Speed CMOS, Very High Speed CMOS,

UNIT – II

VHDL Hardware Description Language: Design flow, program structure, types and constants, arrays, functions and procedures, libraries and packages with examples, Structural design elements, data flow design elements, behavioral design elements, time dimension and simulation.

UNIT – III

Combinational Logic Design I: Adders and Subtractors, 74x283 4-bit adder, Combinational multiplier 8X8, Multiplexers- 74x151 MUX, 74x157 MUX. Decoders-74x139,74x138; Encoders-74x148 Priority encoder, Dual parity encoder

UNIT – IV

Combinational Logic Design II :

Barrel shifter, comparators, 74x85 magnitude comparators, Cascading of Arithmetic and Logic Unit Simple floating- point encoder

UNIT – V

Sequential Logic Design using VHDL: Latches and flip-flops-D flip flop74X74,JK flip flop74X109, Registers-4-bit register 74x175, 8-bit latch 74x373;Counters- 74x163 4-bit binary counter,74X163 as modulo-11 counter, 74X163 as modulo- 193 counter, 3-bit LFSR counters Shift registers-Universal shift register 74x194,

UNIT – VI

Memories: ROM- internal structure, 2D-decoding commercial types, timing and applications. Static RAM- Internal structure, SRAM timing, standard SRAM, synchronous SRAM, Dynamic RAM-Internal structure, timing, synchronous DRAM.

CPLDs,FPGAs:CPLD Xilinx XC9500-architecture,functional block,I/O block architecture, FPGA-Xilinx XC4000 configurable logic block, I/O block.

TEXT BOOKS

1. John F. Wakerly, Digital Design Principles and Practices, PHI/ Pearson Education Publishers, 3rd Edition.
2. Charles H. Roth Jr., Digital System Design Using VHDL, PWS Publications, USA, Reprint 2002.
3. Jan M. Rabaey, Anantha Chandrakasan, and Borivoje Nikolic, "Digital Integrated Circuits: A Design Perspective", Prentice Hall Publishers.

REFERENCES

1. K. C. Chang, Digital Systems Design with VHDL and Synthesis: An Integrated Approach, Wiley-IEEE Computer Society Press.
2. Alan B.Marcovitz, Introduction to Logic Design, Tata McGraw Hill Publishers.
3. Stephen Borwn and ZvonkoVramesic, Fundamentals of Digital Logic with VHDL Design, McGraw Hill Publishers.
4. J.Bhasker, VHDL Primer, Pearson Education/ PHI Publishers.
5. Shipra gupta and Neelu Chaudhary, "Digital Circuit System using VHDL", SK Kartaria and sons Publications, New Delhi.
6. Mark Zwolinski, "Digital System Design with VHDL", Pearson Education Publishers, 2004.

Course Code **18EC6T4A**	**OOPs Through JAVA**	**L**	**T**	**P**	**C**
	Maximum expected contact hours : **64**	**3**	**1**	**--**	**3**
	Prerequisites : C P, C++ and Data structures				
PURPOSE:					
INSTRUCTIONAL COURSE OBJECTIVES					
1	Introducing Object oriented programming languages				
2	Know about objects and classes in abstract level				
3	Know basic level primitives of OOPs				
4	Know conceptual learning on threading				
5	Explains about event handling in OOPs				
6	Know about graphical user interface				
COURSE OUTCOMES					
1	Implementing programs for user interface and application development using core java principles				
2	Comprehension of java programming constructs, control structures in Java Programming Constructs				
3	Implementing Object oriented constructs such as various class hierarchies, interfaces and exception handling				
4	Understanding of Thread concepts and I/O in Java				
5	Being able to build dynamic user interfaces using applets and Event handling in java Applets-				
6	Understanding of various components of Java AWT and Swing and writing code snippets using them Abstract Window Toolkit				

UNIT I: Introduction to OOP Introduction, Need of Object Oriented Programming, Principles of Object Oriented Languages, Procedural languages Vs OOP, Applications of OOP, History of JAVA, Java Virtual Machine, Java Features, Program structures, Installation of JDK1.6

UNIT II: Variables , Primitive Data types, Identifiers- Naming Coventions, Keywords, Literals, Operators: Binary, Unary and ternary, Expressions, Precedence rules and Associativity, Primitive Type Conversion and Casting, Flow of control-Branching, Conditional, loops., **Classes and Objects**- classes, Objects, Creating Objects, Methods, constructors-Constructor overloading, cleaning up unused objects-Garbage collector, Class variable and Methods-Static keyword, this keyword, Arrays, Command line arguments

UNIT III: Inheritance: Types of Inheritance, Deriving classes using extends keyword, Method overloading, super keyword, final keyword, Abstract class **Interfaces, Packages and Enumeration:** Interface-Extending interface, Interface Vs Abstract classes, Packages-Creating packages , using Packages, Access protection, java.lang package **Exceptions & Assertions** - Introduction, Exception handling techniques-try...catch, throw, throws, finally block, user defined exception, Exception Encapsulation and Enrichment, Assertions

UNIT IV: MultiThreading : java.lang.Thread, The main Thread, Creation of new threads, Thread priority, Multithreading- Using isAlive() and join(), Syncronization, suspending and Resuming threads, Communication between Threads **Input/Output:** reading and writing data, java.io package

UNIT V: Applet class, Applet structure, An Example Applet Program, Applet Life Cycle, paint(),update() and repaint() **Event Handling** -Introduction, Event Delegation Model, java.awt.event Description,Sources of Events, Event Listeners, Adapter classes, Inner classes

UNIT VI: Why AWT?, java.awt package, Components and Containers, Button, Label, Checkbox, Radio buttons, List boxes, Choice boxes, Text field and Text area, container classes, Layouts, Menu, Scroll bar **Swing:** Introduction , JFrame, JApplet, JPanel, Components in swings, Layout Managers, JList and JScroll Pane, Split Pane, JTabbedPane, Dialog Box Pluggable Look and Feel

TEXT BOOKS:

1. The Complete Refernce Java, 8ed, Herbert Schildt, TMH
2. Programming in JAVA, Sachin Malhotra, Saurabh choudhary, Oxford.
3. JAVA for Beginners, 4e, Joyce Farrell, Ankit R. Bhavsar, Cengage Learning.
4. Object oriented programming with JAVA, Essentials and Applications, Raj Kumar Bhuyya, Selvi, Chu TMH
5. Introduction to Java rogramming, 7th ed, Y Daniel Liang, Pearson

REFERENCE BOOKS:

1. JAVA Programming, K.Rajkumar.Pearson
2. Core JAVA, Black Book, Nageswara Rao, Wiley, Dream Tech
3. Core JAVA for Beginners, Rashmi Kanta Das, Vikas.
4. Object Oriented Programming Through Java, P. Radha Krishna, Universities Press.

Course Code **18EC6T4B**	**COMPUTER ARCHITECTURE AND ORGANIZATION**	**L**	**T**	**P**	**C**
	Maximum expected contact hours : **64**	**3**	**1**	**--**	**3**
	Prerequisites : C P, C++ and Data structures				

PURPOSE:	
INSTRUCTIONAL COURSE OBJECTIVES	
1	Understand the architecture of a modern computer with its various processing units. Also the Performance measurement of the computer system.
2	In addition to this the memory management system of computer.
3	Understand the fundamentals of different instruction setarchitectures and their relationship to the CPU design.
4	Understand the principles and the implementation of computerarithmetic and ALU.
5	Understand the memory system, I/O organization
6	Understand the operation of modern CPUs including interfacing,pipelining, memory systems and busses.
COURSE OUTCOMES	
1	Students can understand the architecture of modern computer.
2	They can analyze the Performance of a computer using performance equation
3	Understanding of different instruction types.
4	Students can calculate the effective address of an operand by addressing modes
5	Understanding of how a computer performs arithmetic operation of positive and negative numbers.
6	Students can understand the architecture of modern computer.

UNIT -I:

Basic Structure Of Computers: Functional unit, Basic Operational concepts, Bus structures, System Software, Performance, The history of computer development.Data types, Complements, DataRepresentation. Fixed Point Representation. Floating – Point Representation.Error Detection codes.

Unit-II:

COMPUTER ARITHMETIC: Addition and subtraction, multiplicationAlgorithms, Division Algorithms, Floating point Arithmetic operations.Decimal Arithmetic unit, Decimal Arithmetic operations.

