Scheme of Instruction and Syllabi

of

BE III and IV SEMESTERS

of

FOUR YEAR DEGREE COURSE

in

ELECTRONICS AND COMMUNICATION ENGINEERING

(AICTE Model Curriculum with effect from AY 2018-19)

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY

(Autonomous Institution under UGC, Affiliated to Osmania University)

Department of Electronics & Communication Engineering

Accredited by NBA and NAAC-UGC,

Chaitanya Bharathi (Post), Gandipet, Hyderabad–500075

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

OUR MOTTO: SWAYAM TEJASWIN BHAVA

VISION and MISSION of the INSTITUTE

Vision

To be a centre of excellence in technical education and research.

Mission

To address the emerging needs through quality technical education and advanced research.

VISION and MISSION of DEPT. of ECE

Vision

To develop the department into a full-fledged center of learning in various fields of Electronics & Communication Engineering, keeping in view the latest developments.

Mission

To impart value based technical education and train students and to turn out full pledged engineers in the field of Electronics & Communication Engineering with and overall background suitable for making a successful career either in industry/research or higher education in India/Abroad.

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

Program Educational Objectives of B.E(ECE) Programme

PEO1	Student will excel in analysing, design and development of systems in the area of Electronics and Communications.
PEO2	Student will have hand on experience in executing software related applications pertaining to Electronics and Communication Engineering.
PEO3	Student will carry out research in new technologies with modern relevant tools.
PEO4	Student will develop with professional ethics, effective communication skills and knowledge of societal impacts of computing technologies.

Program Specific Outcomes of B.E(ECE) Programme

PSO1	Student will demonstrate the knowledge and understanding of basic principles of mathematics, science, electronic devices, networks and signal processing procedures in simulation, modelling, and describing the behaviour of analog and digital electronic circuit or system.
PSO2	Student will be able to select and apply appropriate techniques, resources and Hardware and Software tools for design, analysis and testing the various analog and digital electronic circuits and networks.
PSO3	Student will demonstrate self-confidence to work independently or in a team and his/her ability to Analyze, synthesize, design and test analog & digital components, process, system or sub-systems of electronics and communication Engineering used in peace as well as war applications as per the specifications.

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING
Program Outcomes of B.E(ECE) Programme

Engineering graduate will be able to:

1. Engineering Knowledge	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization for the solution of complex engineering problems
2. Problem analysis	Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. Design/development of solutions	Design solutions for complex engineering problems and design system components or processes that meet t h e specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.
4. Conduct investigations of complex problems	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. Modern tool usage	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling to complex engineering activities, with an understanding of the limitations.
6. The engineer and society	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. Environment and sustainability	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. Individual and team work	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. Communication	Communicate effectively on complex engineering activities with the engineering community and with the society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. Project management and finance	Demonstrate knowledge and understanding of t h e engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. Life-long learning	Recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

AICTE Model Curriculum with effect from AY 2019-20

B.E (Electronics and Communication Engineering)

SEMESTER – III

S.No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours Per Week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1	18MT C07	Applied Mathematics	3	1	-	3	30	70	4
2	18CS C05	Basics of Data Structures	2	-	-	2	20	50	2
3	18EC C01	Electromagnetic Theory and Transmission Lines	3	-	-	3	30	70	3
4	18EC C02	Electronic Devices	3	-	-	3	30	70	3
5	18EC C03	Network Theory	3	-	-	3	30	70	3
6	18EC C04	Signals and Systems	3	-	-	3	30	70	3
7	18CE M01	Environmental Science	2	-	-	2	-	50	Non-Credit
PRACTICALS									
8	18CS C06	Basics of Data Structures Lab	-	-	2	2	15	35	1
9	18EC C05	Electronic Devices Lab	-	-	2	2	15	35	1
10	18EC C06	Electronic Workshop and Networks Lab	-	-	2	2	15	35	1
11	18EG C03	Soft Skills	-	-	2	2	15	35	1
Total			**19**	**01**	**08**	**-**	**230**	**590**	**22**
Clock Hours Per Week: 28									

L: Lecture **D: Drawing** **CIE: Continuous Internal Evaluation**

T: Tutorial **P: Practical/Project Seminar/Dissertation** **SEE: Semester End Examination**

18MT C07

APPLIED MATHEMATICS

(For ECE and EEE)

Instruction	3 L+1T Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	4

Prerequisite: Knowledge of Integral and Differential calculus

Course Objectives:

This course aims to:

1. To discuss formation of PDE and solution of linear and non-linear equations.
2. To explain the Laplace, Inverse Laplace Transform and Z-Transforms.
3. To interpret roots of equations, interpolation and Numerical differentiation.
4. To discuss Numerical solution of ODE and Engineering problems.
5. To demonstrate fitting of distribution and predicting the future values.

Course outcomes:

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

1. Solve Linear and Non-Linear PDE and wave equations.
2. Use Laplace transforms to solve initial value problems and Z transforms to difference equations.
3. Calculate the approximate roots of transcendental equations.
4. Analyse the analytical and empirical solution of first order ordinary differential equations.
5. Identify the random phenomena by various probability distributions

UNIT-I

Partial Differential Equations: Formation of Partial Differential Equations, Solution of Linear (Lagrange's) and Non-linear PDE of First order standard forms and Charpit's Method, Solutions of PDE by method of separation of variables, solution of one-dimensional wave equation and its applications.

UNIT-II

Transform Theory: Laplace Transform, Properties of Laplace Transform, Laplace transform of periodic functions. Finding inverse Laplace transform by partial fractions and residue method, solving ODEs by Laplace Transform method. Z-transforms and its basic properties, inverse Z-transform and solutions of difference equation by Z-transform.

UNIT-III

Numerical Analysis: Solution of Algebraic and transcendental equations by Bisection method, Newton-Raphson method and Regula-Falsi method. Interpolation, Newton's forward and backward difference formulae. Newton's divided difference and Lagrange's formulae. Numerical Differentiation.

UNIT-IV

Numerical Solutions of ODE: Solutions of First Order Ordinary differential equations, Taylor's series, Euler and modified Euler's methods. Runge-Kutta method of fourth order for solving first and second order equations. Milne's and Adam's predicator corrector methods

UNIT-V:

Basic Statistics: Measures of Central tendency for continuous random variable, Moments, skewness and Kurtosis, Probability distributions: Normal (Gaussian), Rayleigh, Exponential and uniform distributions Correlation and regression. Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas.

Text books:

1. P. Kandasamy, K.Thilagavathy, K.Gunavathi, "Numerical Methods", S. Chand & Company, 2nd Edition, Reprint 2012.
2. S.S. Sastry, "Introductory methods of numerical analysis", PHI, 4th Edition, 2005.
3. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 35th Edition, 2010.
4. Sheldon Ross, "A First Course in Probability", 9th Edition, Pearson publications, 2014.

Suggested Reading:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", 9th Edition, John Wiley & Sons, 2006.
2. Veerarajan T, "Engineering Mathematics", Tata McGraw-Hill, New Delhi, 2008.
3. S.C.Gupta, V.K.Kappoor, "Fundamentals of Mathematical Statistics", Sultan Chand and Sons, 2014.

18CS C05

BASICS OF DATA STRUCTURES

(Common to all Programs except CSE & IT)

Instruction	2 L Hours per week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	20 Marks
Credits	2

Pre-requisite: Basic knowledge of programming language such as C or C++ is preferred (but not mandatory) and some mathematical maturity also will be expected.

Course Objectives:

This course aims to:

1. Basic linear and non-linear data structures.
2. Analyzing the performance of operations on data structures.
3. Different sorting and searching techniques and their complexities.

Course Outcomes:

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

1. Understand the basic concepts of data structures.
2. Understand the notations used to analyze the performance of algorithms.
3. Choose and apply an appropriate data structure for a specified application.
4. Understand the concepts of recursion and its applications in problem solving.
5. Demonstrate a thorough understanding of searching and sorting algorithms.

UNIT-I

Introduction: Data Types, Data structures, Types of Data Structures, Operations, ADTs, Algorithms, Comparison of Algorithms, Complexity, Time- space trade-off.

Recursion: Introduction, format of recursive functions, recursion Vs. Iteration, examples.

UNIT-II

Linked Lists: Introduction, Linked lists and types, Representation of linked list, operations on linked list, Comparison of Linked Lists with Arrays and Dynamic Arrays.

UNIT-III

Stacks and Queues: Introduction to stacks, applications of stacks, implementation and comparison of stack implementations. Introduction to queues, applications of queues and implementations, Priority Queues and applications.

UNIT-IV

Trees: Definitions and Concepts, Operations on Binary Trees, Representation of binary tree, Conversion of General Trees to Binary Trees, Representations of Trees, Tree Traversals, Binary search Tree.

UNIT-V

Graphs: Introduction, Applications of graphs, Graph representations, graph traversals, Minimal Spanning Trees.

Searching and Sorting: Linear searching, binary Searching, sorting algorithms- bubble sort, selection sort, quicksort, heap sort.

Text Books:

1. Narasimha karumanchi, "Data Structures and Algorithms Made Easy", Career Monk Publications, 2017
2. S. Sahniand Susan Anderson-Freed, "Fundamentals of Data structures in C", E. Horowitz, Universities Press, 2nd Edition.
3. Reema Thareja, "Data Structures using C", Oxford University Press.

Suggested Reading:

1. D.S.Kushwaha and A.K.Misra, "Data structures A Programming Approach with C", PHI.
2. Seymour Lipschutz, "Data Structures with C", Schaums Outlines, Kindle Edition

Online Resources:

1. https://www.tutorialspoint.com/data_structures_algorithms/ index.htm
2. https://www.edx.org/course/foundations-of-data-structures
3. https://sites.google.com/site/merasemester/data-structures/data- structures-1#DS

18EC C01

ELECTROMAGNETIC THEORY AND TRANSMISSION LINES

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Students should have prior knowledge about circuit theory, coordinate systems and vector calculus.

Course Objectives:

This course aims to:

1. The mathematical fundamentals necessary for understanding the electromagnetic theory.
2. The electrostatics and magnetics along with Maxwell's equations for EM Waves.
3. The concepts of transmission lines

Course Outcomes:

Upon completion of this course, students will be able to:

1. Comprehend mathematically the coordinate systems and solve simple static Electro-magnetic problems using various laws and theorems.
2. Understand Maxwell's equations in different forms (differential and integral) and apply them to derive wave equations.
3. Demonstrate the Electromagnetic wave properties with respect to different transmission mediums.
4. Predict the behaviour of reflection and refraction of the waves in different mediums.
5. Evaluate the transmission line properties, reflection and matching concepts.

UNIT – I

Review of coordinate systems. Coulomb's Law, Electric field, Electric flux, flux density and Gauss Law. Potential and Potential gradient. Laplace's and Poisson's equations. Current, Current Density and Continuity of current Equation.

UNIT – II

Biot-Savart's law, Ampere's law, Magnetic flux and Magnetic flux density. Gauss law for magnetic fields, Vector magnetic potential. Boundary conditions. Time varying fields, Maxwell equations: Integral form and Point form.

UNIT – III

Wave equations, Uniform plane waves in lossy and lossless medium. Skin Depth, Polarization, Instantaneous and average Poynting theorem and its applications. Reflection and Refraction of Plane Waves - Normal and Oblique Incidence for both perfect Conductor and perfect Dielectrics, Brewster Angle, Critical Angle and Total Internal Reflection.

UNIT – IV

Transmission Lines - I: Types, Parameters, Transmission Line Equations, Primary and Secondary Constants, Characteristics Impedance, Propagation Constant, Phase and Group Velocities, Infinite Line. Impedance at any point on the transmission line.

UNIT – V

Transmission Lines - II: RF and UHF Lines, Open and short circuit lines and their significance. Properties of λ/2, λ/4 and λ/8 Lines. Distortion and distortion less transmission line, Concept of loading of a transmission line, Campbell's formula. Reflection and VSWR. Matching: Quarter wave transformer, Single Stub matching. Smith chart and its applications.

Text Books:

1. Matthew N.O. Sadiku, "Elements of Electromagnetics", 7th edition, Newyork Oxford University Press, 2018.
2. William H. Hayt Jr. and John A. Buck, "Engineering Electromagnetics", 8th edition, TMH, 2016.
3. E.C. Jordan and K.G. Balmain, "Electromagnetic Waves and Radiating Systems", 2nd edition, PHI,2000.

Suggested Reading:

1. John D. Ryder, "Networks Lines and Fields", 2nd edition, PHI, 2015.
2. R.K. Shevgaonkar, "Electromagnetics Waves", Tata McGraw Hill India, 2005.

18EC C02

ELECTRONIC DEVICES

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Students should have the knowledge of semiconductor fundamentals.

Course objectives:
This course aims to:
1. The concepts of semiconductor devices like PN junction diode, Transistor, and special diodes.
2. The applications of diodes.
3. The various configurations, characteristics of transistors – BJT, JFET & MOSFET.

Course Outcomes:
Upon completion of this course, students will be able to:
1. Demonstrate understanding of the characteristic behaviour of various electronic devices such as Diodes, Transistors etc.
2. Apply the acquired knowledge in the analysis of various diode and Transistor circuits.
3. Compare and Contrast the characteristics of BJT and FET in various configurations
4. Evaluate the performance parameters of various diode circuits (rectifiers, clippers and clampers) and Transistor circuits.
5. Choose an appropriate electronic device for a specific application and discuss IC fabrication process

UNIT – I
Semiconductor Diode Characteristics:
The p-n junction Diode, Energy band diagram, Current equations, I-V characteristics, Temperature dependence, Diode resistance, Transition capacitance, Diffusion capacitance, Zener diode - Regulator, Schottky diode.

UNIT – II
Diode Applications:
Diode as a circuit element, Clipping and Clamping circuits, Clamping circuit theorem. Half wave, Full wave and Bridge Rectifiers - their operation, performance characteristics- ripple factor calculations, and analysis; Filters (L, C, LC and CLC filters).

UNIT – III
Bipolar Junction Transistor:
Construction and Operation of NPN and PNP transistor, current components and current flow in BJT, Modes of transistor operation, Early effect, BJT input and output characteristics of CB, CE, CC configuration- h-parameters.

UNIT – IV
Field Effect Transistor: Junction Field Effect Transistor: Principle of Operation-the Pinch-off Voltage V_P, V-I characteristics of JFET.
MOSFETs: Enhancement & Depletion mode MOSFETs, V-I characteristics, MOSFET as resistance.

UNIT – V
Elementary treatment of SCR- UJT- Diac- Triac - Tunnel diode. LED, Photodiode, Solar cell. Introduction to Integrated circuit fabrication process: Oxidation, Diffusion, Ion implantation, Photolithography, Etching, Metallization, Twin-tub CMOS process.

Text Books:

1. Millman and Halkias, "Electronic Devices and Circuits", 2nd Edition, McGraw Hill Publication, 2007.
2. Robert L. Boylestad, "Electronic Devices and Circuit Theory", 10th Edition, PHI, 2009.
3. S.K. Gandhi, "VLSI Fabrication Principles: Silicon and Gallium Arsenide", Wiley India Pvt. Ltd., New Delhi, 2nd edition. 1994.

Suggested Reading:

1. David Bell, "Fundamentals of Electronic Devices and Circuits", 5th Edition, Oxford University Press 2008.
2. Jacob Millman, Christos Halkias, Chetan Parikh, "Integrated Electronics", 2nd Edition, McGraw Hill Publication, 2009.
3. Christian Piguet, "Low Power CMOS Circuits Technology, Logic Design and CAD Tools" 1st Indian Reprint, CRC Press, 2010.

18EC C03

NETWORK THEORY

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Knowledge on Elements of Electrical Engineering.

Course Objectives:
This course aims to:

1. Make understand the concepts of Electric Circuits, Network Theorems and the transients.
2. Make understand the concept of steady state and applying phasor analysis to AC circuits and analyzing magnetic coupled circuits.
3. Familiarize resonant circuits, two port network parameters, concept of Passive Filters and Network Synthesis.

Course Outcomes:
Upon completion of this course, students will be able to:

1. Recall basics of electrical circuits with nodal and mesh analysis
2. Illustrate electrical theorems for AC and DC Circuits.
3. Perform time domain and frequency domain analysis for networks.
4. Analyze the electrical network and two port network parameters for different applications i.e., magnetic coupled circuits, Filters.
5. Build different networks using various synthesis methods.

UNIT-I

Network Theorems: Network reduction techniques, Super Nodal and Super Mesh Analysis, Superposition, Thevenin's and Norton's theorems. Reciprocity, Maximum Power Transfer, Compensation, Millman's, Duality and Tellegen's Theorems using dependent and independent sources.

UNIT-II

Transients: Introduction, Study of initial conditions, DC transients RL, RC circuits, RLC circuits, Formulation of integral, differential equations. Circuit analysis using Laplace Transform and inverse Laplace Transform, Pole-Zero Plots, Zero Input Response, Zero State Response.

UNIT-III

Steady State Analysis of AC circuits: Phasor and vector representations, impedance and admittance, Average power, Apparent Power, Complex Power, Power triangle.
Coupled circuits: Concept of self, mutual inductance, co-efficient of coupling, dot convention rules and analysis of simple circuits.

UNIT-IV

Frequency Domain Analysis: Concept of complex frequency, impedance and admittance functions, Series and parallel resonance, Q-factor, selectivity, bandwidth.
Two Port Networks: Z, Y, h, g, ABCD and Inverse ABCD parameters, equivalence of two port networks. Interconnection of two port networks.

UNIT-V

Filters: Introduction to Filters and classification of Filters (Low pass, High pass, Band pass and Band stop) and their design aspects. **Network Synthesis:** Elements of circuit synthesis, Foster and Cauer forms of LC Networks, Synthesis of RC and RL networks.

Text Books:

1. William H.Hayt, Jr.,Jck E. Kemmerly & Steven M.Durbin, "Engineering Circuit Analysis", 8th edition, McGraw Hill, 2013.
2. Vanvalkenberg M.E, "Network analysis", PHI, New Delhi, 3rd Edition 2002.