UNIT -III:

Machine Instruction and Programs:

Instruction and Instruction Sequencing: Register Transfer Notation, Assembly Language Notation, Basic InstructionTypes,Addressing Modes, Basic Input/output Operations, The role of Stacks and Queues in computer programmingequation. Component of Instructions: Logic Instructions, shift and Rotate Instructions

UNIT -IV:

INPUT/OUTPUT ORGANIZATION: Accessing I/O Devices, Interrupts: Interrupt Hardware, Enabling andDisabling Interrupts, Handling Multiple Devices, Direct Memory Access,Buses: Synchronous Bus,

Asynchronous Bus, Interface Circuits, Standard I/O Interface: Peripheral ComponentInterconnect (PCI) Bus, Universal Serial Bus (USB)

UNIT-V:

THE MEMORY SYSTEM: Memory Hierarchy, Main memory, RAM,ROM, Auxiliarymemory, Associative memory, Cache memory, Virtual memory, Memorymanagement hardware, **Secondary Storage:** Magnetic Hard Disks, Optical Disks

UNIT-VI:

PIPELINE AND VECTOR PROCESSING: Parallel Processing,Pipelining, Arithmetic Pipeline, InstructionPipeline, RISC Pipeline VectorProcessing, Array Processors, **MICRO PROGRAMMED CONTROL:** Control memory, Addresssequencing, micro program example, Design of control unit-Hard wiredcontrol. Micro programmed control

TEXT BOOKS:

1. Computer System Architecture – M.Moris Mano, IIIrd Edition, PHI /Pearson, 2006.
2. Computer Organization – CarlHamacher, ZvonksVranesic, SafwatZaky,V Edition, McGraw Hill, 2002.

REFERENCES:

1. Computer Organization and Architecture – William Stallings SeventhEdition, PHI/Pearson, 2006.
2. Computer Architecture and Organization – John P. Hayes, McGrawHill International editions, 1998.

Course Code **18EC6T4C**	**Optical communication**	**L**	**T**	**P**	**C**
	Maximum expected contact hours : **64**	**3**	**1**	**--**	**3**
	Prerequisites : **:** Snell's law, Refractive index, Energy Bands, Multiplexing Techniques				

PURPOSE	
The student will be introduced to the functionality of each of the components that comprise a fiber-optic communication system	
1	The properties of optical fiber that affect the performance of a communication link and types of fiber materials with their properties and the losses occur in fibers.
2	the principles of single and multi-mode optical fibers and their characteristics
3	Working of semiconductor lasers, and differentiates between direct modulation and external electro-optic modulation.
4	Analyze the operation of LEDs, laser diodes, and PIN photo detectors (spectral properties, bandwidth, and circuits) and apply in optical systems.
5	Analyze and design optical communication and fiber optic sensor systems.
6	The models of analog and digital receivers
COURSE OUTCOMES	
1	Design and build optical fiber experiments in the laboratory, and learn how to calculate electromagnetic modes in waveguides, the amount of light lost going through an optical system, dispersion of optical fibers.
2	Use different types of photo detectors and optical test equipment to analyze optical fiber and light wave systems.
3	Choose the optical cables for better communication with minimum losses Design, build, and demonstrate optical fiber experiments in the laboratory

UNIT I

Overview of optical fiber communication, Historical development, general system, advantages and applications of optical fiber communications, Optical fiber wave guides- Introduction, types of rays, Ray theory transmission, Total Internal Reflection, Acceptance angle, Numerical Aperture, Cylindrical fibers- Modes, V-number, Mode coupling, Step Index fibers, Graded Index fibers, Single mode fibers- Cut off wavelength, Mode Field Diameter, Effective Refractive Index, Related problems.

UNIT II

Fiber materials:- Glass, Halide, Active glass, Chalgenide glass, Plastic optical fibers. Signal distortion in optical fibers- Attenuation, Absorption, Scattering and Bending losses, Core and Cladding losses, Information capacity determination, Group delay, Types of Dispersion:- Material dispersion, Wave-guide dispersion, Polarization-Mode dispersion, Intermodal dispersion, Pulse broadening in Graded index fiber, Related problems.

UNIT III

Optical fiber Connectors-Preparation of optical fiber for connection, Connector types, lensing schemes ,Connector return loss, Fiber Splicing- Splicing techniques, Fiber misalignment and joint loss- Multimode fiber joints, single mode fiber joints.

UNIT IV

Optical sources- Direct and indirect Band gap materials, LEDs, Structures, Materials, Quantum efficiency, Power, Modulation, Power bandwidth product. Injection Laser Diodes- Modes, Threshold conditions, External quantum efficiency, Laser diode rate equations, Resonant frequencies, Reliability of LED&ILD, Optical detectors- Physical principles of PIN and APD, Detector response time, Temperature effect on Avalanche gain, Comparison of Photo detectors, Related problems.

UNIT V

Source to fiber power launching - Output patterns, Power coupling, Power launching, Equilibrium Numerical Aperture, Laser diode to fiber coupling, Optical receiver operation- Fundamental receiver operation, Digital signal transmission, error sources, Receiver configuration, Digital receiver performance, Probability of Error, Quantum limit, Analog receivers.

UNIT VI

Optical system design - Point-to- point links- Component choice and considerations, Link power budget, Rise time budget with examples, Line coding in Optical links, WDM, Necessity, Principles, Measurement of Attenuation and Dispersion, Eye pattern.

TEXT BOOKS :

1. Optical Fiber Communications – Gerd Keiser, Mc Graw-Hill International edition, 3rd Edition, 2000.
2. Optical Fiber Communications – John M. Senior, PHI, 2nd Edition, 2002.

RERFERENCES :

1. Fiber Optic Communications – D.K. Mynbaev , S.C. Gupta and Lowell L. Scheiner, Pearson Education,2005.
2. Text Book on Optical Fiber Communication and its Applications – S.C.Gupta, PHI, 2005.
3. Fiber Optic Communication Systems – Govind P. Agarwal , John Wiley, 3rd Ediition, 2004.
4. Fiber Optic Communications – Joseph C. Palais, 4th Edition, Pearson Education, 2004.

Course Code **18EC6L1**	**Microprocessor and microcontrollers Lab**	**L**	**T**	**P**	**C**
	Maximum expected contact hours : **14 Weeks**	--	--	**3**	**1**
	Prerequisites :Fundamentals of Digital Logic Design and Programming				
PURPOSE : To learn the concepts of assembly language programming and interfacing of various peripheral devices to the microprocessors and microcontrollers					
INSTRUCTIONAL COURSE OBJECTIVES					
1	To study programming based on 8086 microprocessor and 8051 microcontroller.				
2	To study 8086 microprocessor based ALP using arithmetic, logical and shift operations				
3	To study to interface 8086 with I/O and other devices.				
4	To study parallel and serial communication using 8051.				
COURSE OUTCOMES					
1	Will be able to write assembly language program using 8086 micro based on arithmetic, logical, and shift operations.				
2	Will be able to interface 8086 with I/O and other devices.				
3	Will be able to do parallel and serial communication using 8051				

LIST OF EXPERIMENTS

PART- A: (Minimum of 5 Experiments has to be performed)

8086 Assembly Language Programming using Assembler Directives

1. Sorting.
2. Multibyte addition/subtraction
3. Sum of squares/cubes of a given n-numbers
4. Addition of n-BCD numbers
5. Factorial of given n-numbers
6. Multiplication and Division operations
7. Stack operations
8. BCD to Seven segment display codes

PART- B: (Minimum of 3 Experiments has to be performed)

8086 Interfacing

1. Interfacing Stepper motor
2. A/D Interface through Intel 8255
3. D/A Interface through Intel 8255
4. Interfacing of Keyboard Display Controller

PART- C: (Minimum of 3 Experiments has to be performed)
MCU IDE 8051 Assembly Language Programs
1. Finding number of 1's and number of 0's in a given 8-bit number
2. Addition of even numbers from a given array
3. Ascending / Descending order
4. Average of n-numbers

PART-D: (Minimum of 3 Experiments has to be performed)
MCU IDE 8051 Interfacing
1. Switches
2. LEDs and LCD
3. 7-Segment display (multiplexed)
4. Writing to the parallel port

Course Code **18EC6L2**	**MICROWAVE AND OPTICAL COMMUNICATION LAB**	**L**	**T**	**P**	**C**
	Maximum expected contact hours : **14 Weeks**				
	Prerequisites : **Fundamental knowledge in microwave and optical concepts.**	**--**	**--**	**3**	**1**

PURPOSE	
The student will be understood the different parameters of microwave and link design with their loss	
INSTRUCTIONAL COURSE OBJECTIVES	
1	Measurement of wave guide parameters like Attenuation, VSWR, Impedance and frequency.
2	Characteristics of Reflex klystron, Gunn Diode.
3	Scattering parameters of directional coupler, circulator and magic tee.
4	Characterization of LED, laser diode, and Optical fiber
5	Losses in Optical fiber
COURSE OUTCOMES	
1	Measure the wave guide parameters required for different applications.
2	Understand the operation of Reflex klystron and Gunn Diode from the Characteristics.
3	Analyze various characteristics of microwave junctions and design of microwave communication links.
4	Analyze various characteristics of LED, laser diode, and Optical fiber and design of fiber optical analog and digital link.
5	Understand the Practical problems and their remedies due to loses in Optical fiber.