Suggested Reading:

1. C.L.Wadhwai, "Network Analysis and Synthesis", 4th edition, New Age Publications, 2016.
2. Sudhakar, A., Shyammohan, S. P., "Circuits and Network", Tata McGraw-Hill New Delhi, 1994.

18EC C04

SIGNALS AND SYSTEMS

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Knowledge of Differential and Integral Calculus.

Course Objectives:
This course aims to:

1. Know Signals and systems representation/classification, time and frequency domain analysis of continuous time signals with Transform techniques.
2. Expose Sampling, time and frequency domain analysis of discrete time signals with DTFT and Z-Transforms.
3. Familiarise concepts of convolution and correlation integrals.

Course Outcomes:
Upon completion of this course, students will be able to:

1. Classify signals, systems and analyze them using Transform techniques.
2. Evaluate signal characteristics using time and frequency domain analysis.
3. Assess the systems stability and causality
4. Describe the Sampling process and analyze the DT Signals/Systems using DTFT and Z Transform.
5. Apply the Convolution and correlation concepts for analysis of signals and systems

UNIT-I
Continuous Time Signals:
Introduction to signals, their representations and classification. Introduction to systems and their classifications, Orthogonality of signals, Complete set of mutually orthogonal signals, Harmonic signals.
Signal Representation:
Exponential Fourier series, Existence and Convergence. Symmetry conditions, Amplitude and Phase spectra. Power Spectral Density.

UNIT-II
Fourier Transforms:
The direct and inverse Fourier transforms, Existence, Frequency spectrum and properties of Fourier Transforms, Fourier Transform of singularity functions and periodic signals. Energy Spectral Density, Filter characteristics of linear systems, Distortion less system, Phase delay and group delay.

UNIT-III
Signal Representation by Generalized Exponentials:
The Bilateral and unilateral Laplace transforms. Region of convergence and its properties. Properties of Laplace transform, Inverse Laplace transform, Laplace transform of periodic signals. **LTI system:** Impulse response, System transfer function, Stability and Causality.

UNIT-IV
Discrete Time Signals:
Sampling of continuous time signals, DTS representation. Discrete Time Fourier Transform and properties.
Z–Transform: The Direct Z-Transform, Region of convergence and its properties. S–Plane and Z–Plane correspondence, Z–Transform properties. Inverse Z–Transform, Discrete LTI system: impulse response and system transfer function. Stability and Causality.

UNIT-V

Convolution: Continuous convolution, Graphical interpretation and its properties. Discrete convolution and its properties.

Correlation: Continuous correlation Cross correlation, Auto correlation and properties. Discrete correlation Cross correlation, Auto correlation and properties.

Text Books:

1. B.P.Lathi, "Signals, Systems and Communications", BS Publications, 3rd Edition, 2008.
2. Simon Haykin, "Signals and Systems", Wiley India, 5th Edition,2009.

Suggested Reading:

1. Alan V. Oppenheim, Alan S. Willsky, S.Hamid Nawad, "Signals and Systems", PHI 2nd Edition, 2015.
2. M.J. Robert, "Fundamentals of signals and systems", McGraw Hill, 2008.

18CE M01

ENVIRONMENTAL SCIENCE

(Mandatory Course)

Instruction	2 L Hours per week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	--
Credits	Non-Credit

Course Objectives:

This course aims to:

1. Identify environmental problems arising due to over utilization of natural resources and understand the importance of use of renewable energy sources
2. Become aware about the importance of eco system and interlinking of food chain.
3. Identify the importance of biodiversity in maintaining ecological balance.
4. Learn about various attributes of pollution management and waste management practices.
5. Contribute for capacity building of nation for arresting and/or managing environmental disasters.

Course Outcomes:

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

1. Identify the natural resources and realize the importance of water, food, forest, mineral, energy, land resources and effects of over utilization.
2. Understand the concept of ecosystems and realize the importance of interlinking of food chains.
3. Contribute for the conservation of bio-diversity.
4. Suggest suitable remedial measure for the problems of environmental pollution and contribute for the framing of legislation for protection of environment.
5. Follow the environmental ethics and contribute to the mitigation and management of environmental disasters.

UNIT-I

Environmental Studies: Definition, Scope and importance, need for public awareness.

Natural Resources: Use and over utilization of Natural Resources - Water resources, Food resources, Forest resources, Mineral resources, Energy resources, Land resources.

UNIT-II

Ecosystems: Concept of an ecosystem, structure and function of an ecosystem, role of producers, consumers and decomposers, energy flow in an ecosystem, food chains, food webs, ecological pyramids, Nutrient cycling, Bio-geo chemical cycles, Terrestrial and Aquatic ecosystems.

UNIT-III

Biodiversity: Genetic, species and ecosystem biodiversity, Bio-geographical classification of India, India as a Mega diversity nation. Values of biodiversity, hot-spots of biodiversity, threats to biodiversity, endangered and endemic species of India, methods of conservation of biodiversity.

UNIT-IV

Environmental Pollution: Cause, effects and control measures of air pollution, water pollution, marine pollution, soil pollution, noise pollution and Solid waste management, nuclear hazards

Environmental Legislations: Environment protection Act, Air, Water, Forest & Wild life Acts, issues involved in enforcement of environmental legislation, responsibilities of state and central pollution control boards

UNIT-V

Social Issues and The Environment: Water conservation methods: Rain water harvesting and watershed management, Environmental ethics, Sustainable development and Climate change: Global warming, Ozone layer depletion, forest fires, and Contemporary issues.

Text Books:

1. Y. Anjaneyulu, “Introduction to Environmental Science”, B S Publications, 2004.
2. Suresh K. Dhameja, “Environmental Studies”, S. K. Kataria & Sons, 2009.

Suggested Reading:

1. C. S. Rao, “Environmental Pollution Control Engineering”, Wiley, 1991.
2. S. S. Dara, “A Text Book of Environmental Chemistry &Pollution Control”, S. Chand Limited, 2006.

18CS C06

BASICS OF DATA STRUCTURES LAB

(Common for all Programs except CSE & IT)

Instruction	2 P Hours per week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Pre-requisite: Any Programming Language (C)

Course Objectives:

This course aims to:

1. Design and construct simple programs by using the concepts of Data structures as abstract data type.
2. Have a broad idea about how efficiently pointers can be used in the implement of data structures.
3. Enhance programming skills and strengthen practical ability to apply suitable data structure for real time applications.

Course Outcomes:

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

1. Implement the abstract data type.
2. Implement linear data structures such as stacks, queues using array and linked list.
3. Understand and implement non-linear data structures such as trees, graphs and its traversal techniques.
4. Implement various kinds of searching, sorting techniques.
5. Develop the suitable data structure for real world problem.

List of Experiments

1. Implementation of operations on arrays.
2. Implementation of Stack.
3. Implementation of Queue.
4. Implementation of basic operations on Single Linked List.
5. Implementation of Searching techniques.
6. Implementation of Sorting techniques.
7. Case study like Banking System, Students Marks Management, Canteen Management etc.

Text Books:

1. Brian W Kernighan, Dennis Ritchie, "C Programming Language", PH PTR, 2nd Edition.
2. Richard M Reese, "Understanding and Using C Pointers", O,,Reily, 2013.

Online Resources:

1. https://nptel.ac.in/courses/106102064/

18EC C05

ELECTRONIC DEVICES LAB

Instruction	2 P Hours per week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Prerequisite: Students have the knowledge of semiconductor fundamentals.

Course objectives:
This course aims to:
1. The V-I characteristics of diodes and special semiconductor devices.
2. The design and performance evaluation of various diodes as rectifiers.
3. The characteristics of transistor in various configurations.

Course Outcomes:
Upon completion of this course, students will be able to:
1. Demonstrate the characteristic behaviour of PN junction diode, Zener diode and special purpose semiconductor diodes
2. Design various non-linear wave shaping circuits using diodes for a given specification
3. Analyze the behaviour of non-linear wave shaping circuits using diodes.
4. Examine the characteristics of BJT and FET in various configurations
5. Evaluate and compare the significant parameters obtained from the characteristics of BJT and FET.

List of Experiments:

1. V-I Characteristics of Silicon and Germanium diodes and measurement of static and dynamic resistances.
2. Zener diode characteristics and its application as voltage regulator.
3. Clipping and Clamping Circuits.
4. Design, realization and performance evaluation of half wave rectifiers without filters and with filters (capacitor filter and π - section filter).
5. Design, realization and performance evaluation of full wave rectifiers without filters and with C & π section filters.
6. Plotting the characteristics of BJT in Common Base configuration and measurement of h-parameters.
7. Plotting the characteristics of BJT in Common Emitter configuration and measurement of h-parameters.
8. Plotting the characteristics of BJT in Common Collector configuration and measurement of h-parameters.
9. Plotting the characteristics of JFET in CS configurations and measurement of Transconductance and Drain resistance.
10. Characteristics of special semi-conductor devices-UJT and SCR.
11. Characteristics of LED and photo diode.
12. Characteristics of Tunnel diode.

Note:
1. Wherever possible, Analysis and design of circuits shall be carried out using simulation tools.
2. A minimum of 12 experiments should be performed.

Suggested Reading:

1. Robert Diffenderfer, “Electronic Devices Systems and Applications”, Cengage Learning India Private Limited, 2010.
2. Paul B. Zbar, Albert P. Malvino, Michael A. Miller, “Basic Electronics, A Text - Lab Manual”, 7thEdition, TMH 2001.
3. Mahesh Jain, “Practical semiconductors data manual No.3”, BPB Publications, 1981.
4. Bharath electronics ltd, “Semiconductors data manual”, IEC Publication 134, 1969.

18EC C06

ELECTRONIC WORKSHOP AND NETWORKS LAB

Instruction	2 P Hours per week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Prerequisite: Knowledge of **b**asic Electrical components, circuits and equipment.

Course Objectives:
This course aims to:

1. Understand the basic Concepts of Electric Circuits and equipment like CRO, Multimeter and LCR–Q meter
2. Verify network theorems.
3. Analyse Resonant circuits, Attenuators and passive filters.

Course Outcomes:
Upon completion of this course, students will be able to:

1. Identify and measure the passive and active components using electronic equipment.
2. Apply Network theorems to AC and DC Circuits.
3. Determine and analyze two port network parameters.
4. Design and verification of attenuators and filters.
5. Simulation of different networks and circuits using the simulation software.

List of Experiments

1. Study of RLC components, Bread board, Regulated power supply, Function generator, CRO
2. Measurement of R, L, C components using colour code, multimeter and LCR - Q Meter.
3. Practice of Soldering and de-soldering for simple circuits.
4. Verification of Superposition theorem and Tellegen's theorem.
5. Verification of Maximum power transfer theorem.
6. Verification of Reciprocity theorem.
7. Verification of Compensation theorem and Millman's theorem.
8. Verification of Transient Response in RC, RL circuits.
9. Design and Verification of Series Resonance.
10. Design and Verification of Parallel Resonance.
11. Determination of two-port network parameters (Z,Y,h,T).
12. Design and Verification of Attenuators.
13. Design and Verification of Constant-K high-pass filter.
14. Design and Verification of Constant-K low-pass filter.

Note: Experiments are to be simulated by using any simulation software.

Suggested Reading:

1. Thomas Petruzzellis, "Build Your Own Electronics Workshop", McGraw-Hill Companies, Inc., 2005.
2. A.M. Zungeru, J.M. Chuma, M. Mangwala, L.K. Ketshabetswe, "Handbook of Laboratory Experiments in Electronics and Communication Engineering" Vol. 2, 1st Edition, Notion press, 2017.

18EG C03

SOFT SKILLS

Instruction	2 P Hours per week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Course Objectives

This course aims to:

1. Imbibe an impressive personality, etiquette, professional ethics & values, effective time management & goal setting.
2. Understand the elements of professional update & upgrade through industry exposure in a mini-live project. Understand confidence building strategies and thereby to make effective presentations through PPTs.
3. Learn what constitutes proper grooming and etiquette in a professional environment while acquiring the necessary skills to make a smooth transition from campus to corporate.

Course Outcomes

Upon completion of this course, students will be able to:

1. Demonstrate effective time and stress management techniques while being assertive and setting short term and long-term goals.
2. Identify problems and construct an argument in given case studies and write abstracts.
3. Analyze and assess their skills, strengths, weaknesses and face interviews confidently and be able to draft resumes.
4. Adapt to corporate culture by personal and professional sensitivity and also be able to draft an effective SOP.
5. Design a mini-live project by collecting and analyzing data and making oral and written presentations.

Exercise 1

Main Topics: Thinking Skills, Personality Development–Effective Time Management, setting realistic goals, self-confidence and assertiveness, stress management, moral values.

Flipped Sessions: Personal Sensitivity & Professional Sensibility (Reading & Discussion)

Writing Input: Writing to Express - Drafting & Delivering a Speech (Free Writing Exercise)

Exercise 2

Main Topics: Advanced Group Discussion with Case studies: Dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and coherence.

Flipped Sessions: Importance of Professional Updating & Upgrading (Reading & Discussions)

Writing Input: Writing with Precision - Writing Abstracts

Exercise 3

Main Topics: Interview Skills–concept and process, pre-interview planning, opening strategies, answering strategies, mock interviews. Resume' writing – structure and presentation, planning, defining the career objective, projecting one's strengths and skills.

Flipped Sessions: Mock Interviews (Video Sessions & Practice)

Writing Input: Writing to Reflect - Resume Writing

Exercise 4
Main Topic: Corporate Culture–Grooming and etiquette, communication media, academic ethics and integrity
Flipped Sessions: Corporate Culture, Etiquette & Grooming (Video Sessions & Practice through Role-play)
Writing Input: Writing to Define - Writing an effective SOP.

Exercise 5
Main Topic: Mini Project–General/Technical. Research, developing a questionnaire, data collection, analysis, written report and project seminar. Elements & Structure of effective presentation. Presentation tools–Body language, Eye-contact, Props & PPT.
Flipped Sessions: Effective Presentations (Video & Writing Sessions, Practice through Emulation)
Writing Input: Writing to Record - Writing minutes of meeting.

Suggested Reading:

1. Madhavi Apte, "A Course in English communication", Prentice-Hall of India, 2007
2. Dr. Shalini Verma, "Body Language- Your Success Mantra", S Chand, 2006
3. Ramesh, Gopalswamy, and Mahadevan Ramesh, "The ACE of Soft Skills", New Delhi: Pearson, 2010
4. Van Emden, Joan, and Lucinda Becker, "Presentation Skills for Students", New York: Palgrave Macmillan, 2004

* Flipped Class-room: Students explore the concept first and then trainer explains it, students work on their own.

Web Resources:

1. https://www.goskills.com/Soft-Skills
2. https://www.trainerbubble.com
3. https://www.skillsconverged.com

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

AICTE Model Curriculum with effect from AY 2019-20

B.E (Electronics and Communication Engineering)

SEMESTER – IV

S.No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1	18EC C07	Analog Circuits	3	-	-	3	30	70	3
2	18EC C08	Analog Communication	3	-	-	3	30	70	3
3	18EC C09	Antennas and Wave Propagation	3	-	-	3	30	70	3
4	18EC C10	Control Systems	3	-	-	3	30	70	3
5	18EC C11	Digital Systems Design	3	-	-	3	30	70	3
6	18EG M01	Indian Constitution and Fundamental Principles	2	-	-	2	-	50	Non-Credit
7	18EE M01	Indian Traditional Knowledge	2	-	-	2	-	50	Non-Credit
PRACTICALS									
8	18EC C12	Analog Circuits Lab	-	-	2	2	15	35	1
9	18EC C13	Analog Communication Lab	-	-	2	2	15	35	1
10	18EC C14	Digital Systems Design Lab	-	-	2	2	15	35	1
Total			**19**	**-**	**06**	**-**	**195**	**555**	**18**
Clock Hours Per Week: 25									

L: Lecture **D: Drawing** **CIE: Continuous Internal Evaluation**

T: Tutorial **P: Practical/Project Seminar/Dissertation** **SEE: Semester End Examination**

18EC C07

ANALOG CIRCUITS

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Student should have knowledge on Electronic Devices and Network Analysis.

Course objective:
This course aims to:

1. Understand the applications of BJT & FET as a switch and an amplifier.
2. Analysis of BJT & FET in various configurations using small signal equivalent models and their frequency response.
3. Know concept of multistage, feedback amplifiers, multi-vibrators and power amplifier and their analysis.

Course Outcomes:
Upon completion of this course, students will be able to:

1. Recall and relate the knowledge of BJT and FET behaviour in the design of various biasing and amplifier circuits.
2. Apply low and high frequency models of BJT/FET in the analysis of single stage and multistage amplifiers.
3. Design and analyse amplifier and oscillator circuits.
4. Compare and Contrast different types of biasing, Multistage, Feedback, Power amplifiers and Multi-vibrators circuits.
5. Interpret a given analog circuit and evaluate its performance parameters by applying acquired knowledge.

UNIT-I
Biasing of amplifiers:
BJT biasing techniques, stability factors, Bias compensation techniques, Thermal runaway, Thermal stability, BJT as an amplifier and as a switch. JFET biasing-zero current drift biasing, biasing of FET, FET as an amplifier and as a switch. Biasing of MOSFETs, MOSFET as a switch.

UNIT-II
Single Stage Amplifiers:
Analysis of BJT circuits using h-parameters in various configurations - their comparison (approximate and exact analysis), Millers Theorem & its duality – application circuits, frequency response. Analysis of FET circuits using equivalent model for various configurations - their comparison.

UNIT-III
Multi Stage Amplifiers:
Multi stage amplifiers: CE-CE, CE-CB, CC-CC - Bootstrap, High frequency equivalent circuit– Analysis – BJT (f_T, f_β, and gain band-width product), Amplifier Frequency response, Multistage amplifiers: low frequency and High frequency analysis of RC coupled, Transformer coupled and Direct coupled amplifiers with BJT.

UNIT-IV
Feedback Circuits:
Feed Back Amplifiers: The feedback concept, General characteristics of negative feedback amplifier, Effect of negative feedback on input and output impedances, Voltage and current, series and shunt feedbacks. Stability considerations. Oscillators: Positive feedback and conditions for sinusoidal oscillations, RC oscillator, LC oscillator, Crystal oscillator, Amplitude and frequency stability of oscillator.

UNIT-V

Large Signal Amplifies & Multivibrators:

Large Signal Amplifiers: BJT as large signal audio amplifiers, Classes of operation, Harmonic distortion, power dissipation, efficiency calculations. Push-pull audio power amplifiers under Class-A, Class-B operations, Heat Sinks. Analysis of Transistor Multivibrators – Bistable, Monostable and Astable circuits. Operation of regenerative comparator (Schmitt Trigger).

Text Books:

1. David Bell, "Fundamentals of Electronic Devices and Circuits", 5th Edition, Oxford University Press, 2008.
2. Millman and Halkias, "Electronic Devices and Circuits" 2nd Edition, McGraw Hill Publication, 2007.
3. Jacob Millman Herbert Taub Millman's, "Pulse, Digital and Switching Waveforms", Third Edition, McGraw Hill Publication, 2017.

Suggested Reading:

1. Jacob Millman, Christos Halkias, Chetan Parikh, "Integrated Electronics", 2nd Edition, McGraw Hill Publication, 2009.
2. Robert L. Boylestad, "Electronic Devices and Circuit Theory", 10th Edition, PHI, 2009.
3. Donald Schilling, Charles Belove, Tuvia Apelewicz Raymond Saccardi, "Electronic Circuits: Discrete and Integrated", TMH, 3rd Edition, 2012.

18EC C08

ANALOG COMMUNICATION

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: A prior knowledge of signals and systems is required.

Course Objectives:

This course aims to:

1. Introduce the fundamentals of analog communication.
2. Provide the design details of various transmitters and receivers used in analog communication system.
3. Involve the students in analyzing performance of communication system by estimating noise.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Understand various linear and nonlinear modulation schemes.
2. Apply the knowledge of modulation concept to compute various parameters of transmitted signal.
3. Analyze the response of linear system for the given random process.
4. Evaluate the performance of analog communication system through the estimation of noise.
5. Build various transmitters and receivers for the given specifications.

UNIT – I

Linear Modulation Schemes:

Need for Modulation, Double Side Band Suppressed Carrier Modulation, Balanced Modulator, Coherent Detector and Costas Detector. Conventional Amplitude Modulation, Phasor Diagram of AM, Switching Modulator, Envelope Detector. Hilbert Transform and its Properties. Single Side Band Modulation. Vestigial Side Band Modulation.

UNIT – II

Non-Linear Modulation Schemes:

Angle Modulation, Frequency Modulation and Phase modulation, Concept of Instantaneous Phase and Frequency. Types of FM modulation: Narrow Band FM and Wide Band FM. FM Spectrum in Terms of Bessel Functions. Phasor Diagram of NBFM. Direct and Indirect (Armstrong's) methods of FM Generation. Foster–Seeley Discriminator for FM Detection. Introduction to PLL.

UNIT – III

Transmitters and Receivers:

High Level and Low-Level AM Transmitters. Principle and Operation of Tuned Radio Frequency receiver and Super Heterodyne Receivers. Selection of RF Amplifier. Choice of Intermediate Frequency. Image Frequency and its Rejection Ratio, Receiver Characteristics: Sensitivity, Selectivity, Fidelity. Double Spotting, Tracking and Alignment. Pre-emphasis and De-emphasis.

UNIT – IV

Random Process:

Concept of random process, Stationarity and Ergodicity, Auto Correlation and its Properties, Power Spectral Density and its Properties. Linear System with Random inputs: Random Signal Response of Linear System, Auto Correlation of Response.

UNIT – V

Noise: Thermal Noise. White Noise and Colored Noise. Noise Temperature. Noise in Two-Port Network: Noise Figure, Equivalent Noise Temperature and Noise Bandwidth. Noise Figure and Equivalent Noise Temperature for Cascaded stages. S/N Ratios and Figure of Merit Calculations for AM, DSB-SC and SSB systems. Pulse Analog Modulation Schemes: Sampling of low Pass and Band Pass Signals. Types of Sampling. Pulse Modulation Schemes: PAM, PWM and PPM.

Text Books:

1. Simon Haykin, "Communication Systems",2nd Edition, Wiley India, 2011.
2. Herbert Taub, Donald L. Shilling & Goutam Saha, "Principles of Communication Systems", 3rd Edition, TMH, 2008.
3. Peyton Z. Peebles JR., "Probability Random Variables and Random Signal Principles", Tata Mc Graw Hill, edition, 4/e, 2002.

Suggested Reading:

1. Singh, R.P. and Sapre, S.D., "Communication Systems", TMH, 2007.

18EC C09

ANTENNAS AND WAVE PROPAGATION

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Students should have prior knowledge about Electromagnetics theory and Maxwell's equations.

Course Objectives:

This course aims to:

1. The basic principles of an antenna and its parameters for characterizing its performance.
2. The fundamental concepts of various types of antennas, arrays for customizing the pattern parameters.
3. The propagation behaviour of the radio wave in both troposphere and ionosphere.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Understand the basic parameters of an antenna.
2. Analyze the antenna using current distribution concept in order to estimate the field patterns.
3. Appraise and compare the concepts of broad side and end fire arrays.
4. Understand the working principle and characteristics of various antennas.
5. Classify and study of radio wave propagation.

UNIT-I

Principles of radiation, retarded potential. Isotropic, Directional and Omni-directional radiators. Basic antenna parameters: Radiation patterns, radiation intensity, far field, near field, gain and directivity, Antenna Polarization, effective aperture area and efficiency. Point sources, current distribution, Friis transmission formula.

UNIT-II

Analysis of Infinitesimal dipole, Half-wave dipole, quarter wave monopole, loop antenna and their far field patterns, calculation of radiation resistance and directivity.

UNIT- III

Concept of Antenna Array. Uniform linear array: Broadside and End fire arrays and calculation of directivity and beamwidth. Two element arrays of Infinitesimal dipole. Qualitative treatment of nonlinear arrays: Binomial and chebyschef arrays

UNIT-IV

Qualitative treatment of Helical Antennas: Normal and Axial mode patterns, wideband characteristics. Characteristics, radiation principles and applications of Rhombic Antenna, Yagi-Uda antenna, pyramidal Horn antenna, Parabolic antenna system, Log-Periodic antenna. Microstrip antennas: Radiation mechanism, different types, advantages and disadvantages. Design of rectangular Microstrip antenna.

UNIT-V

Ground wave propagation, Space and Surface waves, Tropospheric refraction and reflection, Duct propagation. Sky wave propagation: Critical frequency, Maximum Usable Frequency (MUF) and Skip distance, Line of sight propagation.

Text Books:

1. Constantine A. Balanis, "Antenna Theory: Analysis and Design", 4th Edition, John Wiley, 2016.
2. Edward C. Jordan and Kenneth G. Balmain, "Electromagnetic Waves and Radiating Systems", 2nd Edition, PHI, 2001.

Suggested Reading:

1. John D. Krauss, Ronald J. Marhefka & Ahmad S. Khan, "Antennas and Wave Propagation", 4th Edition, TMH, 2010.
2. Dennis Roody and John Coolen, "Electronic Communications", 4th Edition, Prentice Hall, 2008.

18EC C10

CONTROL SYSTEMS

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: The student is expected to have knowledge of Laplace transform and electrical and electronic circuits.

Course Objectives:

This course aims to:

1. Introduce various control systems and their equivalent mathematical models, block diagrams and signal flow graphs.
2. Familiarize students to time response analysis of different systems, frequency domain techniques to access the stability of a system and different compensators / controllers to control a plant.
3. Introduce students to the concept of state space analysis of control system.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Find the transfer function of a system represented by a block diagram and signal flow graph.
2. Evaluate the time domain specifications and steady state error of a system.
3. Investigate stability of the system using different tests.
4. Compare various controllers and compensators.
5. Apply State Space Concept to analyse and design a control system.

UNIT-I

Control System Fundamentals: Classification of control systems, Open and Closed Loop control systems, Block diagram reduction and signal flow graphs, Mathematical modelling of a Mechanical system and conversion into electrical System.

UNIT-II

Time Response Analysis: Transfer function and Impulse Response, Types of Inputs, Transient Response of first and second Order System with different inputs, Time domain Specifications. Types of Systems, static error coefficients, error series, PD, PI and PID controllers.

UNIT-III

Routh-Hurwitz criteria for stability. Root Locus Techniques, Analysis of typical systems using root locus techniques, Effect of location of roots on system response.

UNIT-IV

Frequency Response Analysis: Frequency domain specifications, bode plot, Principle of Argument, Nyquist plot and stability criterion, Gain and Phase Margins from the Bode and Nyquist diagrams. Lead and Lag compensators.

UNIT-V

State Space Analysis: Concept of State, State Variable, State vector and State space. State space representations of linear time invariant systems, State transition matrix, Solution of state equation, Controllability, Observability and Design of control systems using state variable feedback.

Text Books:

1. I. J. Nagrath and M. Gopal, "Control Systems Engineering", New Age International Publishers, 5/e 2012.
2. Benjamin C. Kuo, "Automatic Control Systems", 7/e, PHI, 2010.

Suggested Reading:

1. K. Ogata, "Modern Control Engineering", EEE, 5/e, PHI, 2003.
2. Richard C. Dorf and Robert H. Bishop, "Modern Control Systems", 11/e Pearson, 2008.
3. Gopal Madan, "Digital control engineering" 1/e, New age publishers, 2008.

18EC C11

DIGITAL SYSTEMS DESIGN

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Knowledge of Electronic device concepts.

Course Objectives:
This course aims to:

1. Learn various techniques for logic minimization.
2. Comprehend the concepts of various combinational circuits and sequential circuits.
3. Learn the Language fundamentals of Verilog HDL, also able to simulate and synthesize various digital modules.

Course Outcomes:
Upon completion of this course, students will be able to:

1. Understand the basic concepts related to digital system design and Verilog HDL
2. Design the combinational and sequential circuits
3. Analyze the behaviour of the digital system design
4. Develop the digital system using various Verilog HDL modelling
5. Apply the Verilog HDL concepts for functional verifications of a digital system

UNIT-I
Logic Simplification and Combinational Logic Design:
Review of Boolean Algebra and De Morgan's Theorem, SOP & POS forms, Canonical forms, Introduction to Logic Gates, Ex-OR, Ex-NOR operations, Minimization of Switching Functions: Karnaugh map method, Quine –McCluskey Tabular Minimization Method. Logic function realization: AND-OR, OR-AND and NAND/NOR realizations.

UNIT-II
Introduction to Combinational Design:
Binary Adders, Subtractors and BCD adder, Code converters Binary to Gray, Gray to Binary, BCD to excess3, BCD to Seven Segment display, Decoders, Encoders, Priority Encoders, Multiplexers, Demultiplexers, Comparators Implementations of Logic Functions using Decoders and Multiplexers

UNIT-III
Sequential Logic Design:
Latches, Flipflops, Difference between latch and flipflop, types of flipflops like S-R, D, T JK and Master-Slave JK FF, Edge triggered FF, flipflop conversions, set up and hold times, Ripple and Synchronous counters, Shift registers, Finite state machines, Design of synchronous FSM, Algorithmic State Machines charts. Clock generation.

UNIT-IV
Introduction to HDLs:
VLSI Design flow, Basic Concepts of Verilog HDL, Data Types, System Tasks and Compiler Directives. Gate Level Modelling: Gate Types and Gate Delays. Dataflow Modelling: Continuous Assignment and Delays. Design of Stimulus Block.

UNIT-V
Behavioural Modelling:
Structured Procedures, Procedural Assignments, Timing control, Conditional statements, Sequential and Parallel Blocks. Switch level Modelling. Introduction to tasks and functions. Design of Mealy and Moore state models using Verilog HDL. Introduction to Logic Synthesis. Concept of Programming using FPGA.

Text Books:

1. Morris Mano M. and Michael D.Ciletti, "Digital Design, With an Introduction to Verilog HDL", 5th edition, Pearson 2013.
2. Samir Palnitkar, "Verilog HDL, A guide to Digital design and synthesis", 2nd edition , Pearson Education, 2008.

Suggested Reading:

1. R.P. Jain, "Modern digital Electronics", Tata McGraw Hill, 4th edition, 2009.
2. Thomas L. Floyd, "Digital Fundamentals", Pearson, 11th edition, 2015.

18EG M01

INDIAN CONSTITUTION AND FUNDAMENTAL PRINCIPLES

(Mandatory Course)

Instruction	2 L Hours per week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	-
Credits	Non credit

Course Objectives:

The course will introduce the students to

1. History of Indian Constitution and how it reflects the social, political and economic perspectives of the Indian society.
2. Fundamental Rights and Duties, administration of the Union Government and Legislature and Judiciary.
3. Various Organs of Governance and Local Administration.

Course Outcomes:

After successful completion of the course the students will be able to

1. Understand the making of the Indian Constitution and its features.
2. Identify the difference among Right To equality, Right To freedom and Right to Liberty.
3. Analyze the structuring of the Indian Union and differentiate the powers between Union and States.
4. Distinguish between the functioning of Lok Sabha and Rajya Sabha while appreciating the importance of Judiciary.
5. Differentiate between the functions underlying Municipalities, Panchayats and Co-operative Societies.

UNIT - I

Constitution of India: Constitutional history-Govt of India Act 1909, 1919 and 1935, Constitution making and salient features. Directive Principles of State Policy - Its importance and implementation.

UNIT - II

Scheme of the Fundamental Rights & Duties: The Fundamental Rights - To Equality, to certain Freedom under Article 19, to Life and Personal Liberty Under Article 21. Fundamental Duties - the legal status.

UNIT- III

Union Government and its Administration - Structure of the Indian Union: Federalism, distribution of legislative and financial powers between the Union and the States. Parliamentary form of government in India: Executive-President's role, power and position.

UNIT – IV

Legislature and Judiciary: Central Legislature-Powers and Functions of Lok Sabha and Rajya Sabha.
Judiciary: Supreme Court-Functions, Judicial Review and Judicial Activism.

UNIT – V

Local Self Government - District's Administration Head (Collector): Role and Importance. Municipalities & Municipal **Corporations:** Introduction, Chairperson/Mayor, Commissioner and Role of Elected Representatives.
Panchayati Raj: Introduction, Zilla Panchayat, Chairperson, CEO, Elected Officials and their roles.
Block/Mandal level: Organizational Hierarchy (Different departments). Village level: Role of Elected and Officials.

Text Books:

1. Indian Government & Politics, Ed Prof V Ravindra Sastry, Telugu Akademy, 2nd edition, 2018.
2. Indian Constitution at Work, NCERT, first edition 2006, Reprinted- January 2020.

Suggested Reading:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar, Framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th edition., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

Online Resources:

1. http://www.nptel.ac.in/courses/103107084/Script.pdf

18EE M01

INDIAN TRADITIONAL KNOWLEDGE

(Mandatory Course)

Instruction	2 L Hours per week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	-
Credits	Non credit

Course Objectives:

This course aims to:

1. Get a knowledge in Indian Culture
2. Know Indian Languages and Literature and the fine arts in India
3. Explore the Science and Scientists of Medieval and Modern India

Course Outcomes:

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

1. Understand the culture, civilization, and heritage of Ancient, Medieval and Modern India.
2. Distinguish various Languages and Literature existing in India
3. Discuss and Compare Philosophy and Religion in Indian since ancient times
4. Explore various Fine arts in Indian History, and Illustrate the development of Science and Technology in India.
5. Describe the Indian Education System, and recognize the efforts of scientist to the development of India

UNIT-I

Introduction to Culture: Culture, civilization, culture and heritage, general characteristics of culture, importance of culture in human literature, Indian Culture, Ancient India, Medieval India, Modern India

UNIT-II

Indian Languages, Culture and Literature:

Indian Languages and Literature-I: the role of Sanskrit, significance of scriptures to current society, Indian philosophies, other Sanskrit literature, literature of south India.

Indian Languages and Literature-II: Northern Indian languages & literature

UNIT-III

Religion and Philosophy: Religion and Philosophy in ancient India, Religion and Philosophy in Medieval India, Religious Reform Movements in Modern India (selected movements only)

UNIT-IV

Fine Arts in India (Art, Technology& Engineering): Indian Painting, Indian handicrafts, Music, divisions of Indian classic music, modern Indian music, Dance and Drama, Indian Architecture (ancient, medieval and modern), Science and Technology in India, development of science in ancient, medieval and modern India

UNIT-V

Education System in India: Education in ancient, medieval and modern India, aims of education, subjects, languages, Science and Scientists of Ancient India, Science and Scientists of Medieval India, Scientists of Modern India

Text Books:

1. Kapil Kapoor, Text and Interpretation: The India Tradition, ISBN: 81246033375,2005
2. Science in Samskrit, Samskrita Bharti Publisher, ISBN-13: 978- 8187276333,2007
3. S. Narain, Examinations in ancient India, Arya Book Depot, 1993
4. Satya Prakash, Founders of Sciences in Ancient India, Vijay Kumar Publisher, 1989
5. M. Hiriyanna, Essentials of Indian Philosophy, Motilal Banarsidass Publishers, ISBN-13: 978-8120810990, 2014

Suggested Reading:

1. Kapil Kapoor, Language, Linguistics and Literature: The Indian Perspective, ISBN-10: 8171880649, 1994.
2. Karan Singh, A Treasury of Indian Wisdom: An Anthology of Spiritual Learn, ISBN: 978-0143426158,2016.

18EC C12

ANALOG CIRCUITS LAB

Instruction	2 P Hours per Week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Prerequisite: Knowledge on Electronic Devices Lab and Electronic Workshop and Networks Lab.

Course objectives:
This course aims to:
1. Design and analysis of Biasing circuits and Power Amplifiers.
2. Know frequency response and behavior of various Single Stage, Multistage and Feedback amplifiers.
3. Generation of analog signals using Oscillators and Multi-vibrators

Course Outcomes:
Upon completion of this course, students will be able to:
1. Design various BJT/FET biasing circuits to identify the appropriate circuit for faithful amplification.
2. Experiment with single stage and multistage BJT/FET amplifiers including large signal amplifier
3. Compare and contrast different types of feedback topologies.
4. Develop and test various multi-vibrator and oscillator circuits for generating non sinusoidal and sinusoidal waveforms.
5. Evaluate and compare the significant parameters obtained from the Frequency response plots of BJT and FET amplifier circuits.