LIST OF EXPERIMENTS
(Minimum 12 experiments has to be conducted)
Part I : Microwave Engineering
1. Reflex Klystron Characteristics.
2. Attenuation Measurement.
3. VSWR Measurement.
4. Impedance and Frequency Measurement.
5. Directional Coupler Characteristics.
6. Scattering parameters of Circulator.
7. Scattering parameters of Magic Tee.
8. Gunn Diode Characteristics.

Part II: Optical Communications
1. Analog and digital link design.
2. LED Characteristics.
3. Laser Diode Characteristics.
4. Measurement of Data rate for Digital Optical link.
5. Measurement of Numerical Aperture of Optical fibre.
6. Measurement of losses for Analog Optical link.

Equipment required for laboratories:
1. Regulated Klystron Power Supply
2. VSWR Meter
3. Micro Ammeter – 0 – 500μA
4. Multimeter
5. CRO
6. GUNN Power Supply, Pin Modulator
7. Reflex Klystron

8. Crystal Diodes
9. Microwave components (Attenuation)
10. Frequency Meter
11. Slotted line Carriage
12. Probe detector
13. Wave guide shorts
14. Pyramidal Horn Antennas
15. Directional Coupler
16. E, H, Magic Tees
17. Circulators, Isolator
18. Matched Loads
19. Fiber Optic Analog Trainer basedLED
20. Fiber Optic Analog Trainer basedLaser
21. Fiber Optic Digital Trainer
22. Fiber Cables – (Plastic,Glass).

Course Code	VLSI DESIGN	L	T	P	C
18EC7T1	Maximum expected contact hours : **64** Prerequisites : **Knowledge in FABRICATION**	4	--	--	3

PURPOSE: very large scale integration is the process of creating an integrated circuit by combining thousands of transistors into a single chip.

INSTRUCTIONAL COURSE OBJECTIVES

1	Give exposure to different steps involved in the fabrication of ICs using MOS transistor, CMOS/BICMOS transistors, and passive components.
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 concept to design different types of logic gates using CMOS inverter and analyze their transfer characteristics.
5	Provide design concepts to design building blocks of data path of any system using gates.
6	Understand basic programmable logic devices and testing of CMOS circuits.

COURSE OUTCOMES

1	Acquire qualitative knowledge about the fabrication process of integrated circuit using MOS transistors.
2	Choose an appropriate inverter depending on specifications required for a circuit
3	Draw the layout of any logic circuit which helps to understand and estimate parasitic of any logic circuit
4	Design different types of logic gates using CMOS inverter and analyze their transfer characteristics
5	Provide design concepts required to design building blocks of data path using gates.
6	Design simple logic circuit using PLA, PAL, FPGA and CPLD
7	Understand different types of faults that can occur in a system and learn the concept of testing and adding extra hardware to improve testability of system

UNIT – I: Introduction to IC Technology IC Era, An overview of silicon semiconductor technology, Fabrication processingsteps for Bipolar and MOS transistors (NMOS, PMOS, CMOS and BiCMOS).

UNIT – II: Basic Electrical Properties of MOS, CMOS and BICMOS Circuits Threshold Voltage Vt, Ids -Vds relationship, Transconductance gm, Outputconductance gds, Figure of merit w0; MOS, CMOS and BiCMOS inverters, Zpu/Zpdratios of inverters, Latch-up in CMOS circuits.

UNIT – III: MOS and BICMOS Circuit Design Processes VLSI circuit design process, MOS layers, Stick and layout representations oflayers, Lambda and Micron based Design rules, Stick and Layout diagrams.

UNIT-IV: Basic Circuit Concepts: Sheet Resistance, Sheet Resistance concept applied to MOS transistors and Inverters, Area Capacitance of Layers, Standard unit of capacitance, Some area Capacitance Calculations, The Delay Unit, Inverter Delays, Driving large capacitive loads, Propagation Delays, Wiring Capacitances, Choice of layers.

UNIT-V Designing High-Speed CMOS Logic Networks : Gate Delays, Driving Large CapacitiveLoads, Logical Effort, BiCMOSDrivers.**AdvancedTechniques in CMOS Logic Circuits :** MirrorCircuits, Pseudo-nMOS, Tri-StateCircuits, Clocked CMOS, Dynamic CMOS Logic Circuits, DualRail LogicNetworks.

UNIT-VI:

Introduction to Low Power VLSI Design: Introduction to Deep submicron digital IC design**,** Low Power CMOS Logic Circuits: Over view of power consumption, Low –power design through voltage scaling, Estimation and optimisation of switching activity, Reduction of switching capacitance. Interconnect Design, Power Grid and Clock Design.

Text Books:

1. Kamran Eshraghian, Douglas A Pucknell and SholehEshraghian, "Essentialsof VLSI Circuits and Systems", Prentice-Hall of India, 2005 Edition. (Units- I to V)
2. Douglas L Perry, "VHDL Programming by Example", 4th Edition, TMH Publishers, 2003. (Unit-VI)

Reference Books:

1. Carver Mead, Lynn Conway, "Introduction to VLSI Systems", Addison-Wesley, 1978.
2. Weste, Neil H.E, "Principles of CMOS VLSI Design", 2nd Edition.
3. John F.Wakerly, "Digital Design Principles and Practice", 3rd Edition

Course Code 18EC7T2	DIGITAL IMAGE PROCESSING	L	T	P	C
	Maximum expected contact hours : **64**	**3**	**1**	**--**	**3**
	Prerequisites :Need to know the Signal Processing				
PURPOSE: This fundamental course will enable the students to learn the concepts of Digital Image processing					
INSTRUCTIONAL COURSE OBJECTIVES					
1	Learn the fundamental concepts and applications of Digital ImageProcessing.				
2	Learn the concepts of and how to perform Intensity transformationsand spatial filtering.				
3	Understand the relationship between Filtering in spatial andfrequency domains,				
4	Understand the concepts of and how to perform Image restorationand reconstruction.				
5	Understand the concepts of different color models and Color imageprocessing.				
6	Learn the concepts of Wavelets and multi-resolution processing,Image compression and Watermarking, Morphological imageprocessing, Image segmentation, Representation and description.				
COURSE OUTCOMES					
1	Perform different transforms on image useful for image processingapplications				
2	Perform spatial and frequency domain filtering on image and canimplement all smoothing and sharpening operations on images				
3	Perform image restoration operations/techniques on images.				
4	Operate effectively on color images and different color conversionson images and can code images to achieve good compression				
5	Do wavelet based image processing and image compression usingwavelets				
6	Perform all morphological operations on images and can be able todo image segmentation also.				
7	Develop simple algorithms for image processing and use the varioustechniques involved in Bio Medical applications, etc.				

UNIT-I: Introduction: Origins of digital image processing, uses digital imageprocessing, fundamental steps in digital image processing, components of animage processing system, digital image fundamentals, Elements of visualperception, light and electromagnetic spectrum, imaging sensing andacquisition, image sampling and quantization. Some basic relationshipsbetween pixels, an introduction to the mathematical tools used in digitalimage processing.

Image Transforms: Need for image transforms, Spatial Frequencies inimage processing, introduction to Fourier transform, discrete Fouriertransform, fast Fourier transform and its algorithm, properties of Fouriertransform. Discrete sine transforms. Walsh Transform. Hadamard transform,Haar Transform. Slant transforms, SVD and KL Transforms or HotellingTransform.

UNIT-II: Intensity Transformations and Spatial Filtering: Background, Some basicintensity transformation functions, histogram processing, fundamentals ofspatial filtering, smoothing spatial filters, sharpening spatial filters, Combining spatial enhancement methods.

Filtering in the frequency domain: Preliminary concepts,the discrete Fourier transform (DFT)of one variable, Extension to functions of two variables, some properties ofthe 2-D Discrete Fourier transform. The Basic of filtering in the frequencydomain, image smoothing using frequency domain filters.

UNIT-III:Image restoration and Reconstruction: A model of the image degradation /Restoration process, Noise models, restoration in the presence of noise only-Spatial Filtering, Periodic Noise Reduction by frequency domain filtering,Linear, Position –Invariant Degradations, Estimation the degradationfunction, Inverse filtering, Minimum mean square error(Wiener) filtering,constrained least squares filtering ,geometric mean filtering.

UNIT-IV:Color image processing: color fundamentals, color models, pseudo colorimage processing, basic of full color image processing, color transformations,smoothing and sharpening. Image segmentation based on color, noise in colorimages, color image compression.

UNIT-V: Wavelets and Multi-resolution Processing: image pyramids, sub bandcoding & Haar transforms multi resolution expressions, wavelet transforms inone dimensions. The fast wavelets transform, wavelet transforms in two dimensions,**Image compression:** Fundamentals, various compression methods-codingtechniques, digital image water marking.

UNIT-VI: Morphological image processing: preliminaries Erosion and dilation,opening and closing, the Hit-or-miss transformation, some BasicMorphological algorithms, grey –scale morphology

Image segmentation: Fundamentals, point, line, edge detection thresholding,region –based segmentation, segmentation using Morphological watersheds,

The use of motion in segmentation**.**

Text Books:

1. R. C. Gonzalez and R. E. Woods, Digital Image Processing, 3rd edition,Prentice Hall, 2008.
2. R. C. Gonzalez, R. E. Woods and Steven L. Eddins , Digital ImageProcessing Using MATLAB , 2rd edition, Prentice Hall, 2009.

Reference Books

1.Anil K.Jain, "Fundamentals of Digital Image Processing", Prentice Hallof India, 9th Edition, Indian Reprint, 2002.
2. Jayaraman, S. Esakkirajan, and T. Veerakumar, Digital Image Processing, Tata McGraw-Hill Education, 2011.

Course Code	**RADAR ENGINEERING**	**L**	**T**	**P**	**C**
18EC7T3	Maximum expected contact hours : **64** Prerequisites : **Knowledge in Engineering**	**3**	**1**	**--**	**3**

PURPOSE: This fundamental course will enable the students to learn how to Achieving in communication by using RADAR.

INSTRUCTIONAL COURSE OBJECTIVES: The student will be able to

1	To familiarize with the basic principles of RADAR and operation of different types of Radars
2	To introduce different RADAR performance factors.
3	To introduce the different radar systems

COURSE OUTCOMES: After going through this course the student will be able to

1	Understand the basic principle of RADAR and working of MTI and Pulse Doppler Radars.
2	Calculate radar parameters
3	Understand the design principles of RADAR SYSTEMS.
4	Detect signals in the presence of noise.

UNIT-1 Introduction to RADAR

Nature of Radar, Maximum Unambiguous Range, Radar Waveforms, Simple form of Radar equation, Radar Block diagram and Operation, Radar frequencies and Applications, Radar Equation, Minimum Detectable signal, Detection of signals in noise, Receiver noise and signal to noise ratio, Integration of Radar Pulses, PRF and Range Ambiguities, System Losses.

UNIT-2 CW AND FM-CW RADAR

Doppler Effect, CW Radar-Block Diagram, Isolation between Transmitter and Receiver; Non-zero IF Receiver, Receiver Bandwidth Requirements, FM-CW Radar, Range and Doppler Measurement, Block Diagram and Characteristics(Approaching/Receding Targets),FM-CW altimeter, Measurement Errors, Multiple Frequency CW Radar.

UNIT-3 MTI AND Pulse Doppler Radar

Principle, Block diagram of MTI Radar, Delay Line Cancellers-Filter characteristics, Blind Speeds, Double Cancellation, Staggered PRFs; Range Gated Doppler Filters, MTI Radar Parameters, Limitations to MTI performance, Non-coherent MTI,MTI versus Doppler Radar.

UNIT-4 TRACKING RADAR

Tracking with radar,Sequential lobbing,Conical Scan,Mono-pulse Tracking Radar-Amplitude Comparison(one-and Two-Coordinates),Phase Comparison, Target Reflection Characteristics and Angular Accuracy, Tracking in Range, Acquisition and Scanning Patterns.

UNIT-5 DETECTION OF RADAR SIGNALS IN NOISE

Matched Filter Receiver-Response Characteristics and Derivation, Correlation Function and Cross Correlation Receiver, Efficiency of Non-Matched Filter, Matched Filter with Non-white Noise.

UNIT-6 RADAR RECIEVERS

Noise Figure and Noise Temperature, Different types of radar displays, Duplexers-Branch type and Balanced Type, Circulators as Duplexers, Introduction to Phased Array Antennas-Basic Concepts, Radiation pattern, Beam Steering and Beam Width Changes, Series versus Parallel Feeds, Applications, Advantages and Disadvantages.

Text Books:

1. Merrill I Skolnik," RADAR SYSTEMS",2^nd EDITION

Reference Books:

1. Stimson's," Introduction to Airborne Radar"3^rd Edition.
2. Merrill I Skolnik, "Introduction to RADAR SYSTEMS",3^rd Edition

Course Code:	**Application Oriented IOT**	**L**	**T**	**P**	**C**
18EC6T3B	Maximum expected contact hours : **14 Weeks** Prerequisites : **Knowledge in Fundamentals in Programming and Microcontrollers**	**4**	**-**	**--**	**3**

PURPOSE	
This course will enable the fundamental concepts in and things, how they are connected to external internet world.	
INSTRUCTIONAL COURSE OBJECTIVES	
1	Assess the genesis and impact of IoT applications, architectures in real world.
2	Illustrate diverse methods of deploying smart objects and connect them to network.
3	Compare different Application protocols for IoT.
4	Infer the role of Data Analytics and Security in IoT.
5	Identify sensor technologies for sensing real world entities and understand the role of IoT in various domains of Industry.
COURSE OUTCOMES	
1	Interpret the impact and challenges posed by IoT networks leading to new architectural models.
2	Compare and contrast the deployment of smart objects and the technologies to connect them to network.
3	Appraise the role of IoT protocols for efficient network communication
4	Elaborate the need for Data Analytics and Security in IoT.
5	Illustrate different sensor technologies for sensing real world entities and identify the applications of IoT in Industry.

UNIT-I: Introduction of IOT

Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges, IoT Network Architecture and Design, Drivers Behind New Network Architectures, Comparing IoT Architectures, A Simplified IoT Architecture, The Core IoT Functional Stack, IoT Data Management and Compute Stack.

UNIT-II: Smart Objects

The "Things" in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies.

UNIT-III:IoT Physical Devices and Endpoints

Arduino UNO: Introduction to Arduino, Arduino UNO, Installing the Software, Fundamentals of Arduino Programming. IoT Physical Devices and Endpoints.

UNIT-IV: Data and Analytics for IoT

An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics, Securing IoT, A Brief History of OT Security, Common Challenges in OT Security, How IT and OT Security Practices and Systems Vary, Formal Risk Analysis Structures: OCTAVE and FAIR, The Phased Application of Security in an Operational Environment.

UNIT -V: IP as the IoT Network Layer

The Business Case for IP, The need for Optimization, Optimizing IP for IoT, Profiles and Compliances, Application Protocols for IoT, The Transport Layer, IoT Application Transport Methods.

UNIT-VI:RaspberryPi

Introduction to RaspberryPi, About the RaspberryPi Board: Hardware Layout, Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming RaspberryPi with Python, Wireless Temperature Monitoring System Using Pi, DS18B20 Temperature Sensor, Connecting Raspberry Pi via SSH, Accessing Temperature from DS18B20 sensors, Remote access to RaspberryPi, Smart and Connected Cities, An IoT Strategy for Smarter Cities, Smart City IoT Architecture.

Text Books:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry,"IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", 1 stEdition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978- 9386873743)
2. Srinivasa K G, "Internet of Things",CENGAGE Leaning India, 2017

Reference Books:

1. Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-on-Approach)", 1 stEdition, VPT, 2014. (ISBN: 978-8173719547)
2. Raj Kamal, "Internet of Things: Architecture and Design Principles", 1st Edition, McGraw Hill Education, 2017. (ISBN: 978-9352605224)

Course Code	COMPUTER NETWORKS	L	T	P	C
18EC7T4C	Maximum expected contact hours : **64**	**3**	**1**	**--**	**3**
	Prerequisites: basics of Computers				

PURPOSE: To understand the basic primitives of Computer networks

INSTRUCTIONAL COURSE OBJECTIVES	
1	Understand state-of-the-art in network protocols, architectures, and applications; Process of networking research; Constraints and thought processes for networking research; Problem Formulation—Approach—Analysis

COURSE OUTCOMES	
1	Understand OSI and TCP/IP models
2	Analyze MAC layer protocols and LAN technologies
3	Design applications using internet protocols
4	Understand routing and congestion control algorithms
5	Understand how internet works

UNIT–I:Introduction: Computer Network, Network uses, applications, limitations, network hardware, network software, Network Topologies WAN, LAN, MAN. Reference models- The OSI Reference Model- the TCP/IP Reference Model - A Comparison of the OSI and TCP/IP Reference Models

UNIT–II: Physical Layer – Fourier Analysis – Bandwidth Limited Signals – The Maximum Data Rate of a Channel - Guided Transmission Media, Digital Modulation and Multiplexing: Frequency Division Multiplexing, Time Division Multiplexing, Code Division Multiplexing-Circuit switched networks-Data gram networks-Virtual circuit networks.