List of Experiments

1. BJT and FET biasing circuits.
2. Design and frequency response of Common Emitter BJT amplifier.
3. Design and frequency response of Single stage and Multistage RC - Coupled amplifier using FET.
4. Voltage series feedback amplifier.
5. Voltage shunt feedback amplifier.
6. Current series feedback amplifier.
7. Current shunt feedback amplifier.
8. RC Phase Shift Oscillator.
9. Hartley Oscillator & Colpitts Oscillator.
10. Design of Class-B power amplifier.
11. Design and development of Astable multi-vibrator.
12. Design and development of Monostable multi-vibrator.
13. Design and development of Schmitt Trigger.
14. Design and development of Voltage to Frequency converter.

Note:
1. Wherever possible, Analysis and design of circuits should be carried out using SPICE tools.

Suggested Reading:

1. Robert Diffenderfer, "Electronic Devices Systems and Applications", Cengage Learning India Private Limited, 2010.
2. Paul B. Zbar, Albert P. Malvino, Michael A. Miller, "Basic Electronics, A Text - Lab Manual", 7th Edition, TMH 2001.

18EC C13

ANALOG COMMUNICATION LAB

Instruction	2 P Hours per week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Prerequisite: A thorough knowledge on signal analysis and its representation along with communication systems is required.

Course objectives:

This course aims to:

1. Generate and detect various analog and pulse modulation schemes.
2. Develop and analyze the characteristics of PLL, Mixer and Pre-Emphasis & De-Emphasis circuits.
3. Estimate the power spectral density by analyzing the spectrum of a given signal.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Demonstrate the generation and detection of various analog modulated signals.
2. Illustrate the sampling concept and interpret the generation and detection of various pulse modulated signals.
3. Analyze frequency response of Pre-Emphasis and De Emphasis circuits
4. Experiment with Mixer, Radio receiver and PLL characteristics, FDM and TDM.
5. Estimate the Power spectral density of noise and SNR and conclude the spectra of AM and FM signals.

List of Experiments

1. AM signals generation and detection.
2. Generation of DSB-SC using Balanced modulator.
3. SSB Modulation and Demodulation.
4. FM generation and detection.
5. Frequency response of Pre-Emphasis and De-Emphasis circuits.
6. Evaluation of Radio Receiver characteristics.
7. Sampling of continuous time signal and its Reconstruction (PAM).
8. Frequency division multiplexing and De-Multiplexing.
9. Time division multiplexing and De-Multiplexing.
10. PWM Modulation and Demodulation.
11. PPM Modulation and Demodulation.
12. Determination of PLL Characteristics.
13. Analysis of Mixer Characteristics.
14. Spectral Analysis of AM and FM signals using Spectral Analyzer.

Suggested Reading:

1. A.M. Zungeru, J.M. Chuma, M. Mangwala, L.K. Ketshabetswe, “Handbook of Laboratory Experiments in Electronics and Communication Engineering”, Vol. 2, 1st Edition, Notion press, 2017.

18EC C14

DIGITAL SYSTEMS DESIGN LAB

Instruction	2 P Hours per week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Prerequisite: Digital concepts and C language concepts**.**

Course Objectives:

This course aims to:

1. Simulate and synthesize combinational logic circuits.
2. Simulate and synthesize sequential logic circuits.
3. Learn and implement procedure for any digital design.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Demonstrate the process steps required for simulation /synthesis
2. Develop HDL codes/scripts with appropriate syntax.
3. Apply an appropriate modelling style to describe various combinational and sequential circuits in Verilog HDL
4. Examine the successful execution of the codes/ schematic using various Simulation Tools
5. Build various digital circuits on hardware boards like FPGA.

Write a Verilog HDL code to Simulate and synthesize the following in Gate level, Data flow and Behavioural Modelling styles

1. Logic Gates.
2. Arithmetic Units: Adders and Subtractors.
3. Multiplexers and De-multiplexers.
4. Encoders, Decoders, Priority Encoder and Comparator.
5. Implementation of logic function using Multiplexers and Decoders.
6. Arithmetic and Logic Unit.
7. Flip-Flops.
8. Up, Down and UP/Down Counters.
9. Sequence Detector using Mealy and Moore type state machines.
10. Implementation of SSI Circuits using FPGA.

Suggested Reading:

1. Samir Palnitkar, “Verilog HDL, A guide to Digital design and synthesis”, 2/e, Pearson Education, 2008.

Scheme of Instruction and Syllabi

of

BE V to VIII SEMESTERS

of

FOUR YEAR DEGREE COURSE

in

ELECTRONICS AND COMMUNICATION ENGINEERING

(AICTE Model Curriculum with effect from AY 2018-19)

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY

(Autonomous Institution under UGC, Affiliated to Osmania University)
Department of Electronics & Communication Engineering
Accredited by NBA and NAAC-UGC,
Chaitanya Bharathi (Post), Gandipet, Hyderabad–500075

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

OUR MOTTO: SWAYAM TEJASWIN BHAVA

VISION and MISSION of the INSTITUTE

Vision

To be a centre of excellence in technical education and research.

Mission

To address the emerging needs through quality technical education and advanced research.

VISION and MISSION of DEPT. of ECE

Vision

To develop the department into a full-fledged center of learning in various fields of Electronics & Communication Engineering, keeping in view the latest developments.

Mission

To impart value based technical education and train students and to turn out full pledged engineers in the field of Electronics & Communication Engineering with and overall background suitable for making a successful career either in industry/research or higher education in India/Abroad.

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

Program Educational Objectives of B.E(ECE) Programme

PEO1	Student will excel in analysing, design and development of systems in the area of Electronics and Communications.
PEO2	Student will have hand on experience in executing software related applications pertaining to Electronics and Communication Engineering.
PEO3	Student will carry out research in new technologies with modern relevant tools.
PEO4	Student will develop with professional ethics, effective communication skills and knowledge of societal impacts of computing technologies.

Program Specific Outcomes of B.E(ECE) Programme

PSO1	Student will demonstrate the knowledge and understanding of basic principles of mathematics, science, electronic devices, networks and signal processing procedures in simulation, modelling, and describing the behaviour of analog and digital electronic circuit or system.
PSO2	Student will be able to select and apply appropriate techniques, resources and Hardware and Software tools for design, analysis and testing the various analog and digital electronic circuits and networks.
PSO3	Student will demonstrate self-confidence to work independently or in a team and his/her ability to Analyze, synthesize, design and test analog & digital components, process, system or sub-systems of electronics and communication Engineering used in peace as well as war applications as per the specifications.

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

Program Outcomes of B.E(ECE) Programme

Engineering graduate will be able to:

1. Engineering Knowledge	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization for the solution of complex engineering problems
2. Problem analysis	Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. Design/development of solutions	Design solutions for complex engineering problems and design system components or processes that meet t h e specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.
4. Conduct investigations of complex problems	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. Modern tool usage	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling to complex engineering activities, with an understanding of the limitations.
6. The engineer and society	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. Environment and sustainability	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. Individual and team work	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. Communication	Communicate effectively on complex engineering activities with the engineering community and with the society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. Project management and finance	Demonstrate knowledge and understanding of t h e engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. Life-long learning	Recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

AICTE Model Curriculum with effect from AY 2020-21

B.E (Electronics and Communication Engineering)

SEMESTER – V

S. No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1	18EC C15	Computer Architecture and Microprocessors	3	-	-	3	30	70	3
2	18EC C16	Digital Communication	3	-	-	3	30	70	3
3	18EC C17	Linear and Digital Integrated Circuits	3	-	-	3	30	70	3
4	18ME C09	Principles of Management	3	-	-	3	30	70	3
5		Program Elective-I	3	-	-	3	30	70	3
6		Open Elective-I	3	-	-	3	30	70	3
PRACTICALS									
7	18EC C18	Digital Communication Lab	-	-	2	2	15	35	1
8	18EC C19	Linear and Digital Integrated Circuits Lab	-	-	2	2	15	35	1
Total			**18**	**-**	**04**	**-**	**210**	**490**	**20**
Clock Hours Per Week: 22									

L: Lecture **D: Drawing** **CIE: Continuous Internal Evaluation**

T: Tutorial **P: Practical/Project Seminar/Dissertation** **SEE: Semester End Examination**

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

AICTE Model Curriculum with effect from AY 2020-21

B.E (Electronics and Communication Engineering)

List of Courses in Program Elective-I		List of Courses in Open Elective-I	
Course code	**Title of the Course**	**Course code**	**Title of the Course**
18ECE01	Electronic Measurements and Instrumentation	18BT O01	Basics of Biology
18EC E02	Industrial Electronics	18CS O05	Fundamentals of Virtual Reality
18EC E03	Optical Communication	18ME O07	Intellectual Property Rights
18EC E04	Telecommunication Switching Systems	18IT O01	Object Oriented Programming Using Java
		18MT O04	Quantum Computing

18ECC15

COMPUTER ARCHITECTURE AND MICROPROCESSORS

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Basic knowledge on digital system design

Course Objectives:

This course aims to:

1. Study and understand the principles of computer system
2. Understand the design of computer system
3. Explore the architecture and instruction set of the microprocessors

Course Outcomes:

Upon completion of this course, students will be able to:

1. Understand how computer works.
2. Apply fixed and floating-point arithmetic algorithms.
3. Compare various memories, memory access techniques.
4. Assess the performance of computers.
5. Analyze architecture and instruction set of microprocessors.

UNIT-I

Data representation and Computer Arithmetic: Basic structure of computers, Functional units, Fixed point representation of numbers, Digital arithmetic algorithms for Addition, Subtraction, Multiplication using Booth's algorithm and Division using restoring and non-restoring algorithms, Floating point representation with IEEE standards.

UNIT-II

Basic Computer Organization and Design: Instruction codes, Stored program organization, Computer registers and computer instructions, Timing and control, hardwired and micro programmed control unit, Instruction cycle, Program interrupt, Interrupt cycle, Micro programmed Control organization, Address sequencing, Micro instruction format.

UNIT-III

Central Processing Unit: General register organization, Stack organization, Instruction formats, Addressing modes, Data transfer and manipulation, Program control, CISC and RISC: features and comparison, Instruction Pipeline.

Input-Output Organization: Peripheral devices, I/O interface: I/O Bus and interface modules, isolated versus memory mapped I/O. Modes of Transfer: Programmed I/O, DMA and Interrupt initiated I/O. Priority interrupt: Daisy chaining, Parallel Priority interrupt

UNIT-IV

Memory Organization: Memory hierarchy, Primary memory, Auxiliary memory, Associative memory, Cache memory, mapping functions: direct, associate and set associate, Virtual memory: address mapping using pages, Memory management.

UNIT-V

8086 Microprocessor: Evolution of microprocessors, 8086 Microprocessor**:** Internal architecture, flag register, Signal description under minimum and maximum mode of operation, register organization, Addressing modes. Overview of Instruction set. Introduction to the advanced microprocessors (x86): Salient features, real and protected modes. Evolution of Pentium Processors.

Text Books:

1. Morris Mano. M., "Computer System Architecture", 3/e, Pearson Education, 2005.
2. Hayes J.P, "Computer Architecture and Organization", 3/e, McGraw Hill, 2012.
3. Barry B. Brey, "The Intel Microprocessors 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium, Pentium Pro, Pentium II, III, IV", 8/e Pearson Education, 2006.

Suggested Reading:

1. Carl Hamacher, ZvonkoVranesic, SafwatZaky, "Computer Organization" 5/e McGraw Hill, 2011.
2. Ray A.K. and Bhurchandi, K.M., "Advanced Microprocessor and peripherals", 2/e TMH 2007.
3. Douglas V Hall, SSSP Rao, "Microprocessors and Its Interfacing" (SIE), 3/e, Tata McGraw-Hill Education Pvt. Ltd, 2012.

18EC C16

DIGITAL COMMUNICATION

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Fundamentals of probability theory and analog communication systems is required.

Course Objectives:
This course aims to:

1. Make the student learn the different techniques involved in digital transmission of analog signals.
2. Give the student an understanding of the various concepts of information theory, source coding and Channel coding schemes.
3. Enable the student to interpret the performance of digital modulation schemes and learn various spread spectrum techniques.

Course Outcomes:
Upon completion of this course, students will be able to:

1. Understand the concept of pulse digital modulation schemes and compare their performance.
2. Interpret the concept of information theory and apply source coding schemes.
3. Demonstrate various error control schemes and develop the encoding and decoding techniques to detect and correct the errors.
4. Analyze different digital modulation schemes and can compute the bit error performance.
5. Apply various spread spectrum modulation techniques.

UNIT-I Digital Transmission of Analog Signals: Elements of a digital communication system, Uniform quantization, PCM system, Bandwidth requirement of PCM system, Noise in PCM Systems, Non- uniform quantization, TDM-PCM system. Differential quantization, Differential PCM system, Delta Modulation, Noise in DM system, ADM. Comparison of PCM, DPCM, DM and DM schemes.

UNIT-II Information Theory: Uncertainty, Information and Entropy, Source coding: Source coding theorem, Shannon – Fano algorithm and Huffman coding. Discrete memory-less channels, Types of channels, cascaded channels, mutual information, Channel capacity, Information rate and Information capacity, Rate distortion theory.

UNIT-III Error Control Coding: Need for error control coding, Types of transmission errors. Linear Block Codes (LBC): description of LBC, generation, Syndrome and error detection, minimum distance of a block code, error detecting capabilities and error correcting, Hamming codes, Standard array and syndrome decoding. Binary cyclic codes (BCC): description of cyclic codes, encoding, decoding and error correction of cyclic codes using shift registers, Convolution codes: description, encoding, decoding: Exhaustive search method and sequential decoding.

UNIT-IV Digital Carrier Modulation Schemes: Optimum receiver for Binary Digital Modulation Schemes, Binary ASK, PSK, DPSK, FSK signaling schemes and their error probabilities. Introduction to MSK, Comparison of Digital Modulation Schemes. Introduction to M-ary Signaling Schemes: QPSK, Synchronization methods.

UNIT–V Spread-Spectrum Modulation: Need for spreading a code, generation and properties of PN sequence. Direct Sequence Spread Spectrum, Frequency Hopping spread spectrum systems and their applications.

Text Books:

1. Sam Shanmugham.K., "Digital and Analog Communication Systems", Wiley, 2012.
2. Simon Haykin, "Communication Systems", 4/e, Wiley India, 2011.
3. Herbert Taub, Donald L. Shilling &GoutamSaha, "Principles of Communication Systems", 4/e, Tata McGraw-Hill Education 2013.

Suggested Reading:

1. John Proakis, Massoud Salehi, "Digital Communications", 5/e, McGraw Hill Higher Education, 2007.
2. R.P. Singh, S.D. Sapre, "Communication Systems", 2/e, Tata McGraw Hill Education, 2008.
3. P.Ramakrishna Rao, "Digital Communication", McGraw Hill Education, 2011.

18EC C17

LINEAR AND DIGITAL INTEGRATED CIRCUITS

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Knowledge about Analog electronic circuits.

Course Objectives:

This course aims to:

1. Impart the concepts of Op-Amp, 555 Timers, IC regulator, data converter and its characteristics.
2. Illustrate the linear and nonlinear applications of operational amplifier.
3. Design combinational and sequential circuits with IC, memories and PLD.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Understand the basic construction, characteristics and parameters of Op-Amp.
2. Analyze the linear and nonlinear applications of Op-Amp.
3. Explain the concepts of IC555 timer, IC723 regulator, memories and PLD.
4. Classify and describe the characteristics of different logic families
5. Design logic functions of Combinational and Sequential circuits with ICs.

UNIT – I

Operational Amplifier: Op-Amp block diagram, ideal Op-Amp Characteristics, Inverting and Non-inverting amplifiers with ideal and non-ideal Op-amps, Voltage Follower, Op-Amp parameters: Input offset voltage, Output offset voltage, input offset and bias currents, Slew rate, CMRR and PSRR.

UNIT – II

Op-Amp Applications: Summing Amplifier, Difference Amplifier, ideal and practical Integrator and differentiator. Sample and hold circuit, Comparator, Schmitt Trigger with and without reference voltage, Triangular waveform generator.

UNIT – III

555 Timer: Functional diagram. Modes of operation: Monostable, Astablemulti-vibrators.
Voltage Regulator: IC7805, Analysis and design of regulators using IC 723.
Data Converters: Specifications, DAC- Weighted Resistor, R-2R Ladder, ADC-Parallel Comparator, Successive Approximation and Dual Slope.

UNIT – IV

Logic Families: Digital IC characteristics. TTL logic family, TTL series and TTL output configurations: open collector, Totem pole, Tri state logic. MOS logic family, CMOS logic family and its series characteristics, CMOS transmission gate, CMOS open drain and high impedance outputs. Comparison of TTL and CMOS logic families.

UNIT – V

Combinational and Sequential Circuits: Design of logic functions/circuits with: Decoder, Multiplexer, Adder: Serial adder, parallel adder and BCD adder, counters: asynchronous counter (7493/74293) and synchronous counter (74163/74193)
Semiconductor Memories: Memory Terminology, ROM, RAM types, Architectures, operation, FIFO memory, FIFO depth calculations, Expanding word size and capacity, Introduction to PLD's: PAL and PLA.

Text Books:

1. Ramakant A. Gayakwad, "Op-Amps and Linear Integrated Circuits", 4/e, PHI, 2010.
2. Ronald J. Tocci, Neal S. Widmer& Gregory L.Moss, "Digital Systems: Principles and Applications", PHI, 10/e, 2011.

Suggested Reading:

1. K.R.Botkar, "Integrated Circuits", 10/e, Khanna Publishers, 2010.
2. Roy Chowdhury D, Jain S.B, "Linear Integrated Circuits",4/e, New Age International Publishers, 2010.
3. Jain R.P., "Modern Digital Electronics", 4/e, TMH, 2011.
4. Charles H Roth and Larry L Kinney, "Fundamentals of Logic Design" 7th edition, Cengage Publication, 2014.
5. David A. Bell, 'Operational Amplifier and Linear ICs', third edition, Oxford university press, 2013.

18ME C09

PRINCIPLES OF MANAGEMENT

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

To make the students to

1. Understand basic fundamentals and insights of management
2. Understand the nature and purpose of planning
3. Gain the knowledge about the frame work of organizing
4. Understand the essence and significance of directing
5. Recognize the importance of controlling and its outcomes

.

Course Outcomes:

At the end of the course, student will be able to understand

1. Identify and evaluate the principles of management
2. Demonstrate the ability to have an effective and realistic planning
3. Identify the nature and the type of organization
4. Apply the tools and techniques of directing
5. Explain and evaluate the necessity for controlling and further refinement of an organization.

UNIT - I

Management: Definition of management**,** science or art, manager vs entrepreneur; managerial roles and skills; Evolution of management, Basic management theories by FW Taylor, Henry Fayol, Types of Business Organizations, sole proprietorship, partnership, company, public and private enterprises; Organization culture and environment; Current trends and issues in management

UNIT - II

Planning: Nature and purpose of Planning, types of Planning, objectives, setting objectives, policies, Strategic Management, Planning Tools and Techniques, Planning plant location and layout, Decision making steps & processes.

UNIT - III

Organizing: Nature and purpose of Organizing, formal and informal organization, organization structure, types, line and staff authority, departmentalization, delegation of authority, centralization and decentralization, job design, human resource management, HR planning, Recruitment selection, Training & Development, Performance Management, Career planning and Management

UNIT - IV

Directing: Individual and group behavior, motivation, motivation theories, motivational techniques, job satisfaction, job enrichment, leadership, types & theories of leadership, effective communication.

UNIT - V

Controlling: system and process of controlling, budgetary and non-budgetary control techniques, use of computers and IT in management control, productivity problems and management, control and performance, direct and preventive control, reporting.

Text Books:

1. S.P. Robins and M. Couiter, "Management", 10th Edition,Prentice Hall India, 2009.
2. JAF Stoner, RE Freeman and DR Gilbert, "Management", 6/e., Pearson Education,2004.

Suggested Reading:

1. P.C. Tripathy& P.N. Reddy, "Principles of Management", Tata McGraw Hill,1999
2. Harold Koontz and Cyril O'Donnell "Principles of Management'', Tata McGraw Hill, 2017

18EC E01

ELECTRONIC MEASUREMENTS AND INSTRUMENTATION

(Program Elective-I)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Fundamental concepts of Network Theory and Electronic Circuits.

Course Objectives:

This course aims to:

1. Explain basic concepts, definitions and error analysis in measurement.
2. Identify the details of instrumentation and devices intended for a particular application.
3. Elaborate discussion about the importance of signal display devices and analyzers in measurement and describe the various bridge configurations and their applications.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Define the characteristics and analyze the errors of measurement systems.
2. Select the appropriate passive or active transducers for measurement of physical phenomenon.
3. Relate and apply the appropriate measuring techniques to real time applications.
4. Interpret the usage of DVM, Spectrum Analyzer and DSO instruments for appropriate measurements.
5. Develop an understanding of construction and working of different AC and DC bridges and their applications.

UNIT– I

Error - Absolute error, Relative error and Accuracy, Precision - conformity and significant figures, limiting errors, Propagation of errors, Errors in measurement-gross, systematic and random errors, Loading effect, Statistical analysis of measurement data and probable error, Resolution, Sensitivity, Calibration.

UNIT – II

Classification of transducers, Strain gauges - gauge factor, bonded, un-bonded and semiconductor stain gauges, rosettes, LVDT - principle, construction and displacement measurement, Capacitive transducer - principle and thicknessmeasurement, Piezo-electric transducer and different modes of operation, Photo- electric transducers.

UNIT – III

Characteristics, pressure, power and intensity levels of sound, Microphones, Temperature measurement - resistance wire thermometers, semiconductor thermometers and thermocouples.

UNIT – IV

DVMs- ramp, dual-slope integration, integrating and successive-approximation types, digit, resolution, sensitivity and general specifications, Spectrum analyzers, Digital storage oscilloscope, Introduction to Virtual Instrumentation (LabView).

UNIT – V

Introduction to Bridges, DC Bridges - Wheatstone's bridge, Kelvin's bridge, AC bridges - introduction, general balance equation for four arm bridge, capacitance comparison bridge, inductance comparison bridge, Maxwell's bridge, Wien's bridge, Wagner's earth connection.

Text Books:

1. Albert D. Helfric, and William D. Cooper, "Modern Electronic Instrumentation and Measurement Techniques", PHI, 2010.
2. D V S Murthy, "Transducers and Instrumentation", 2nd Edition, PHI, 2013.
3. Nakra B.C, and Chaudhry K.K., "Instrumentation, Measurement and Analysis", 3rdEdition, TMH, 2013.

Suggested Reading:

1. David A. Bell, "Electronic Instrumentation and Measurements", 2nd Edition, PHI, 2003.
2. H S Kalsi, "Electronic Instrumentation", 3rdEdition, TMH, 2011.
3. A.K.Sawhney, "Electrical & Electronic Measurement and Instruments", DhanpatRai& Co. Publications, 2005.

18EC E02

INDUSTRIAL ELECTRONICS

(Program Elective-I)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Knowledge about Electronic Devices and Electrical Circuits.

Course objectives:
This course aims to:

1. Introduce electronic device characteristics suitable for industrial applications.
2. Design AC to DC, DC to AC Converters, Amplifiers and inverters and SMPS
3. Appreciate electronic techniques for industrial heating, welding and to minimize EM interference.

Course Outcomes:
Upon completion of this course, students will be able to:

1. Understand Industrial Semiconductor devices DIAC, TRAIC, THYRISTOR using SCR, and MOS respectively.
2. Comprehend DC amplifiers, Operational amplifier and Instrumentation amplifier.
3. Design and analysis of DC to DC converters and DC to AC converters and different type of Choppers.
4. Develop skills to build and trouble shoot power electronic circuits.
5. Synthesis of PWM Inverters, UPS and Switched mode regulators.

UNIT-I
Characteristics of Semiconductor Power Devices: Thyristor, power MOSFET and IGBT (Qualitative Treatment only). protections and thermal considerations. Brief introduction to power devices: DIAC and TRIAC, MOS controlled thyristor, Power Integrated Circuit (Smart Power), Concept of fast recovery and Schottky diodes as freewheeling and feedback diode.

UNIT-II
DC Amplifiers: Need for DC amplifiers, DC amplifiers: Drift, Causes, Darlington Emitter Follower, Cascode amplifier, Stabilization, Operational Amplifiers, and Instrumentation Amplifiers.
Choppers: Chopper circuits: Principle, methods and Configurations operations of Type A, Type B, Type C, Type D and type E choppers, TRIACS: Triggering modes, Firing Circuits, Control techniques for choppers: TRC and CLC, Detailed analysis of Type A chopper. Chopper stabilization, Step up chopper and Multiphase Chopper.

UNIT- III
Regulated Power Supplies: Block diagram, Principle of voltage regulation, Series and Shunt type Linear Voltage Regulators, Protection Techniques: Short Circuit, over voltage and Thermal Protection. Switched Mode and IC Regulators: Switched Mode voltage regulator, Comparison of Linear and Switched Mode Voltage Regulators, Servo Voltage Stabilizer, monolithic voltage regulators Fixed and Adjustable IC Voltage regulators, 3-terminal Voltage regulators: Current boosting
.
UNIT-IV
Single-Phase Inverters: Principle of operation of full bridge square wave, quasisquare wave, PWM inverters and comparison of their performance. Driver circuits for above inverters voltage and harmonic control at output of inverter, Filters at the output of inverters, Single phase current source inverter. Block diagram and configuration of UPS, salient features of UPS, selection of battery and charger ratings.

UNIT-V
Industrial Applications-Industrial timers, Classification, types, Electronic Timers –Classification, RC and Digital timers. Electric Welding Classification, types and methods of Resistance and ARC wielding, Electronic DC Motor Control.
Industrial Applications-II: High Frequency heating, principle, merits, applications, High frequency Source for Induction heating. Dielectric Heating: principle, material properties, Electrodes and their Coupling to RF generator.

Text Books:

1. Theodore. H. Bogart, "Electronic Devices and circuits", Pearson Education, 6th Edition., 2003.
2. P.C. Sen., "Modern Power Electronics", 2nd Edition, Chand& Co., 2004.
3. V.R.Moorthi, "Power Electronics", Oxford University Press,2005

Suggested Reading:

1. G. K. Mithal and Maneesha Gupta, "Industrial and Power Electronics", Khanna Publishers,19th Edition, 2003.
2. Ned Mohan, Robbins, "Power electronics", 3rd Edition, John Wiley and sons, 2002.
3. Biswanth Paul," Industrial Electronics and Control", PHI Learning,3rd edition 2014.
4. S.Chatterjee and Bhattacharya ," Industrial Electronics and Control", Technical education series,1st edition 2017.

18EC E03

OPTICAL COMMUNICATION

(Program Elective-I)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Fundamentals of Electromagnetic theory and Communication is required.

Course Objectives:

This course aims to:

1. Understand 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 and the principles of single and multi-mode optical fibers and their characteristics.
2. Know working of semiconductor lasers, and differentiate between direct modulation and external electro-optic modulation.
3. Analyze the operation of LEDs, laser diodes, and PIN photo detectors (spectral properties, bandwidth, and circuits) and apply in optical systems.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Select necessary components required in modern optical communications systems.
2. Analyze various distortions in optical fibers.
3. Distinguish the various Optical sources and fiber optical receivers.
4. Examine the Power Launching and coupling, Lensing schemes.
5. Determine the performance of optical communication link.

UNIT–I

Overview of Optical Fiber Communication: The general system, advantages of optical fiber communications. Optical fiber wave guides- Acceptance angle, Numerical Aperture, Skew rays, 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.

UNIT–II

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.

Optical Fiber Connectors: Connector types, Single mode fiber connectors,

Connector return loss, Fiber Splicing: Splicing techniques, Splicing single mode fibers, Fiber alignment and joint loss: Multimode fiber joints, single mode fiber joints.

UNIT–III

Optical Sources: 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, Optical detectors: Physical principles of PIN and APD, Detector response time, Temperature effect on Avalanche gain, Comparison of Photo detectors.

UNIT–IV

Source to Fiber Power Launching: Power coupling, Power launching, Fundamental receiver operation, error sources, Receiver configuration, Digital receiver performance, Probability of Error, Quantum limit.

UNIT–V

Optical System Design: Point-to- point links, Component choice and considerations, Link power budget, Rise time budget with examples, WDM, Necessity, Principles, Measurement of Attenuation and Dispersion.

Text Books:

1. Gerd Keiser, "Optical Fiber Communications", McGraw-Hill International edition, 3rd Edition, 2000.
2. John M. Senior, "Optical Fiber Communications", PHI, 2nd Edition, 2002.
3. D.K. Mynbaev, S.C. Gupta and Lowell L. Scheiner, "Fiber Optic Communications", Pearson Education,2005.

Suggested Reading:

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

18ECE04

TELECOMMUNICATION SWITCHING SYSTEMS

(Program Elective-I)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Knowledge on communication systems is required.

Course Objectives:

This course aims to:

1. Understand basic concepts of switching and signalling.
2. Solve problems and design simple systems related to tele-traffic and trunking efficiency.
3. Analyse the switching systems like Space division switching, Time division switching, circuit switching, Packet switching and Cell relay (ATM).

Course Outcomes:

Upon completion of this course, students will be able to:

1. Understand the fundamental concepts of various signaling and switching involved in telecommunication switching systems.
2. Elaborate the basic principle of time and space division switching in telecommunication networks.
3. Design the multistage switch by inclusion of space and time switching techniques.
4. Analyze the performance comparison of Control signaling schemes in circuit switching systems.
5. Evaluate the performance of packet switching and cell relay.

UNIT-I

Introduction:

Introduction to telephone communication, manual switching system, Automatic Strowger switching system, crossbar switching system, Signalling in Automatic Strowger Switching System, Elements of a Switching System, Design parameters of Switching System.

UNIT- II

Electronic Space and Time Division Switching:

Stored program control; centralized and distributed, software architecture, application software, enhanced services; Basic time division space switching, basic time division time switching, time multiplexed space switching, time multiplexed time switching, combination switching, multistage combination switching.

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UNIT-III

Elements of Tele-Traffic:

Network traffic, Load and parameters, grade of service, Trunking Efficiency and blocking probability, modelling switching systems, incoming traffic and service time characterization, blocking models and loss estimates, delay systems.

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UNIT-IV

Circuit Switching and Signalling:

Circuit Switching concepts, Circuit Switch Elements, Three Stage Blocking Type Space Division Switch**;** Control Signalling Functions, In Channel Signalling, Common Channel Signalling, Features of Signalling System Number7 (SS7).

UNIT-V

Packet Switching and Cell Relay:

Packet Switching, Datagram and Virtual Circuit switching Principles, Effects of variable packet size; ATM, features of ATM, Quality of Service in ATM. .

Text books:

1. J E Flood, "Telecommunication switching traffic and networks" Pearson education, 2002.
2. William Stallings, "Data and Computer Communications", Ninth Edition, Pearson Prentice Hall, 2011.

Suggested Reading:

1. ThiagarajanVishwanathan, "Telecommunication Switching Systems and Networks", PHI, 2nd Edition,2015.
2. Behrouz A. Forouzan, "Data Communications and Networking", 4thEdition, Tata McGraw Hill, 2007.
3. Roger L. Freeman, "Fundamentals of Telecommunications", 2nd Edition, Wiley- IEEE Press-2005.

18BTO01

BASICS OF BIOLOGY

(Open Elective-I)

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Knowledge about Human organ systems

Course Objectives:

This course aims to:

1. Impart knowledge of origin and evolution of biological organisms.
2. Understand the structure and functions of human organ systems.
3. Understand the principles behind medical devices for diagnosis of human health and environment protection.
4. Give an insight of biological information, relationship and genome sequencing of various organisms.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Explain the theories of origin and evolution of life.
2. Describe the anatomical structure and physiological functions of the human organ systems.
3. Outline the principle and applications of medical devises.
4. Discuss the technology advancements in improving human health and environment
5. Explain the biological information, sequencing and evolutionary relationship among organisms.

UNIT-I

Introduction to Biology: Classical Vs Modern Biology; Importance of Biological Science and Historical developments; Origin of Life, Urey Miller Experiment, Spontaneous Generation Theory; Three Domains of Life; Principle and Applications of Microscope (Light and Electron Microscope), Prokaryotic and Eukaryotic Cell-Structure and their differences.

UNIT-II

Human organ systems and their functions -I: Introduction to various organ systems of human body and their functions; Skeletal System-Bones, Tendon, Ligaments, principle and applications in knee replacement; Nervous System - Structure of Brain, Spinal Cord, Neuron, Neurotransmitters, Synapse, Alzheimer's - a case study, principle and applications of Imaging Techniques (CT & MRI scans); Circulatory System - Heart structure and functions, principle and applications of cardiac devices (Stent and Pacemaker), Artificial heart, blood components and typing, haemocytometer.

UNIT-III

Human Anatomy and Functions-II: Respiratory Systems- Lung structure and function, principle and applications of Peak Flow Meter, ECMO (Extra Corporeal Membrane Oxygenation); Excretory Systems-Kidney structure and function, principle and applications of Dialysis; Prenatal diagnosis; Assisted reproductive techniques- IVF, Surrogacy.

UNIT-IV

Medical Biotechnology and Bioremediation: Cells of Immune System, Etiology of cancer, Cancer treatment (Radiation Therapy); Stem Cells and its Clinical applications; Scaffolds and 3D printing of organs; Bio sensors and their applications; Parts of bioreactor and its types; Bioremediation.

UNIT-V

Bioinformatics: Nucleic acid composition, Genetic Code, Amino acid, Polypeptide, Levels of protein structure, Homolog, Ortholog and Paralog, Phylogenetics, Genome Sequencing, Human Genome Project, Next generation sequencing.

Text Books:

1. Campbell, N.A.,Reece, J.B.,Urry,Lisa, Cain,M, L.,Wasserman,S.A.,Minorsky,P.V.,Jackson, R.B. "Biology: A Global Approach", 11th edition, Pearson Education Ltd. 2017
2. Shier,David,Butler,Jackie, Lewis,Ricki., "Hole'sHumanAnatomy&Physiology",13th edition,McGrawHill2017.
3. Dubey RC, "A Text book of Biotechnology" 5th Edition, S Chand and Company limited, 2014.
4. Bernard R. Glick, T. L. Delovitch, Cheryl L. Patten, "Medical Biotechnology", 1st edition, ASMPress,2014.

18CS O05

FUNDAMENTALS OF VIRTUAL REALITY

(Open Elective-I)

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

This course aims to:

1. To introduce hardware and software components of virtual reality.
2. To provide knowledge about geometry of virtual worlds.
3. To understand visual physiology, perception and audio in VR.
4. To study the applications of VR in various domains like military and robotics.

Course Outcomes:

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

1. Define Virtual Reality and describe the components of a VR system
2. Apply geometric modeling and transformation techniques to model real world scenarios
3. Use visual physiology, visual perception and audio for developing interfaces
4. Analyse tracking and rendering for building VR systems
5. Evaluate virtual reality systems for usability
6. Illustrate the applications of VR systems in Medical, Military and Robotics domains

UNIT - I

Introduction: The three I's of virtual reality, commercial VR technology and the five classic components of a VR system.
Input Devices: Trackers, Navigation and Gesture Interfaces: Three-dimensional position trackers, navigation and manipulation, interfaces and gesture interfaces.
Output Devices: Graphics displays, sound displays and haptic feedback.

UNIT - II

Geometry of Virtual Worlds: Geometric modeling, transforming models, Matrix algebra and 2D rotations, 3D rotations and yaw, pitch, and roll, Axis-angle representations, Quaternions, Converting and multiplying rotations, Homogeneous transforms, The chain of viewing transforms, Eye transforms, Canonical view transform, Viewport transform.