UNIT–III: The Data Link Layer - Services Provided to the Network Layer – Framing – Error Control –Flow Control, Error Detection and Correction – Error-Correcting Codes – Error Detecting Codes, Elementary Data Link Protocols- An Unrestircted Simplex Protocol-A Simplex Stop and Wait Protocol for an Error free channel-A Simplex Stop and Wait Protocol for a Noisy Channel, Sliding Window Protocols-A One Bit Sliding Window Protocol-A Protocol Using Go-Back-NA Protocol Using Selective Repeat.

UNIT–IV: The Medium Access Control Sublayer-The Channel Allocation Problem-Static Channel Allocation-Assumptions for Dynamic Channel Allocation, Multiple Access Protocols-Aloha-Carrier Sense Multiple Access Protocols-Collision-Free Protocols-Limited Contention Protocols-Wireless LAN Protocols, Ethernet-Classic Ethernet Physical Layer-Classic Ethernet MAC Sub layer Protocol-Ethernet Performance-Fast Ethernet Gigabit Ethernet-10-Gigabit Ethernet-Retrospective on Ethernet, Wireless Lans-The 802.11 Architecture and Protocol Stack-The 802.11 Physical Layer-The802.11 MAC Sublayer Protocol-The 805.11 Frame Structure-Services

UNIT–V: Design Issues-The Network Layer Design Issues – Store and Forward Packet Switching-Services Provided to the Transport layer- Implementation of Connectionless Service-Implementation of Connection Oriented Service-Comparison of Virtual Circuit and Datagram Networks, Routing Algorithms-The Optimality principle-Shortest path Algorithm, Congestion Control Algorithms- Approaches to Congestion Control-Traffic Aware Routing-Admission Control-Traffic Throttling-Load Shedding.

UNIT–VI: Transport Layer – The Internet Transport Protocols: UDP, the Internet Transport Protocols: TCP **Application Layer –**The Domain Name System: The DNS Name Space, Resource Records,Name Servers, Electronic Mail: Architecture and Services, The User Agent, Message Formats,Message Transfer, Final Delivery.

TEXT BOOKS:

1. Tanenbaum and David J Wetherall, Computer Networks, 5th Edition, Pearson Edu, 2010
2. Computer Networks: A Top Down Approach, Behrouz A. Forouzan, FirouzMosharraf, McGraw Hill Education

REFERENCE BOOKS:

1. Larry L. Peterson and Bruce S. Davie, "Computer Networks - A Systems Approach" (5th ed), Morgan Kaufmann/ Elsevier, 2011

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Course Code	SATELLITE COMMUNICATIONS	L	T	P	C
18EC7T5A	Maximum expected contact hours : **64** Prerequisites : **Knowledge in Communications**	3	1	--	3

PURPOSE: This fundamental course will enable the students to learn how to Achieving in communication by using satellites.

INSTRUCTIONAL COURSE OBJECTIVES: The student will be able to

1	Know, Design understand the Construction and Principles of Satellites used for Communications,GPS and other apllications
2	Know the Tracking Techniques of satellites
3	Learn about various Multiple Accessing Techniques
4	Learn the Geo-Stationary satellite Systems
5	Know the idea of Design Various Satellites
6	Learn the concepts Satellite Navigation Global Positioning systems

COURSE OUTCOMES: After going through this course the student will be able to

1	Understand the Communication Satellite Mechanics
2	Know about the satellite internal subsystems for Communication Applications
3	Design the Power Budget for Satellite Links
4	Know About the Principles of GPS
5	Understand various constellations of Satellite and Their Applications

UNIT-I

INTRODUCTION: Origin of Satellite Communications, Historical Back-ground, Basic Concepts of Satellite Communications, Frequency Allocations For Satellite Services, Applications, Future Trends of Satellite Communications. Orbital Mechanics and Launchers: Orbital Mechanics, Look Angel Determinations, Orbital peturbations, Orbital Determination, Launches and Launch Vehicles, Orbital Efects in Communication Systems Performance.

UNIT-II

SATELLITE SUBSYSTEMS: Attitude and Orbital Control System,Telemetry,Tracking, Companding and Monitoring,Power Systems, Communication Sub Systems, Satellite antennas, Equipment Reliability and Space Qualification.

UNIT-III

SATELITE LINK DESIGN: Basic Transmission Theory, System Noise Temperature and G\T Ratio, Design of Down links, Up link Design, Design of Satellite Links Specified C\N ,System Design Examples.

Earth Station Technology: Introduction, Transmitters,Recievers, Antennas, Tracking Systems, Terrestrial Interface, Primary Power test Methods.

UNIT-IV

LOW EARTH ORBIT AND GEO-STATIONARY SATELLITE SYSTEMS: Orbit Considerations Coverage and Frequency Consideration, Delay and Throughput Considerations, Systems Considerations, Operational NGSO Constellation Designs.

UNIT-V

SATELLITE NAVIGATION AND GLOBAL POSITIONING SYSTEM:

Radio and Satellite Navigation,GPS Position Location Principles,GPS Recievers and Codes,Satellite Signal Acquisation,GPS Navigation Message, Gps Signal levels,Gps Reciever Operation,GPS C\A Code Accuracy, Differential GPS.

TEXT BOOKS:

1. Satellite Communications-Timothy Pratt,Charles Bostain and Jeremy Allnut,WSE,Wiley Publications,2^nd Edition,2003.
2. Satelite communications Engineering-Wilbur L.Pritched,Robert A Nelson and Henri G.suyderhoud,2^nd Edition,Pearson Publications,2003.

Reference Books:

1.Satelite Communications: Design Principles-M.Richharia, BS Publications,2^nd Edition,2003.
2.Satellite Communications-D.C Agarwal,khanna Publications,5^th Edition.
3.Fundamentals of Satellite Communications-K.N Raja rao,PHI,2004.
4.Satellite Communications-Dennis Roddy, Mc Graw Hill,4^th Edition,2009.

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Course Code **18EC7T5B**	**SCRIPTING LANGUAGES**	**L**	**T**	**P**	**C**
	Maximum expected contact hours : **64**	**3**	**1**	**--**	**3**
	Prerequisites :				

PURPOSE:

INSTRUCTIONAL COURSE OBJECTIVES

1	The course demonstrates an in depth understanding of the tools and the scripting languages necessary for design and development of applications dealing with Bio- information/ Bio-data.
2	The instructor is advised to discuss examples in the context of Bio-data/ Bio-information application development.

COURSE OUTCOMES

1	To master the theory behind scripting and its relationship to classic programming.
2	To survey many of the modern and way cool language features that show up frequently in scripting languages.
3	To gain some fluency programming in Ruby, JavaScript, Perl, Python, and related languages.
4	To design and implement one's own scripting language.

UNIT–I:
Static and Dynamic Web Pages, Introduction to scripting. Origin Of Scripting. Characteristics of Scripting Languages, Types and Examples of Scripting Languages, Differences between Client side and server side scripting, Uses for Scripting Languages, Web Scripting, and the universe of Scripting Languages. Introduction of PERL- Names and Values, Variables, Scalar Expressions, Control Structures, arrays, list, hashes, strings, pattern and regular expressions, subroutines.

UNIT–II:
Advanced Perl Finer points of looping, pack and unpack, file system, eval, data structures, packages, modules, objects, interfacing to the operating system, Creating Internet ware applications, Dirty Hands Internet Programming, security Issues.

UNIT-III:
PHP Basics PHP Basics- Features, Sample PHP Program and its execution , Embedding PHP Code in your Web pages, Outputting the data to the browser, Data types, Variables, Constants, expressions, string interpolation, control structures, Function, Creating a Function, Function Libraries, Arrays, strings and Regular Expressions.

UNIT-IV:
Advanced PHP Programming PHP and Web Forms, Files, Error handling , PHP Authentication and Methodologies -Hard Coded, File Based, Database Based, IP Based, Login Administration, Uploading Files with PHP, Sending Email using PHP, PHP Encryption Functions, the Mcrypt package, Building Web sites for the World.