UNIT - III

Light and Optics: Three interpretations of light, Refraction, Simple lenses, Diopters, Imaging properties of lenses, Lens aberrations, Optical system of eyes.
Visual Physiology: Photoreceptors, Sufficient resolution for VR, Light intensity, Eye movements, Eye movement issues for VR, Neuroscience of vision,
Visual Perception: Depth perception, Motion perception, Frame rates and displays.

UNIT - IV

Tracking Systems: Overview, Orientation tracking, Tilt drift correction, Yaw drift correction, Tracking with a camera, Perspective n-point problem, Filtering, Lighthouse approach
Visual Rendering: Overview, Shading models, Rasterization, Pixel shading, VR-specific problems, Distortion shading, Post-rendering image warp.

UNIT – V

Audio: Physics and physiology, Auditory perception, Auditory localization, Rendering, Spatialization and display, Combining other senses.
Interfaces: overview, Locomotion, Manipulation, System control, Social interaction, Evaluation of VR Systems.
Applications: Medical, Military, Robotics.

Text Books:

1. John Vince, "Virtual Reality Systems", Pearson Education Asia, 2007
2. Anand R., "Augmented and Virtual Reality", Khanna Publishing House, Delhi.

Suggested Reading:

1. George Mather, Foundations of Sensation and Perception: Psychology Press; 2nd edition, 2009.
2. Peter Shirley, Michael Ashikhmin, and Steve Marschner, Fundamentals of Computer Graphics, A K Peters/CRC Press; 3rd edition, 2009.
3. K. S. Hale and K. M. Stanney, Handbook on Virtual Environments, 2ndedition, CRC Press, 2015.

Online Resources:

1. http://msl.cs.uiuc.edu/vr/
2. https://nptel.ac.in/courses/106106139/

18MEO07

INTELLECTUAL PROPERTY RIGHTS

(Open Elective-I)

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

This course aims to:

1. Fundamental aspects of IP.
2. Salient features of IPR acts.
3. The methods of registrations of Intellectual property.
4. Awareness for innovation and its importance of protection.
5. The changes in IPR culture and techno-business aspects of IPR.

Course Outcomes:

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

1. Understand the evolution of IP, working of organization's at global level to protect and promote IP.
2. Familiarize with the patent filing process at national and international level.
3. Draw the logical conclusion of research, innovation and patent filing.
4. Compare different kinds of IP and their patenting system.
5. Understand the techno-legal-business angle of IP, infringement and enforcement mechanisms for protection.

UNIT-I

Introduction: Definition of intellectual property, the need for intellectual property rights (IPR), kinds of intellectual property rights, IPR in India – genesis and development, IPR abroad, importance of WTO, TRIPS agreement, patent cooperation treaty, Berne and universal copyright conventions.

UNIT-II

Patents: Definition of patent, commercial significance , term of patent, patentable subject- matter, rights and obligations of patentee, searching of existing patents, drafting of patent, specification of patent, filing of a patent, the different layers of the patent system (national, regional and international options), compulsory licensing and licenses of rights, revocation of patents, differences between utility model and patent.

UNIT-III

Industrial designs: Definition of designs, registration of design, rights and duties of proprietor of design, piracy of registered design.

Trademarks: Meaning of trademarks, purpose of protecting trademarks, registration of trademarks, passing off, assignment and licensing of trademarks, infringement of trademarks.

Geographical indications: Definition, differences between GI and trademarks.

UNIT-IV

Copy right: Nature and scope of copy right, term of copyright, subject matter of copyright, rights conferred by copyright, publication, broad casting, telecasting, computer program, database protection, assignment and transmission of copyright, infringement of copy right trade secrets and know-how agreement.

UNIT-V

Enforcement of intellectual property rights: Infringement of intellectual property rights, enforcement measures, emerging issues in intellectual property protection, case studies of patents and IP Protection.

Unfair competition: What is unfair competition, relationship between unfair competition and intellectual property laws.

Text Books:

1. Ajit Parulekar and Sarita D' Souza, "Indian Patents Law – Legal & Business Implications"; Macmillan India ltd, 2006
2. B. L.Wadehra;" Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications"; Universal law Publishing Pvt. Ltd., India 2000
3. P. Narayanan; "Law of Copyright and Industrial Designs"; Eastern law House, Delhi 2010

Suggested Reading:

1. Cronish W.R1 “Intellectual Property; Patents, copyright, Trad and Allied rights”, Sweet & Maxwell, 1993.
2. P. Narayanan, “Intellectual Property Law”, Eastern Law Edition., 1997.

18ITO01

OBJECT ORIENTED PROGRAMMING USING JAVA

(Open Elective-I)

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

This course aims to:

1. To familiarize with fundamentals of object-oriented programming paradigm.
2. To impart the knowledge of string handling, interfaces, packages and inner classes.
3. To facilitate learning Exception handling and Multithreading mechanisms.
4. To gain knowledge on collection framework, stream classes.
5. To familiarize with event driven GUI programming and Database connectivity.

Course Outcomes:

Upon completing this course, students will be able to:

1. Understand the concepts of Object-Oriented Programming and class concept in Java.
2. Apply concepts of OOP such as Inheritance, Interfaces, Packages and Inner classes.
3. Handle exceptions and demonstrate the concepts of Multithreading and Generic classes.
4. Develop programs using Java Collection API and Stream classes.
5. Design and Develop GUI applications with JDBC.

UNIT-I

OOP concepts: Data abstraction, encapsulation, inheritance, benefits of inheritance, polymorphism, classes and objects, Procedural and object-oriented programming paradigms.

Introduction to Java: Java's Magic: The Byte code, The Java Buzzwords, Simple Java Programs, Java Primitive Types, Arrays: How to create and define arrays, Basic Operators, Control statements.

Introducing Classes: Declaring objects, methods, Constructors, this keyword, Method Overloading and Constructor Overloading, Objects as parameters, Returning objects, Use of static and final keywords.

UNIT-II

Inheritance: super and subclasses, Member access rules, super keyword**,** Method overriding, Dynamic method dispatch, Abstract classes, using final with inheritance, Introduction to Object class.

Packages: Defining, Creating and Accessing a Package, Understanding CLASSPATH, importing packages.

Interfaces: Defining and implementing interfaces, Nested Interfaces.

Strings Handling: String & String Buffer classes, String Tokenizer class and Wrapper classes and conversion between Objects and primitives.

Inner classes in Java: Types of inner classes, Creating static / non-static inner classes, Local and anonymous inner classes.

UNIT-III

Exception Handling in Java: what are Exceptions? Exception types**,** Usage of try, catch, throw, throws and finally clauses, writing your own exception classes.

Multi-threading in Java: The java Thread Model, How to create threads, Thread class in java, Thread priorities, Thread synchronization.

Generics: What are Generics? Generic classes, bounded types, Generic methods and interfaces.

UNIT-IV

Collections Framework: Overview of Collection Framework, commonly used Collection classes – ArrayList, LinkedList, HashSet, Linked HashSet, TreeSet, Collection Interfaces –Collection, List, Set, SortedSet, accessing a collection via an Iteration, storing user-defined classes in collections, Map Interfaces and Classes, Using a comparator. Legacy classes – Vector, Hash table, The Enumeration interface.

Input/Output: How to read user input (from keyboard) using scanner class, Stream classes, InputStream, OutputStream, FileInputStream, FileOutputStream, Reader and Writer, FileReader, FileWriter classes. File class.

UNIT-V

GUI Design and Event Handling: Component, Container, window, Frame classes. Working with Frame window GUI Controls, Layout Managers, Introduction to Swings, Delegation Event Model, Event Classes, Source of Events, Event Listener Interfaces, Handling button click events, Adapter classes. Writing GUI Based applications.

Database Handling in Java: Java Database Connectivity (JDBC) using MySQL.

Text Books:

1. Herbert Schildt, "Java: The Complete Reference", 8th Edition, Tata McGraw Hill Publications, 2011.
2. Cay S. Horstmann, Gary Cornell, "Core Java, Volume I, Fundamentals", 8th Edition, Prentice Hall, 2008.

Suggested Reading:

1. Sachin Malhotra & Saurabh Choudhary, "Programming in Java", 2nd Edition, Oxford University Press, 2014.
2. C. Thomas Wu, "An introduction to Object-oriented programming with Java", 4th Edition, Tata McGraw-Hill Publishing company Ltd., 2010.
3. Kathy Sierra, Bert Bates, "Head First Java: A Brain-Friendly Guide" 2nd Edition, O'Reilly,2005

Web Resources:

1. https://www.cse.iitb.ac.in/~nlp-ai/javalect_august2004.html.
2. http://nptel.ac.in/courses/106106147/
3. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-092-introduction-to-programming-in-java-january-iap-2010/lecture-notes/

18MT O04

QUANTUM COMPUTING

(Open Elective-I)

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Knowledge of Number theory and cryptography

Course Objectives:

This course aims to:

1. To translate fluently between the major mathematical representations and its quantum operations,
2. To implement' basic quantum algorithms
3. To explain quantum decoherence in systems for computation
4. To discuss the physical basis of uniquely quantum phenomena.

Course Outcomes:

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

1. Identify the working of a Quantum Computing Program, its architecture and program model.
2. Compute basic mathematical operations.
3. Demonstrate quantum logic gate circuits.
4. Develop quantum algorithm.
5. Appraise quantum algorithm on major toolkits

UNIT-I

Introduction to Quantum Computing:

Motivation for Studying Quantum Computing, Major players in the industry (IBM, Microsoft, Rigetti, D-Wave etc), Origin of Quantum Computing, Overview of major concepts in Quantum Commuting (Qubits and multi-qubits states, Bra-ket notation, Bloch Sphere representation, Quantum Superposition, Quantum Entanglement)

UNIT-II

Math Foundation for Quantum Computing:

Matrix Algebra: Basis vectors and orthogonality, inner product and Hilbert spaces, matrices and tensors, unitary operators and projectors, Dirac notation, Eigen values and Eigen Vectors.

UNIT-III

Building Blocks for Quantum Program:

Architecture of a Quantum Computing Platform, Details of q-bit system of information representation (Block Sphere, Multi-qubits States, Quantum superposition of qubits (valid and invalid superposition), Quantum Entanglement, Useful states from Quantum algorithmic perceptive e.g.Bell State,

UNIT-IV

Quantum Logic Gates and Circuits:

Quantum Logic gates and Circuit: Pauli, Hadamard, Phase shift, controlled gates, ising, Deutsch,Swap etc.), Programming model for a Quantum Computing program (Steps performed on classical computer, steps performed on Quantum Computer, Moving data between bits and qubits)

UNIT-V

Quantum Algorithms:

Basic techniques exploited by quantum algorithms (Amplitude amplification, Quantum Fourier Transform, Phase Kick-back, Quantum Phase estimation, Quantum walks), Major Algorithms (Shor's Algorithm, Grover's Algorithm, Deutsch's Algorithm, Deutsch-Jozsa Algorithm), OSS Toolkits for implementing Quantum program (IBM quantum experience, Microsoft Q, RigettiPyQuil (QPU/QVM))

Text Books:

1. Michael A.Nielsen, "Quantum Computation and Quantum Information", Cambridge University Press.
2. David McMahon, "Quanturm Computing Explained", Wiley

18EC C18 DIGITAL COMMUNICATION LAB

Instruction	2 P Hours per Week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Prerequisite: Knowledge about analog communication is required.

Course Objectives:
This course aims to:

1. Carry out experiments on various pulse digital modulation techniques.
2. Conduct the experiment to identify errors in cyclic codes
3. Work on convolutional encoder and decoder for controlling the errors.

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

1. Demonstrate various pulse digital modulation techniques.
2. Assess different line coding techniques.
3. Detect and correct errors in cyclic codes.
4. Examine the errors in convolutional encoder and decoder.
5. Evaluate various digital carrier modulation techniques experimentally.

List of Experiments:

1. PCM generation and detection.
2. Data formats / Line coding techniques.
3. Linear Delta Modulation and demodulation.
4. Adaptive Delta Modulation and demodulation.
5. Error detection and correction in cyclic codes.
6. Convolutional encoder and decoder.
7. ASK generation and detection.
8. FSK generation and detection.
9. BPSK generation and detection.
10. QPSK generation and detection.
11. MSK generation and detection.
12. Structured Enquiry:
    - Design N-bit PCM encoder based on the given specifications.
13. Open ended Enquiry:
    - Develop a code for different digital modulation schemes and verify through simulation.
    - Design different Line coding schemes using logic Gates.

Suggested Reading:

1. A.M. Zungeru, J.M. Chuma, M. Mangwala , L.K. Ketshabetswe, “Handbook of Laboratory Experiments in Electronics and Communication Engineering”, Vol. 2, 1st Edition, Notion press, 2017.

18EC C19

LINEAR AND DIGITAL INTEGRATED CIRCUITS LAB

Instruction	2 P Hours per Week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Prerequisite: Knowledge of Analog electronic circuits.

Course Objectives:

This course aims to:

1. Know and verify the concepts of 741 Op-Amp, IC555 timer, IC723 and data converters.
2. Know the various characteristics of TTL and CMOS gates and implement the circuits with Digital ICs.
3. Contrast the differences between linear and digital ICs.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Analyze the configurations, parameters of Op-Amp (IC741).
2. Demonstrate the circuits of Op-Amp for various applications.
3. Design the circuits using IC555 timer, IC723 and data converters.
4. Determine the characteristics of TTL and CMOS gates
5. Develop various combinational circuits and sequential circuits using digital ICs.

Lab Experiments

Part-A: Linear IC Experiments

1. Voltage Follower, Inverting and Non-Inverting Amplifiers using OpAmp.
2. Measurement of Op-Amp parameters
3. Arithmetic Circuits using Op-Amp
4. Waveform generation using Op-Amp.
5. Astable and Monostable multi vibrators using IC555Timer.
6. Low and High Voltage Regulators using IC723.
7. D to A Converter using R-2R ladder.

Part-B: Digital IC Experiments

1. Measurement of various characteristic parameters of TTL and CMOS gates.
2. Logic function Implementations using Decoders.
3. Logic function Implementations using Multiplexers
4. Binary adder and subtractor, BCD adders using ICs.
5. Design of Synchronous, Asynchronous up/down counters.
6. Shift registers and ring counter using ICs.
7. Interfacing counters with 7-segment LED display units.
8. Structured enquiry: Implement a Security Monitoring System (Use only nonprogrammable ICs.)
9. Open ended enquiry: Design a Digital Clock structure to display minutes and seconds. (Use only nonprogrammable Ics.)

Mini Project cum Design Exercise(s):
To realize and design a Mini project using either linear or digital or combination of linear and digital IC's

Sample Mini Projects:

a. Design and implementation of Binary Multiplier
b. Design and implementation of a Water level indicator using 555 IC
c. Design and implementation of FSK Modulator using 555 IC.
d. Design a circuit to generate a one pulse per second signal from 1 KHz square wave.

Suggested Reading:

1. National Semiconductor Corporation, "Linear applications", Data book, 1986.
2. National Semiconductor Corporation, "Logic data book-Vol-II", 1984.

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

AICTE Model Curriculum with effect from AY 2020-21

B.E (Electronics and Communication Engineering)

SEMESTER – VI

S. No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1	18ECC20	Digital Signal Processing	3	-	-	3	30	70	3
2	18ECC21	Microcontrollers	3	-	-	3	30	70	3
3	18ECC22	Microwave and Radar Engineering	3	-	-	3	30	70	3
4		Program Elective-II	3	-	-	3	30	70	3
5		Program Elective-III	3	-	-	3	30	70	3
6	18MBC01	Engineering Economics and Accountancy	3	-	-	3	30	70	3
PRACTICALS									
7	18ECC23	Digital Signal Processing Lab	-	-	2	2	15	35	1
8	18ECC24	Microcontrollers Lab	-	-	2	2	15	35	1
9	18ECC25	Microwave Engineering Lab	-	-	2	2	15	35	1
Total			**18**	**-**	**06**	**-**	**225**	**525**	**21**
Clock Hours Per Week: 24									

L: Lecture **D: Drawing** **CIE: Continuous Internal Evaluation**

T: Tutorial **P: Practical/Project Seminar/Dissertation** **SEE: Semester End Examination**

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

AICTE Model Curriculum with effect from AY 2020-21

B.E (Electronics and Communication Engineering)

List of Courses in Program Elective-II		List of Courses in Program Elective-III	
Course Code	**Title of the Course**	**Course Code**	**Title of the Course**
18EC E05	Analog and Mixed Signal Design	18EC E10	Coding Theory and Techniques
18EC E06	Mobile Cellular Communication	18EC E11	CPLD and FPGA Architectures
18EC E07	Principles and Applications of AI	18EC E12	Data Analytics for signal processing
18EC E08	Principles of Optimization Techniques	18EC E13	Satellite Communication
18EC E09	System Automation and Control Engineering	18EC E14	Spread Spectrum Communication

18EC C20

DIGITAL SIGNAL PROCESSING

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Concepts of Signals, Systems and Filter designing.

Course Objectives:

This course aims to:

1. Know Discrete-time signals in the frequency domain using DFT and FFT.
2. Design digital IIR and FIR filters for the given specifications.
3. Introduce the basics of Multirate digital signal processing, Digital signal processor and its applications

Course Outcomes:

Upon completion of this course, students will be able to:

1. Understand the concept of DFT and FFT for signal processing applications.
2. Design FIR filters for the given specifications.
3. Implementation of IIR filters for the given specifications.
4. Interpret the concepts of Multirate digital signal processing and its applications.
5. Explain the architecture features of TMS320C67XX processor.

UNIT-I

Discrete Fourier Transform: Introduction, Discrete Fourier Transform (DFT), Properties of DFT, Efficient computation of DFT-Fast Fourier Transform (FFT) algorithms: Radix-2 FFT algorithms – Decimation in Time, Decimation in Frequency algorithms, Inplace computation, Bit reversal algorithm, Linear filtering using FFT algorithm.

UNIT-II

FIR Filter Design: Amplitude and Phase responses of FIR filters – Linear phase FIR filters – Windowing technique for design of FIR filters – Rectangular, Bartlet, Hamming, Blackman, and Kaiser Windows. Realization of digital filters-Direct form-I and II of IIR filters, Realization of linear phase FIR filter, Finite word length effects.

UNIT-III

IIR Filter Design: Butterworth and Chebyshev approximation, IIR digital filter design techniques- Impulse Invariant transformation, Bilinear transform techniques, Digital Butterworth and Chebyshev filters, Spectral transformation techniques. Comparison between FIR and IIR filters.

UNIT- IV

Multirate Digital Signal Processing: Introduction -Decimation by a Factor -D, Interpolation by a Factor -I, Sampling Rate Conversion by a Rational Factor -I/D, Nobel identities, Applications of Multirate Signal Processing: Phase shifters, QMF filter banks, Narrowband filters and sub band coding of speech signal.

UNIT-V

DSP Processors: Introduction, Difference between DSP and General-Purpose Processor architectures, need for DSP processors. General purpose DSP processor- TMS320C67XX processor, architecture, functional units, pipelining, registers, linear and circular addressing modes, instruction set.

Text Books:

1. Alan V. Oppenheim & Ronald W. Schafer, "Digital Signal Processing", PHI, 2/e, 2010.
2. John G. Proakis & Dimtris G. Manolakis, "Digital Signal Processing Principles, Algorithms and Application", PHI, 4/e, 2012.
3. Rulph Chassaing, "Digital Signal Processing and Applications with the C6713 and C6416 DSK", John wiley& sons, 2005.

Suggested Reading:

1. Sanjit K Mitra, "Digital Signal Processing, A computer-based approach", TMH, 3/e, 2011.
2. Tarun Kumar Rawat, "Digital Signal Processing", 1stedition, Oxford, 2015.
3. Avtar Singh & S. Srinivasan, "Digital Signal Processing Implementation using DSP microprocessors", Thomson Brooks, 2/e, 2004.
4. Chi- Tsong Chen, "Digital Signal Processing Spectral Computation and filter Design", Oxford, 2/e, 2007.

18ECC21

MICROCONTROLLERS

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Knowledge of Computer Architecture and Microprocessors.

Course Objectives:

This course aims to:

1. Understand architecture features of the microcontrollers
2. Learn the programming of the microcontrollers
3. Understand interfacing of various modules with microcontrollers.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Acquire an overview of how a processor and a controller are distinguished.
2. Understand the architectures of different microcontrollers to enable to design applications using them.
3. Develop code both in assembly and in high level language for various applications of microcontrollers.
4. Analyze and design real world applications by using on/off chip peripherals of different microcontrollers.
5. Apply theoretical learning to practical real time problems for automation.

UNIT-I

8051Microcontroller: Introduction to Microcontroller, Overview of 8051 family, Internal Architecture of 8051, PSW, Pin description, I/O Ports, Memory organization and expansion. Addressing modes and Bit addressable features, 8051 Instruction set: Data transfer, Arithmetic, Logical, Program branching and bit manipulation instructions.

UNIT-II

8051 Programming: Introduction to 8051 programming development tools, basic programming using instruction set, Introduction to 8051 C Programming, SFRs, 8051 Timer Programming in Assembly and C, 8051 Serial port Programming in Assembly and C, 8051 Interrupt Programming in Assembly and C.

UNIT-III

8051 Interfacing: 8051 interfacing to external memory (RAM, ROM), 8255 PPI interfacing, LCD and Keyboard interfacing, Digital to Analog converter, Analog to Digital converter and Sensor interfacing, Relay and PWM, DC Motor interfacing, Stepper Motor interfacing

UNIT-IV

ARM: Introduction to RISC Processors, ARM Design Philosophy, ARM Processor families, Architecture- Revisions, Registers, Program status register, Pipeline, Introduction to Exceptions,

ARM Instruction set: Data processing instructions, Branch instructions, Load-Store instructions, Software interrupt instruction, Program Status Register instructions, Loading constants, and Conditional executions. Introduction to THUMB instructions: Differences between Thumb and ARM modes, Register usage.

UNIT-V

ARM 7 Microcontroller (LPC2148)**:** Salient features of LPC 2148, Pin description of 2148, Architectural Overview.

ARM 7(LPC2148) **Peripherals:** Description of General-Purpose Input/output (GPIO) ports, Pin control Block. Features, Pin description, Register description and operation of PLL, Timers, PWM, ADC, DAC. Communication protocols: Brief overview on I2C, SPI, and CAN.

Text Books:

1. Mazidi M.A, Mazidi JG & Rolin D. Mckinlay, "The 8051 Microcontroller & Embedded Systems using Assembly and C", 2/e, Pearson Education, 2007.
2. Andrew N.Sloss, Domonic Symes, Chris Wright, "ARM System Developers Guide Designing and Optimizing system software", 1/e, Elsever, 2004.

Suggested Reading:

1. Ayala K.J, "The 8051 Microcontroller Architecture, Programming and Applications", Penram International, 2007.
2. Steve Furber, "ARM System on Chip Architecture", 2/e, Pearson education, 2000.
3. Philips semiconductors, "ARM 7 (LPC 214x) user manual", 2005.
4. Lyla B. Das, "Architecture, Programming and Interfacing of Low-power Processors-ARM 7, Cortex-M", CENGAGE, 2017.

18ECC22

MICROWAVE AND RADAR ENGINEERING

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

This course aims to:

1. To understand the importance of microwaves and their applications.
2. To understand the principle and operation of microwave sources.
3. To understand principle and operation of different radar systems.

Course Outcomes:

Upon completing this course, students will be able to:

1. Apply the wave equations and their solutions to analyze the waves in the waveguides.
2. Determine the scattering matrix for various microwave components.
3. Analyze the interaction of electron beam and RF field for various microwave sources.
4. Examine the principles of operation of pulse, CW and MTI radar system.
5. Compare different types of tracking radars.

Unit-I

Introduction to Microwaves: Microwave frequency spectrum, Advantages and Applications of Microwaves.

Rectangular Waveguides: Rectangular waveguides, TM and TE waves, Impossibility of TEM wave in waveguides. Wave Impedance.

Circular Waveguides: Solution of wave equations in cylindrical coordinates, Characteristics of TM and TE modes.

Microwave Cavities: Rectangular and Circular Cavity Resonators, Quality factor and applications of cavity resonators.

Unit-II

Microwave Circuits and Components: Concept of microwave hybrid circuit, Introduction to scattering parameters. Properties and S-parameters of reciprocal components – E and H Plane Tees, Magic Tee, Directional Coupler.

Non-Reciprocal Components: Ferrites – Composition and Faraday Rotation; Ferrite Components – Isolators, Gyrators and Circulators. S- Parameters of Isolator and Circulator.

Unit-III

Microwave Tubes: Limitations of Conventional Tubes at Microwave Frequencies. Principles of Gunn Diode.

O-type tubes: Two cavity klystron, velocity modulation process, bunching process. Output power and efficiency. Reflex Klystron-Velocity Modulation, Power out and efficiency, Electronic admittance.

Helix TWT: Slow Wave Structures, Principles of Operation and Applications of TWT (qualitative treatment only).

M-type Tubes: Introduction, Magnetron Oscillators, different types, π-mode of operation, frequency pushing and pulling effects and their remedies.

Unit- IV

Radar Systems: Introduction to radar, radar block diagram and operation, radar frequencies, Applications of radar, Prediction of range performance, minimum detectable signal, receiver noise, probability density function, SNR, Integration of radar pulses, radar cross-section of targets, PRF and range ambiguities, transmitter power, system losses.

Unit-V

Radar Types: Doppler effect, CW radar, FM CW radar, multiple frequency CW radar. MTI radar, delay line canceller, range gated MTI radar, blind speeds, staggered PRF.

Tracking radar: Sequential lobbing, Conical scan, Monopulse: Amplitude comparison and Phase comparison methods.

Text Book:

1. Samuel Y. Liao, "Microwave Devices and Circuits", 3/e, Pearson Education, 2003.
2. Merril. I. Skolnik, "Introduction to Radar Systems", 2/e, MGH, 2001.

Suggested Readings:

1. Rizzi P, "Microwave Devices and Circuits", 3/e, Pearson Education, 2003.
2. Annapurna Das and Sisir K Das "Microwave Engineering" 1/e, 2000, Tata McGraw-Hill.
3. Herbert J.Reich, John G.Skalnik, Philip F. Ordung, Herbert L. Krauss," Microwave Principles", East-West Pvt. Ltd. Madras.

18ECE05

ANALOG AND MIXED SIGNAL DESIGN

(Program Elective-II)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Student should have good understanding of MOSFET and Application of OP-Amp

Course Objectives:

This course aims to:

1. Characteristic behavior of MOS amplifier in various configurations
2. Different types of Current mirrors and differential amplifiers using MOSFET.
3. Analysis of Two-stage Op-Amp amplifier, switched capacitors, sample and hold circuits, stability of Op-Amp and different types of data converters.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Recall the elementary concepts of MOS device, MOS amplifiers and Op-Amp
2. Classify and Relate the performance of different types of MOS Amplifiers, Current Mirrors, Op-Amps and data converters
3. Model the behavior of MOS device for different scenarios.
4. Distinguish different types of Op- Amp configurations and their applications.
5. Design and develop data converter for the given specifications.

UNIT I

MOS Amplifiers: Introduction to analog design, Basics of MOS device: general consideration, MOS VI Characteristics, Second order effects, MOS small signal model, Signal stage amplifier: common source amplifier, Source follower, common gate stage.

UNIT II

Current Mirrors & Op-Amp: Simple CMOS current mirrors, Cascode Current Mirror (Gain, Output Resistance), Bipolar Current Mirrors, High out Impedance Current Mirrors Cascode Gain Stage, Wilson current mirror, Source degenerated current mirrors, MOS amplifiers using CM as load, Differential pairs with current mirror loads (MOS and bipolar)

UNIT III

Two Stage Op-Amp: Basic two stage MOS Operational amplifier–Characteristic parameters, two stage MOS Op-Amp with Cascoding MOS Telescopic-Cascade Op-Amp, MOS Folded Cascade Op-Amp, Fully differential folded Cascode Op-Amp, Op-Amp Stability and Frequency Compensation of Op-Amps,

UNIT IV

Switched Capacitors: Comparators: Op-Amp Based Comparators Basic building blocks, basic operation and analysis, switched capacitors- basic operation and analysis, Inverting and Non-inverting integrators, signal flow diagrams. Sample and Hold circuits.Performance Requirements, MOS Sample and Hold basics, Clock feed through problems

UNIT V

D/A and A/Converters: D/A converters: Specifications, Decoder based converter, Binary scaled converters, Thermometer code converters, Current mode converters. Nyquist rate A/D Converters: Integrated converters successive approximation converters.

Text Books:

1. Behzad Razavi, “Design of Analog CMOS Integrated Circuits”, Tata McGraw Hill, 2002.
2. David Johns, Ken Martin, “Analog Integrated Circuit Design”, John Wiley & sons, 2004.

Suggested Reading:

1. Paul. R. Gray & Robert G. Major, “Analysis and Design of Analog Integrated Circuits”, John Wiley & sons, 2004.
2. Phillip E. Allen, Douglas R. Holberg, Allen, "CMOS Analog Circuit Design" Oxford University Press

18EC E06

MOBILE CELLULAR COMMUNICATION

(Program Elective-II**)**

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Basic course on Analog Communication, Digital Communication, Antenna and Wave propagation.

Course Objectives:

This course aims to:

1. Understanding of Cellular mobile architecture and key concepts like interference and handoff.
2. Know the effects of multipath and Doppler on wireless channel performance in terms of fading.
3. Study the use of Modulation and Multiple access techniques in GSM and CDMA mobile cellular systems

Course Outcomes:

Upon completion of this course, students will be able to:

1. Choose an appropriate concept, Propagation model and multiple access technique to improve the capacity
2. Demonstrate various technologies and their specifications for mobile communication.
3. Distinguish the system architecture of Mobile Communication Systems.
4. Estimate path loss of fading channel and performance measures of antenna and receiver.
5. Compare the technology trends changing from generation to generation

UNIT-I

Cellular Concepts: Cell structure, frequency reuse, cell splitting, channel assignment, handoff, interference, capacity, power control; Wireless Standards: Overview of 4G and 5G cellular standards. Signal propagation-Propagation mechanisms, large scale signal propagation and log-normal shadowing.

UNIT-II

Fading Channels: Multipath and small-scale fading, Doppler shift, statistical multipath channel models, narrowband and wideband fading models, power delay profile, average and RMS delay spread, coherence bandwidth and coherence time, flat and frequency selective fading, slow and fast fading, average fade duration and level crossing rate. Capacity of flat and frequency selective channels.

UNIT-III

Antennas: Antennas for mobile terminal- monopole antennas, PIFA, base station antennas and arrays. Multiple access schemes: FDMA, TDMA, CDMA and SDMA. Modulation schemes QAM and GMSK; multicarrier modulation -OFDM.

UNIT-IV

Receiver Structure: Diversity receivers- selection and MRC receivers, RAKE receiver, MIMO and space time signal processing, spatial multiplexing, diversity/ multiplexing. Trade off, Performance measures Outage, average SNR, average symbol/bit error rate.

UNIT-V

Mobile Cellular System Examples: GSM, EDGE, GPRS, IS-95, CDMA 2000 and WCDMA. Comparison of system specifications

Text Books:

1. Rappaport Theodore S, "Wireless Communications Principles and Practice", 2nd Edition, 2002.
2. William C.Y.Lee, "Mobile Cellular Telecommunications: Analog and Digital Systems", 2/e, Mc-Graw Hill, 2011.
3. Raymond Steele, "Mobile Radio Communications", IEEE Press, New York, 1992.

Suggested Reading:

1. AJ Viterbi, "Principles of Spread Spectrum Communications", Addison Wesley, 1995.
2. VK Garg& JE Wilkes, "Wireless & Personal Communication Systems", Prentice Hall, 1996.
3. T.L.Singhal, "Wireless Communication Systems", 1/e, TMH Publications, 2010.
4. Kernilo, Feher, "Wireless Digital Communications", PHI, 2002.

18EC E07

PRINCIPLES AND APPLICATIONS OF AI

(Program Elective-II)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Knowledge of probability, Linear Algebra, Data Structure and programming.

Course Objectives:

This course aims to:

1. Exposure to the foundation of Artificial Intelligence.
2. Familiarize the applications of Artificial Intelligence in Industry
3. Inculcate the concepts of Neural Networks and Pattern Recognition

Course Outcomes:

Upon completion of the course, students will be able to:

1. Understand the basics of AI and intelligent agents.
2. Apply Expert Systems to solve real time problems
3. Understand knowledge representation methods.
4. Build algorithms using Clustering techniques for various applications
5. Solve the various classification problems like object recognition

UNIT-I

Introduction to AI and Intelligent Agents: Concept of AI, current status of AI, Agents, Good Behavior: Environment, problem formulation. The structure of agents. Basic concepts of Search Algorithms.

UNIT-II

Knowledge representation: Bayesian network representation, Construction and inference**.** Hidden Markov Model. Approaches to knowledge representation, knowledge representation using the semantic network, extended semantic networks for Knowledge representation, knowledge representation using frames.

UNIT-III

Neural Networks: What is a neural network, the human brain, models of a neuron, neural networks as a directed graph, feedback and network architectures. Learning processes and learning tasks.

UNIT-IV

Expert system and applications: Introduction phases in building expert systems, expert system versus traditional systems, Rule-based expert systems, blackboard systems truth maintenance systems and application of expert systems.

UNIT-V

Applications and tools of Artificial Intelligence: Pre-processing, time series prediction and feature extraction. Principle Component Analysis. **Statistical Pattern Recognition:** Object recognition, Classification and regression, Concepts of Associative memories and optimization. Application of AI in speech, Image processing and IOT.

Text Books:

1. Stuart Russell and Peter Norvig, “Artificial Intelligence—A Modern Approach”, 3rd Edition, Prentice-Hall Series, 2010.
2. Christopher M. Bishop, Clareddon, “Neural networks for pattern Recognition”, Oxford, 1995.
3. Simon Haykin, “Neural networks and learning Machines”, 3rd Edition, Pearson- Prentice Hall, 2009.
4. M. Narsimhamurty and V. Susheela Devi, “Pattern Recognition- An Algorithmic Approach", Springer Universities Press, 2011
5. B. Yegnanarayana, “Artificial Neural Networks”, PHI, 2005.

Suggested Books:

1. Elaine Rich, Kevin Knight and Shivashankar B Nair, “Artificial Intelligence”, Tata McGraw Hill Education Pvt. Ltd., 2010.
2. Flasiński, Marius, “Introduction to Artificial Intelligence”, Springer International Publisher, 2016.

18EC E08

PRINCIPLES OF OPTIMIZATION TECHNIQUES

(Program Elective-II**)**

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Knowledge about engineering mathematics and problem-solving skills with programming languages.

Course Objectives:

This course aims to:

1. Understand LPP and NLP techniques.
2. Understand the difference between local and global optimization methods.
3. Compare different optimization methods.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Understand importance of optimization of industrial process management.
2. Illustrate the basic concepts of linear programming and application to real life problems.
3. Demonstrate the principles of nonlinear programming to one dimensional problem.
4. Apply basic concepts of mathematics to formulate an optimization problem.
5. Examine the working of Genetic Algorithm for nonlinear function.

UNIT-I

Introduction to Optimization, Applications of optimization techniques, statement of the problem, linear programming-standard form of LPP, Motivation of the simplex method, simplex algorithm, two phases of simplex method, sensitivity Analysis.

UNIT-II

Non-Linear Programming (NLP): One Dimensional: Unrestricted search, exhaustive search, Fibonacci method, golden section method-Newton and secant methods. Unconstrained optimization: direct search method, simplex method. Gradient of a function, steepest Descent search method (Cauchy) method, Conjugate gradient method.

UNIT-III

NLP-Constrained Optimization: Characteristic of a constrained problem, Direct Methods-Random search methods, Sequential linear programming method. Indirect methods: Transformation techniques, interior and exterior penalty function methods.

UNIT-IV

Further Topics in Optimization: Multi objective Optimization-Utility function method, Invent and utility function methods, global criterion method. Simulated Annealing, Optimization of Fuzzy systems.

UNIT-V

Genetic Algorithm (GA): Introduction, optimization of a simple function- Representation, Initial population, Genetic operators: Crossover and Mutation. Travelling salesman problem (TSP), Comparison between Hill climbing, Simulated annealing and Genetic algorithms. How do GAs work-Chromo some selection, Selection process, Recombination operators, Example of maximization of a nonlinear function.