UNIT-V:
TCL Structure, syntax, Variables and Data in TCL, Control Flow, Data Structures, input/output, procedures , strings , patterns, files, Advance TCL- eval, source, exec and uplevel commands, Name spaces, trapping errors, event driven programs, making applications internet aware, Nuts and Bolts Internet Programming, Security Issues, C Interface. Tk-Visual Tool Kits, Fundamental Concepts of Tk, Tk by example, Events and Binding , Perl-Tk.

UNIT-VI:
Python Introduction to Python language, python-syntax, statements, functions, Built-in-functions and Methods, Modules in python, Exception Handling. Integrated Web Applications in Python – Building Small, Efficient Python Web Systems, Web Application Framework.

TEXT BOOKS:
The World of Scripting Languages, David Barron, Wiley Publications.
Python Web Programming, Steve Holden and David Beazley, New Riders Publications.
Beginning PHP and MySQL, 3rd Edition, Jason Gilmore, Apress Publications (Dream tech)

REFERENCE BOOKS:
Open Source Web Development with LAMP using Linux, Apache, MySQL, Perl and PHP, J.Lee and B.Ware (Addison Wesley) Pearson Education.
Programming Python, M.Lutz,SPD.
PHP 6 Fast and Easy Web Development, Julie Meloni and Matt Telles, Cengage Learning Publications.
PHP 5.1, I.Bayross and S.Shah, The X Team, SPD.
Core Python Programming, Chun, Pearson Education.
Guide to Programming with Python, M.Dawson, Cengage Learning.
Perl by Example, E.Quigley, Pearson Education.

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Course Code 18EC7T5C	ADVANCED WIRELESS SENSOR NETWORKS	L	T	P	C
	Maximum expected contact hours : **64**	3	1	--	3
	Prerequisites : **Knowledge in Communication and Switching systems**				

PURPOSE: This fundamental course will enable the students to learn how to design the wireless sensor networks.

INSTRUCTIONAL COURSE OBJECTIVES: The student will be able to

1	To understand the architecture of wireless sensor networks
2	To understand issues and challenges in Providing Wireless Networks
3	To know the importance of Wireless Sensor Networks

COURSE OUTCOMES: After going through this course the student will be able to

1	Understand the issues and challenges in Networking technologies
2	Understand the issues of routing in WSN
3	Analyze MAC protocols for Wireless Networks

UNIT I

OVERVIEW OF WIRELESS SENSOR NETWORKS:

Key definitions of sensor networks, Advantages of sensor Networks, Unique constraints an challenges, Driving Applications, Enabling Technologies for Wireless Sensor Networks.

ARCHITECTURES:

Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes, Operating Systems and Execution Environments, Network Architecture -Sensor Network Scenarios, Optimization Goals and Figures of Merit, Gateway Concepts.

UNIT II

NETWORKING Technologies:

Physical Layer and Transceiver Design Considerations, Personal area networks (PANs), hidden node and exposed node problem, Topologies of PANs, MANETs, WANETs.

UNIT-III

MAC Protocols for Wireless Sensor Networks:

Issues in Designing a MAC protocol for Ad Hoc Wireless Networks, Design goals of a MAC Protocol for Ad Hoc Wireless Networks, Classifications of MAC Protocols, Contention - Based Protocols, Contention - Based Protocols with reservation Mechanisms, Contention – Based MAC Protocols with Scheduling Mechanisms, MAC Protocols that use Directional Antennas, Other MAC Protocols.

UNIT-IV

ROUTING PROTOCOLS:

Introduction, Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classification of Routing Protocols, Table –Driven Routing Protocols, On – Demand Routing Protocols, Hybrid Routing Protocols, Routing Protocols with Efficient Flooding Mechanisms, Hierarchical Routing Protocols, Power – Aware Routing Protocols, Proactive Routing

UNIT-V

TRANSPORT LAYER AND SECURITY PROTOCOLS:

Introduction, Issues in Designing a Transport Layer Protocol for Ad Hoc Wireless Networks, Design Goals of a Transport Layer Protocol for Ad Hoc Wireless Networks, Classification of Transport Layer Solutions, TCP Over Ad Hoc Wireless Networks, Other Transport Layer Protocol for Ad Hoc Wireless Networks,

UNIT- VI

SECURITY IN WSNs:

Security in Ad Hoc Wireless Networks, Network Security Requirements, Issues and Challenges in Security Provisioning, Network Security Attacks, Key Management, Secure Routing in Ad Hoc Wireless Networks.

SENSOR NETWORK PLATFORMS AND TOOLS:

Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms, Node-level Simulators, State-centric programming.

APPLICATIONS of WSN:

S Ultra wide band radio communication, Wireless fidelity systems. Future directions, Home automation, smart metering Applications

TEXT BOOKS:

1. Ad Hoc Wireless Networks: Architectures and Protocols - C. Siva Ram Murthy and B.S.Manoj, 2004, PHI
2. Wireless Ad- hoc and Sensor Networks: Protocols, Performance and Control – Jagannathan Sarangapani,CRC Press
3. Holger Karl & Andreas Willig, "Protocols And Architectures for Wireless Sensor Networks", John Wiley,2005.

REFERENCES:

1. Kazem Sohraby, Daniel Minoli, & Taieb Znati, "Wireless Sensor Networks- Technology, Protocols, and Applications", John Wiley, 2007.
3. Feng Zhao & Leonidas J. Guibas, "Wireless Sensor Networks- An Information Processing Approach",

Elsevier, 2007.
3. Ad- Hoc Mobile Wireless Networks: Protocols & Systems, C.K. Toh ,1 ed. Pearson Education.
4. Wireless Sensor Networks - C. S. Raghavendra, Krishna M. Sivalingam, 2004, Springer
5. Wireless Sensor Networks – S Anandamurugan , Lakshmi Publications

Course Code	VLSI DESIGN LAB	L	T	P	C
18EC7T5C	Maximum expected contact hours : **10 Weeks**	--	--	3	1
	Prerequisites : Knowledge of Digital IC applications				

PURPOSE

The students are required to design schematic diagrams using CMOS logic and layout diagrams to perform 4the following experiments using 130nm technology with an industry EDA Tools.

INSTRUCTIONAL COURSE OBJECTIVES

The main **purpose** of this **lab** course is to explore various **design** style of simple and complex Integrated Circuits(IC) near to students. In this **laboratory** students are able to understand about models and model parameters of MOSFET amplifier CMOS Inverter etc. which are suited for IC Technology.

COURSE OUTCOMES

This course provides the design of various digital circuits using different VLSI simulation software tools like Modelsim, Xilinx and Microwind. The outcome of this course to learn VHDL and Verilog language and also learn the usage of different tools.

List of Experiments:

1. Design and Implementation of an Universal Gates
2. Design and Implementation of an Inverter
3. Design and Implementation of Full Adder
4. Design and Implementation of Full Subtractor
5. Design and Implementation of Decoder
6. Design and Implementation of RS-Latch
7. Design and Implementation of D-Latch
8. Design and Implementation asynchronous counter
9. Design and Implementation of static RAM cell
10. Design and Implementation of 8 bit DAC using R-2R latter network

Additional Experiments:

1. Design and Implementation of ring oscillator
2. Design and Implementation of differential amplifier

Software Required:

1. Mentor Graphics Software / Equivalent Industry Standard Software.
2. Personal computer system with necessary software to run the programs and to implement.

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Course Code **18EC7L2**	**DIGITAL IC APPLICATIONS LAB**	**L**	**T**	**P**	**C**
	Maximum expected contact hours : **14 Weeks**	--	--	**3**	**1**
	Prerequisites : Knowledge onBJTs, MOSFET, Digital electronic circuits				

PURPOSE	
In this Laboratory student will learn about Digital IC And	
1	Modeling of CMOS circuits
2	Various Digital modules modeling using VHDL/Verilog
3	Modeling Complex Digital Controllers using VHDL/Verilog.

COURSE OUTCOMES	
1	Design CMOS Logic gates using PSPICE/Multisim
2	Write VHDL/Verilog programs for digitalmodules and simulate them.
3	Verify Implementation of Digital design on Advanced FPGA boards

List of experiments: (Minimum 14 experiments to be conducted)
(The following experiments are to be simulated using PSPICE/Multisim,VHDL and Verilog Softwares)

1. NMOS and PMOS Characteristics.
2. MOS Inverter DC Characteristics, AC Characteristics, Transient Analysis.
3. INVERTER, NAND, NOR, EXOR, EXNOR using CMOS Logic
4. Adders (Half and Full adders, Serial Binary Adder, Multi Precision Adder, CarryLook Ahead Adder)
5. Flip Flops
6. Decade Counter
7. Shift Register
8. 3X8 Decoder
9. 4-BIT Magnitude Comparator
10. 8X1 Multiplexer and 1X4 Demultiplexer
11. Up/Down Counter
12. Multiplier
13. ALU Design
14. Mealy Machine modeling
15. Moore Machine modeling
16. Stepper motor Controller
17. LCD Controller

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Course Code	MICROWAVE AND OPTICAL COMMUNICATION LAB	L	T	P	C
18EC7L2	Maximum expected contact hours : **14 Weeks**				
	Prerequisites : **Fundamental knowledge in microwave and optical concepts.**	--	--	3	1

PURPOSE

The student will be understood the different parameters of microwave and link design with their loss

INSTRUCTIONAL COURSE OBJECTIVES	
1	Measurement of wave guide parameters like Attenuation, VSWR, Impedance and frequency.
2	Characteristics of Reflex klystron, Gunn Diode.
3	Scattering parameters of directional coupler, circulator and magic tee.
4	Characterization of LED, laser diode, and Optical fiber
5	Losses in Optical fiber
COURSE OUTCOMES	
1	Measure the wave guide parameters required for different applications.
2	Understand the operation of Reflex klystron and Gunn Diode from the Characteristics.
3	Analyze various characteristics of microwave junctions and design of microwave communication links.
4	Analyze various characteristics of LED, laser diode, and Optical fiber and design of fiber optical analog and digital link.
5	Understand the Practical problems and their remedies due to loses in Optical fiber.

LIST OF EXPERIMENTS

(Minimum 12 experiments has to be conducted)

Part I : Microwave Engineering

9. Reflex Klystron Characteristics.
10. Attenuation Measurement.
11. VSWR Measurement.
12. Impedance and Frequency Measurement.
13. Directional Coupler Characteristics.
14. Scattering parameters of Circulator.
15. Scattering parameters of Magic Tee.
16. Gunn Diode Characteristics.

Part II: Optical Communications

7. Analog and digital link design.
8. LED Characteristics.
9. Laser Diode Characteristics.
10. Measurement of Data rate for Digital Optical link.
11. Measurement of Numerical Aperture of Optical fibre.
12. Measurement of losses for Analog Optical link.

Equipment required for laboratories:

23. Regulated Klystron Power Supply, VSWR Meter
24. Micro Ammeter – 0 – 500μA, , Multimeter, CRO
25. GUNN Power Supply, PinModulator
26. Reflex Klystron, Crystal Diodes
27. Microwave components (Attenuation), Frequency Meter
28. Slotted line Carriage
29. Probe detector
30. Wave guide shorts
31. Pyramidal Horn Antennas
32. Directional Coupler
33. E, H, Magic Tees
34. Circulators, Isolator
35. Matched Loads
36. Fiber Optic Analog Trainer basedLED
37. Fiber Optic Analog Trainer basedLaser
38. Fiber Optic Digital Trainer
39. Fiber Cables – (Plastic,Glass).

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Course Code 18EC8T1	Advanced Cellular Communications	L	T	P	C
	Maximum expected contact hours : **64**				
	Prerequisites Fundamentals of Mobile and **Wireless Communications**	4		--	3

PURPOSE: students will understand the mobile technologies and communications	
INSTRUCTIONAL COURSE OBJECTIVES	
1	To understand the basic cellular system concepts
2	To have an insight into the various propagation models and the speech coders used in mobile communication.
3	To understand the multiple access techniques and interference reduction techniques in mobile communication.
COURSE OUTCOMES *After undergoing the course students will be able to:*	
1	Discuss cellular radio concepts.
2	Identify various propagation effects.
3	To have knowledge of the mobile system specifications.
4	Classify multiple access techniques in mobile communication.
5	Outline cellular mobile communication standards.
6	Analyze various methodologies to improve the cellular capacity.

UNIT I

CELLULAR MOBILE RADIO SYSTEMS: Introduction to Cellular Mobile System, Performance criteria, uniqueness of mobile radio environment, operation of cellular systems, Hexagonal shaped cells, Analog and Digital Cellular systems.
ELEMENTS OF CELLULAR RADIO SYSTEM DESIGN:
General description of the problem, concept of frequency channels, Co-channel Interference Reduction Factor, desired C/I from a normal case in a Omni directional Antenna system, Cell splitting, consideration of the components of Cellular system.

UNIT II

INTERFERENCE : Introduction to Co-Channel Interference, real time Co- Channel interference, Co-Channel measurement, design of Antenna system, Antenna parameters and their effects, diversity receiver, non-cochannel interference-different types.
CELL COVERAGE FOR SIGNAL AND TRAFFIC: Signal reflections in flat and hilly terrain, effect of human made structures, phase difference between direct and reflected paths, constant standard deviation, straight line path loss slope, and general formula for mobile propagation over water and flat open area, near and long distance propagation antenna height gain, form of a point to point model.

UNIT III

FREQUENCY MANAGEMENT AND CHANNEL ASSIGNMENT:
Numbering and grouping, setup access and paging channels channel assignments to cell sites and mobile units, channel sharing and borrowing, Handoff, types of handoff ,dropped calls and cell splitting

UNIT IV

DIGITAL CELLULAR NETWORK:
2G-NETWORK: GSM, GSM Architecture, GSM channel and channel modes, multiple access schemes, channel coding and Interleaving.
CDMA; Terms of CDMA, modulation characteristics, call processing

UNIT V

B2G Systems: GPRS, GPRS architecture, GPRS network architecture, GPRS transmission plane & signaling plane, GPRS traffic performance, EDGE: network architecture, network control, HSCSD: iDEN.

UNIT-VI

3G Technology: UMTS-architecture, description, WCDMA, CDMA2000- architecture, bandwidth requirement, characteristics

TEXTBOOKS:

Mobile Cellular Telecommunications – W.C.Y. Lee, Tata McGraw Hill, 2rd Edn., 2006.
Principles of Mobile Communications – Gordon L. Stuber, Springer International 2nd Edition, 2007.

REFERENCES:

Wireless Communications - Theodore. S. Rapport, Pearson education, 2nd Edn., 2002.
Wireless and Mobile Communications – Lee McGraw Hills, 3rd Edition, 2006.
Mobile Cellular Communication – G Sasibhushana Rao Pearson
Wireless Communication and Networking – Jon W. Mark and Weihua Zhqung, PHI, 2005.
Wireless Communication Technology – R. Blake, Thompson Asia Pvt. Ltd., 2004.

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Course Code 18EC8T2	ELECTRONIC MEASUREMENTS AND INSTRUMENTATION	L	T	P	C
	Maximum expected contact hours : **64**	4	--	--	3
	Prerequisites : **Knowledge in Instrumentation**				

PURPOSE: This fundamental course will enable the students to learn how to design the measuring instruments.	
INSTRUCTIONAL COURSE OBJECTIVES: The student will be able to	
1	To familiarize with the characteristics and operation of measuring instruments
2	To introduce the concepts of passive and active Transducers.
3	To introduce the different oscilloscopes
COURSE OUTCOMES: After going through this course the student will be able to	
1	Classify the instruments based on static and dynamic characteristics
2	Understand the principle of operation of electronic measuring instruments
3	Understand the concepts of passive and active transducers

UNIT-1

Performance characteristics of instruments, Static characteristics-Accuracy, Resolution, Precision, Expected value, Error, Sensitivity, Errors in Measurement, Dynamic Characteristics-speed of response,Fidelity,Lag and Dynamic error,DC Voltmeters-Multirange, D 'Arsonval Movement, AC Voltmeters-multi range,True RMS Responding Voltmeters,DC ammeter, Aryton shunt, Ohmmeters-series and shunt type.

UNIT-2

Digital Voltmetes: Ramp technique, Dual slope integrating type DVM(Voltage to Time conversion),Integrating type DVM(Voltage to Frequency Conversion),Sucessive Approximations,Digital multimeters.

UNIT-3

Signal generators:AF,RF Signal generators,Sweep Frequency Generators,Pulse and Square wave Generators,Function generators,Arbitary waveform Generator.

UNIT-4

Bridges & Wave Analyzers: Wheatstone bridge,Kelvin bridge;Measurement of inductance-Maxwell's,Anderson bridge;Measurement of capacitance-Schering bridge;Q-meter,Wave Analyzers,Harmonic Distortion Analyzer,Spectrum Analyzers.

UNIT-5

Oscilloscopes-CRT features,vertical amplifier,horizontal deflection system,simple CRO,Dual beam CRO,Dual trace oscilloscope,Sampling oscilloscope,Standard specifications of CRO,Probes for CRO

UNIT-6

Transducers-Passive and active,Strain gauges,LVDT,Piezoelectric transducers,Thermocouples,Thermistor,Sensistor

Text Books:

1. A.D Helfrick and W.D.Cooper,"Modern Electronic Instrumentation and Measurement Techniques",PHI,5th Edition,2002.

Reference Books:

1. David A.Bell,"Electronic Instrumentation and Measurements",PHI,2ND Edition
2. H.S.Kalsi,"Electronic Instrumentation",Second Edition,Tata McGraw Hill,2004.

Course Code 18EC8T3	EMBEDDED SYSTEMS	L	T	P	C
	Maximum expected contact hours : **64**	**3**	**1**	**--**	**3**
	Prerequisites : **Knowledge in Microcontrollers and C programming**				

PURPOSE: This fundamental course will enable the students to learn the concepts of design principles and Programming Language along with understanding of Embedded system design.

INSTRUCTIONAL COURSE OBJECTIVES	
1	The basic concepts of an embedded system are introduced. The various elements of embedded hardware and their design principles are explained.
2	Different steps involved in the design and development of firmware for embedded systems is elaborated.
3	Internals of Real-Time operating system and the fundamentals of RTOS based embedded firmware design is discussed.
4	Fundamental issues in hardware software co-design were presented and explained.
5	Familiarize with the different IDEs for firmware development for different family of processors/controllers and embedded operating systems.
6	Embedded system implementation and testing tools are introduced and discussed.
COURSE OUTCOMES	
1	Understand the basic concepts of an embedded system and able to know an embedded system design approach to perform a specific function.
2	The hardware components required for an embedded system and the design approach of an embedded hardware.
3	The various embedded firmware design approaches on embedded environment.
4	Understand how to integrate hardware and firmware of an embedded system using real time operating system.

UNIT-I: INTRODUCTION: Embedded system-Definition, history of embedded systems, classification of embedded systems, major application areas of embedded systems, purpose of embedded systems, the typical embedded system-core of the embedded system, Memory, Sensors and Actuators, Communication Interface, Embedded firmware, Characteristics of an embedded system, Quality attributes of embedded systems, Application-specific and Domain-Specific examples of an embedded system.

UNIT-II: EMBEDDED HARDWARE DESIGN: Analog and digital electronic components, I/O types and examples, Serial communication devices, Parallel device ports, Wireless devices, Timer and counting devices, Watchdog timer, Real time clock.

UNIT-III: EMBEDDED FIRMWARE DESIGN: Embedded Firmware design approaches, Embedded Firmware development languages, ISR concept, Interrupt sources, Interrupt servicing mechanism, Multiple interrupts, DMA, Device driver programming, Concepts of C versus Embedded C and Compiler versus Cross-compiler.

UNIT-IV: REAL TIME OPERATING SYSTEM: Operating system basics, Types of operating systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling, Threads, Processes and Scheduling, Task communication, Task synchronization, Device Drivers. **Case Studies:** Case study of embedded system design and coding for an Automatic Chocolate Vending Machine (ACVM) Using Mucos RTOS, case study of digital camera hardware and software architecture, Case Study of Embedded System of Mobile Phone Software for Key Inputs.

UNIT-V: HARDWARE SOFTWARE CO-DESIGN: Fundamental Issues in Hardware Software Co-Design, Computational models in embedded design, Hardware software Trade-offs, Integration of Hardware and Firmware, ICE. **EMBEDDED SYSTEM DEVELOPMENT:** The integrated development environment, Types of files generated on cross-compilation, Deassembler/Decompiler, Simulators, Emulators and Debugging, Target hardware debugging, Boundary Scan, Embedded Software development process and tools.
UNIT-VI: EMBEDDED SYSTEM IMPLEMENTATION AND TESTING: The main software utility tool, CAD and the hardware, Translation tools-Pre-processors, Interpreters, Compilers and Linkers, Debugging tools, Quality assurance and testing of the design, Testing on host machine, Simulators, Laboratory Tools. **Programming in Linux:** Overview and programming concepts of Unix/Linux Programming, Shell Programming, System Programming.

Text Books:

1. Embedded Systems Architecture- By Tammy Noergaard, Elsevier Publications, 2013.
2. Embedded Systems-By Shibu.K.V-Tata McGraw Hill Education Private Limited, 2013.

Reference Books

1.Embedded System Design, Frank Vahid, Tony Givargis, John Wiley Publications, 2013.
2.Embedded Systems-Lyla B.Das-Pearson Publications, 2013.
3. Dr. K.V.K.K. Prasad: "Embedded/Real-Time Systems" Dream Tech Publications, Black pad book.
4. Rajkamal: "Embedded Systems-Architecture, Programming and Design", Tata McGraw Hill Publications, Second Edition, 2008.

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Course Code 18EC8T4C	TELEVISION AND VIDEO ENGINEERING	L	T	P	C
	Maximum contact hours excepted **: 64**	4	--	--	3
	Prerequisites : Knowledge of Television broadcast fundamentals, TV Display Devices				

PURPOSE : students can understand and know the working of video processing and television working

In this course student will be able to

1	Learn the fundamentals of Television Picture formation, transmission, reception.
2	Understand the Television broadcast fundamentals
3	Learn about the principles of color video transmission.
4	Learn about the latest Technologies like Digital Television, HDTV

COURSE OUTCOMES

1	To Study the video signal fundamentals.
2	To Understand the issues related to propagation of TV signals, antennas.
3	To Know the working of TV Receiver and design principles.
4	To Understand the various video systems like VCR, Video disc systems CCTV.
5	To Know the principles involved in the working of Latest Technologies like HDTV.

UNIT – I Television System Fundamentals:

TV Transmitter, Receiver, Synchronization, Television Pictures- Geometric form and aspect ratio, Persistence of vision and Flicker, Image Continuity, Vertical resolution, The Kell factor Horizontal resolution and video bandwidth, The scanning process, Interlaced Scanning, Scanning sequence. Composite Video Signal : Video signal dimension, Composite video signal, Horizontal and Vertical sync signals, Video modulation and Vestigial sideband signal, Sound modulation and the intercarrier system, reception of Vestigial sideband signal.

UNIT – II Television Equipment:

TV Transmitters-TV broadcast channels, Design principles of TV transmitters, Block diagrams of TV Transmitters; TV Standards-Consolidated CCIIR SystemB standard, NTSC color System, SECAM System, PAL system. TV Cameras-Camera tube types, Silicon diode Array Vidicon, CCD Image scanners, Colour Camera; TV Picture Tube-Monochrome picture tube, PIN picture tube, TRINITRON picture tube. Studio Equipment- Production control room facilities, Master control room Equipment;TV Antenna systems-Antenna Requirements, TV transmission Antennas, Television Reception problems.

UNIT – III Television Receiver:

Receiver Functions and Subsystems-Monochrome Receiver-RF Tuner, IF subsystem, AGC, Video amplifier, FM Sound Detectors, Sound section, Sync separation and processing, Noise in sync pulses, Separation of frame and line Sync pluses, AFC, deflection circuits, Deflection Drive ICs scanning circuits, PAL-D; Colour Receiver-Electronic Tuners, Digital tuning techniques, IF subsystem, Y-signal channel, chroma decoder, video and intercarrier sound signal detection, raster circuits;

UNIT – IV Display Devices:

Colour TV display Tubes-Delta-gun, Precision-in-line and Trinitron Color Picture tubes, Remote control of TV Receivers, Receiver Antennas. Flat panel Display TV receivers-LCD TV, LED TV, Plasma TV, and OLED TV

UNIT – V Video Systems:

TV Applications:CCTV, Cable TV, Video games, Tele-Text broadcast receiver, Stereo sound in TV. VCR and Video Disc Systems: video camera signal processing, video monitors, video cassette recorders, video disc systems, interactive video systems.

UNIT – VI Advanced Television Systems:

Cable Television and Direct Broadcast Satellite Systems;CATV Systems and channels, Scrambling and conditional access Systems, Direct Broadcasting Satellites, INSAT series, International Direct Broadcast Satellites. Digital Television Technology: Digital Television signals, Transmission of Digital TV Signals, Bit-rate Reduction, Digital TV Receivers, Picture-in-Picture processor. High Definition TV systems: HDTV standards and compatibility, The MUSE system, The HD-MAC family. State of the art TV Systems:3D TV, Direct to Home Television, IP TV.

TEXT BOOKS:

1. Television and Video Engineering - AM Dhake, 2nd Edition, TMH, 2003.
2. Modern Television Practice, Principles, Technologyand Servicing - RR.Gulati, New Age International Publishers 2004, 3rdEdition.

REFERENCES:

1. R.R.Gulati, "Monocrome and Colour Television" New Age International Publishers,2003.
2. SP Bali, Colour Television, Theory and Practice, Tata McGrawHill Publishers.