Text Books:

1. SingiresuS.Rao, "Engineering Optimization: Theory and Practice", 3rd edition, New Age International(P) Limited, 2013.
2. Zbigniew Michalewicz, "Genetic Algorithms + Data structures = Evolution Programs", Third Revised and Extended Edition, Springer, 2013.

Suggested Reading:

1. Kalyanmay Deb, "Optimization for Engineering Design-Algorithms and Examples", Second edition, PHI, 2012.
2. Merrium C.W," Optimum theory and the design of feedback control systems", McGraw Hill,1964.
3. A.Ravindran, K.M.Ragsdell, G.V.Reklaitis, "Engineering Optimization –Methods and Applications", Second Edition, Wiley Publication.

18EC E09

SYSTEM AUTOMATION AND CONTROL ENGINEERING

(Program Elective-II)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Knowledge on instrumentation and control system is required.

Course Objectives:

This course aims to:

1. Understand industrial Automation functions.
2. Learn industrial sensors for mobile robotics.
3. Learn industrial PID and PLC programming.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Understand the need of automation in industrial environments
2. Classify different types of industrial Sensors with their applications.
3. Explain how advanced instructions can be used in industrial automation to implement and maintain the PLC systems
4. Elaborate the significance of process controllers in industrial automation
5. Identify various applications of robots in industrial automation

UNIT-I

Introduction: Function of Industrial Automation, Basic Devices in Automated Systems, Different Controllers Employed in Automated Systems, Safety in Industrial Automation, Lockout-Tag Out Procedures in Industrial Environments.

UNIT-II

Programming Developed Skills: Programmable Logic Controller Applications, History of the PLC, Basic PLC Skills, Programming, Coils, Contacts, Timers and Counters, Logical Program Development.

UNIT-III

Instructions: Arithmetic and Advanced Instructions in Industrial Automation Including, Common Arithmetic Instructions, Add, Subtract, Multiply, Divide, and Compare Function, Logical Operators, Average, Standard Deviation, Trigonometric, Numbering System Conversion, Sequencers and Shift.

UNIT-IV

Sensors and Robotics: Industrial Sensors-Optical, Inductive, Capacitive, Encoders, Ultrasonic and Thermocouples. Demonstrate Proper Wiring Techniques and Practical Applications, Robotics, Identify Types of Robot, Distinguish Uses and Applications of Robot.

UNIT-V

Process Control System: Fundamentals of Process Control Including, Process and Control, Proportional, Integral, Derivative (PID) Control, Tuning. Process Control System, Distinguish Types of Process Control Device, Apply Process Control Devices to Practical Level, Flow and Temperature Control Systems, Perform Maintenance Techniques Including, Installation, Maintenance, Troubleshooting of PLC Systems.

Text Books:

1. Terry Bartle, "Industrial Control Electronics Devices, Systems, & Applications", 3rd Edition, Kindle Edition, Publisher: Delmar, 2005.
2. Benjamin C. Kuo, "Automatic Control Systems", 7/e, PHI, 2010.

Suggested Reading:

1. Mazidi M.A, Mazidi J.G and Rolin D Mckinlay, "The 8051 Microcontroller and Embedded systems using Assembly and C", 2nd edition, Pearson education 2007.
2. A. K Peters, "Sensors for mobile robotics theory and applications", A. K. Peters LTD copy right 1995.
3. William C. Dunn, "Fundamentals of Industrial Instrumentation and Process Control", 1st Ed., McGraw-Hill-2005.

18EC E10
CODING THEORY AND TECHNIQUES

(Program Elective-III)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Student must have completed the course in Digital communication.A good background of mathematics including probability theory is expected.

Course Objectives:

This course aims to:

1. Implementation of channel coding techniques in digital communications.
2. Know basic notions of error control coding and fundamentals of abstract algebra, finite fields and its extension.
3. Understand the mathematical structure and algorithms for RS and BCH codes.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Recall the theory and principles of information theory and channel Coding.
2. Design and analyze the encoding and decoding circuits for various coding techniques.
3. Apply the principles of abstract algebra, finite fields and its extension to design related codes.
4. Examine the error detection and correction capability of coding techniques for digital communication.
5. Evaluate the performance of error control codes using different decoding algorithms

UNIT-I

Linear Block Codes: Introduction, generator and parity-check matrices, encoding, Syndrome decoding, Maximum Likelihood (ML) decoding-hard decision decoding and soft decision decoding.

Binary Cyclic Codes: Description, encoding, Syndrome computation and error detection, Encoder and Syndrome generator implementations, Meggit decoder.

UNIT II

Galois Fields: Fields, Binary arithmetic, Basic properties of Galois Fields, polynomials over GF (2), Construction of Galois Fields GF(2^m) from GF (2), properties of extension fields, conjugates, Minimal polynomials, Factorization of (X^n+1) over a finite field.

UNIT III

BCH Codes: Introduction, general description of BCH codes, Encoding, Decoding – Berlekamp's algorithm, a Fast Berlekamp-Massey algorithm.

UNIT IV

RS Codes: Introduction, general description of Reed-Solomon codes, encoding, decoding of Reed- Solomon codes using Berlekamp-Massey algorithm. MDS codes, Spectral characteristics of cyclic codes.

UNIT V

Convolution Codes: Introduction, Encoding, State diagram, Code Tree, Code Trellis diagram, Decoding -Wozencraft's sequential decoding, Fann's algorithm, Maximum Likelihood (ML) Viterbi decoding - soft decision and hard decision decoding.

Text books:

1. Shulin and Daniel J. Costello Jr., "Error Control Coding", 2/e, Pearson, 2011.
2. L.H.Charles LEE, "Error control block codes for Communication Engineers", Artech,, 1st edition,2000.
3. Man Young Ree, "Error-Correcting Coding Theory", Mc-Graw-Hill publishing company, 1st edition,1989

18ECE11

CPLD AND FPGA ARCHITECTURES

(Program Elective-III)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Digital logic design and digital integrated circuits.

Course Objectives:

This course aims to:

1. Study various PLD, CPLDs and FPGA Architectures and its features.
2. Understand the different programming technologies, placement and routing.
3. Study the design tools for FPGA and ASICs.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Recall the fundamental concepts of Digital logic circuits and PLDs
2. Compare the performance of the various types of PLDs
3. Understand the architecture and design aspects of various CPLDs and FPGAs
4. Implement the various logic functions using PLDs and FPGAs
5. Demonstrate the VLSI tool flow for CPLD and FPGA

UNIT I

Review of Logic Design: Implementation of logic functions with multiplexers.
Programmable Logic Devices: Architectures of PROM, PLA and PAL. Implementation of MSI circuits using Programmable Logic Devices.

UNIT II

Complex Programmable Logic Devices: Introduction to CPLD Architecture of CPLD. Logic Block, I/O Block, Interconnect matrix, and features of Altera max 7000 series, AMD Mach 4 and Xilinx XC-9500 CPLD.

UNIT III

Xilinx FPGAs: Introduction to FPGA, FPGA Programming Technologies. Architecture, Logic Blocks, I/O Block, Routing Architecture and features of Xilinx XC-4000, SPARTAN-II, Virtex-II and salient features of Virtex III to VII devices.

UNIT IV

Actel and Altera FPGAs: Anti-Fuse Programmed FPGAs: Introduction, Architecture of Actel's Act1, Act2, and Act3 FPGAs. Designing of logic circuits with the ACT devices. Logic Block, I/O Block, Routing Architecture and features of Altera's Flex 10000 series FPGA.

UNIT V

Digital Design Flow: Digital design tools for FPGAs. Digital design flow for CPLDs and FPGAs. Importance of Placement and Routing, Introduction to ASICs: Semi-Custom and Full-Custom ASICs.

Text books:

1. S. Trimberger, Edr, "Field Programmable Gate Array Technology", Springer Publication., 2011.
2. Ronald J. Tocci, Neal S. Widmer, Gregory L. Moss "Digital Systems", 10/e, Pearson academic press 2011.
3. P.K.Chan& S. Mourad, "Digital Design Using Field Programmable Gate Array", PHI, 1994.

Suggested Reading:

1. S. Brown, R.J.Francis, J.Rose, Z.G.Vranesic, "Field programmable gate array", BSP, 2007.
2. Altera, AMD, Actel, "Manuals Xilinx", 2015.
3. Ian Grout, "Digital Systems Design with FPGAs and CPLDs", Elsevier, 2008
4. Bob Zeidman, ―Designing with FPGAs & CPLDs, CMP Books, Berkeley, Calif 2002.
5. John V. Oldfield, Richard C. Dorf, "Field Programmable Gate Arrays", Wiley India.1995

18EC E12

DATA ANALYTICS FOR SIGNAL PROCESSING

(Program Elective-III)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Programming using MATLAB/Python, Probability and Statistics and Linear Algebra.

Course Objectives:

This course aims to:

1. Find a meaningful pattern in data.
2. Insights from data through visual representation.
3. Implementation of various machine learning algorithms.
4. Handle large scale analytics projects from various domains such as image and speech signals.
5. Develop intelligent decision support systems.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Explain data science fundamentals.
2. Explore the principles of probability and statistical theory.
3. Understand various machine learning algorithms using applied statistics.
4. Analyze supervised and unsupervised learning models with regression and classification techniques.
5. Construct various applications of image and speech processing using MATLAB/Python.

Unit-I:

Introduction to Data Analytics: **Descriptive Statistics**: The Central limit theorem, distributions of the sample mean and the sample variance for a normal population, Sampling distributions (Chi-Square, t, F, z), **Probability Distributions:**, **and Inferential Statistics**: Inferential Statistics through Testing of Hypothesis: Testing for Attributes – Mean of Normal Population – One-tailed and two-tailed tests, F-test and Chi-Square test, Permutation & Randomization test.

Unit-II:

Regression & ANOVA: Regression ANOVA (Analysis of Variance): One way and two-way variance. Machine Learning: Introduction and Concepts, differentiating algorithmic and model-based frameworks, Regression: Ordinary Least Squares, Ridge Regression, Lasso Regression, Regression and Classification.

Unit-III:

Supervised and Unsupervised Learning with Regression and Classification techniques : Bias-Variance Dichotomy, Model Validation Approaches, Logistic Regression, Linear Discriminant Analysis, Quadratic Discriminant Analysis, Support Vector Machines (SVM), Ensemble Methods: Random Forest, Clustering: Partitioned based Clustering - K-means Clustering, Principal Component Analysis (PCA); Hierarchical Clustering - Agglomerative- Divisive- Distance measures; Neural networks- the perceptron algorithm- multilayer perceptron's(MLP)- back propagation nonlinear regression (BPMLP)- multiclass discrimination- training procedures- dimensionality reduction interpretation.

Unit-IV:

Data Analytics in Speech processing:

Speech recognition using Python: Understanding and visualization of the Speech/Audio data, Spectral representation of speech/audio data: Discrete Fourier Transform (DFT), Fast Fourier Transform (FFT), Spectrogram.

Natural Language Processing: Text pre-processing, Parsing and exploratory data analysis. Supervised or unsupervised model of the data, Evaluation and Deployment using Python.

Unit-V:Data Analytics in Image processing:

Transformation of images/videos data using Python: Segmentation and feature extraction, detection of relationships between variables, features and time, Extraction of time stamped variables, Image Compression using K-means Clustering.

Textbooks:

1. Hastie, Trevor, et al." The elements of statistical learning" Vol. 2. No. 1. New York: springer, 2009.
2. Montgomery, Douglas C., and George C. Runger "Applied statistics and probability for engineers" John Wiley & Sons, 2010.
3. C. Bishop, "Pattern Recognition and Machine Learning, Springer", 2006.
4. John Mueller and Luca Massaron, "Machine Learning for Dummies", John Wiley & Sons, 2016.

Suggested Reading:

1. Little, Max A. *Machine Learning for Signal Processing: Data Science, Algorithms, and Computational Statistics*. Oxford University Press, USA, 2019.
2. Chellappa, Rama, and Sergios Theodoridis. *Signal Processing Theory and Machine Learning*. Academic Press, 2014.

18ECE13

SATELLITE COMMUNICATION

(Program Elective-III)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Knowledge of fundamental concepts of analog, digital communication and antennas is required.

Course objectives:

This course aims to:

1. Develop awareness about satellite orbits, orbital mechanics and orbital effects.
2. Make the students acquire the knowledge of various satellite subsystems.
3. Make the student to design a satellite link and understand the functioning of VSATs and DBS TV.

Course outcomes:

Upon completion of this course, students will be able to:

1. Extend the fundamental concepts of analog and digital communications in understanding a basic communication satellite system and satellite orbits.
2. Apply the principles of orbital mechanics to locate the satellite and examine the orbital effects on satellites.
3. Compare the Multiple access techniques for satellite communications and demonstrate the understanding of launch mechanisms and satellite subsystems.
4. Design an appropriate satellite communication link for the given specifications
5. Appraise the working principle and related aspects of DBSTV and VSAT.

UNIT-I

Introduction to Satellite Communication: Brief history of satellite communications, satellite services, frequency allocations, basic communication satellite system – earth segment and satellite segment, advantages and applications of satellite communications, salient features of Indian communication satellites. Introduction to satellite orbits – LEO, MEO, HEO, Polar orbits, sun-synchronous orbits, geo-synchronous and geo-stationary orbits.

UNIT-II

Orbital Mechanics: Kepler's laws, describing the orbit of a satellite, locating the satellite in the orbit and with respect to earth, orbital elements.

Look Angle Determination: sub-satellite point, elevation and azimuth angle calculations, visibility test.

Orbital Perturbations: Longitudinal changes and inclination changes

Orbital Effects on Communication System Performance

UNIT-III

Launches and Launch Vehicles: Launch vehicles, placing satellites into geo-stationary orbit, salient features of Indian launch vehicles – PSLV and GSLV.

Satellite Subsystems: Attitude and orbit control system, TTC&M, power systems, communication subsystems, satellite antennas, reliability and redundancy.

Satellite Multiple Access: Comparison of FDMA, TDMA and CDMA systems in the context of satellite communications.

UNIT-IV

Satellite Link Design: Basic transmission theory, system noise temperature and G/T ratio – noise temperature, calculation of system noise temperature, noise figure and noise temperature, design of down link, uplink design, design for specified C/N – combining C/N and C/I values, overall $(C/N)_0$ with uplink and downlink attenuation, attenuation in rain, uplink attenuation and $(C/N)_{up}$, downlink attenuation and $(C/N)_{dl}$, satellite communication link design procedure.

UNIT-V

DBS TV: Introduction, power rating and number of transponders, frequencies and polarization, transponder capacity, home receiver outdoor unit and indoor unit.

VSAT: Overview, network architecture, modulation, coding and interference issues, brief introduction to VSAT antennas, indoor and outdoor units.

Text Books:

1. Timothy Pratt Charles, W Bostian, and Jeremy and E.Allnutt, "Satellite Communications", 2/e,, John Wiley,1986.
2. Dennis Roddy, "Satellite Communications", Fourth edition, McGraw Hill, 2006.

Suggested Reading:

1. M. Richharia, "Satellite Communication Systems: Design Principles", McGraw Hill, 2/e, 2003.
2. Gagliardi Robert M, "Satellite Communications", 2/e, Van Nostrand Reinhold, 1991.

18EC E14

SPREAD SPECTRUM COMMUNICATION

(Program Elective-III)

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: A prior knowledge of digital communication is required.

Course Objectives:

This course aims to:

1. Introduce the fundamental concepts of Spread Spectrum Communication Systems.
2. Train the students with various key issues related to synchronization in Spread Spectrum Communication Systems.
3. Familiarize with various code generators.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Understand the fundamental concepts of Spread Spectrum Communication Systems.
2. Interpret the requirement of diversity in fading channels.
3. Integrate various synchronization techniques in Spread Spectrum Communication.
4. Analyze various multiple access schemes.
5. Devise various code generators required for estimating tracking loops.

UNIT-I: Introduction to Various Multiple Access Techniques: FDMA, TDMA, CDMA, SDMA, CSMA and OFDMA. Merits and demerits of multiple access schemes and their Comparison. Introduction to Spread Spectrum Communication Systems and its types.

UNIT-II: Direct Sequence Spread Spectrum: BPSK Direct Sequence Spread Spectrum. Frequency Hop Spread Spectrum: Coherent Slow Frequency Hop Spread Spectrum, Non-Coherent Slow Frequency Hop Spread Spectrum, Non-Coherent Fast Frequency Hop Spread Spectrum.

UNIT-III Binary Shift Register Sequences for Spread Spectrum Systems: Maximal Length Sequences: Properties of m-Sequences, Power Spectrum of m-Sequences, Gold Codes, Code Tracking Loops: Optimum Tracking of Wide Band Signals,

UNIT-IV Synchronization of the Receiver Spreading Code: Problem Definition and the Optimum Synchronizer, Serial Search Synchronization Techniques: Calculation of Mean and Variance of Synchronization Time, Modified Sweep Strategies, Generalized Analysis of Average Synchronization Time, Synchronization Using a Matched Filter.

UNIT-V Fading Channels: Statistical Model of Fading: General Fading Channel Model, WSSUS Fading Channels, Doubly Spread Channels, Requirement for Diversity in Fading Channels: Diversity Approaches, Diversity Combining Methods, Performance of Maximal Ratio Combining, The Rake Receiver.

Text Books:

1. R. L. Peterson, R. Ziemer and D. Borth, “Introduction to Spread Spectrum Communications”, PHI, 1995.
2. Vijay K Garg “IS95 CDMA and CDMA 2000”, Low price Edition, 2002.
3. Rappaport Theodore S, “Wireless Communications Principles and Practice”, 2nd Edition, 2002.

Suggested Reading:

1. J. Viterbi, “CDMA - Principles of Spread Spectrum Communications”, Addison-Wesley, 1997.
2. M. K. Simon, J. K. Omura, R. A. Scholts and B. K. Levitt, “Spread Spectrum Communications Handbook”, McGraw Hill, 1994.
3. G. R. Cooper and C. D. McGillem, “Modern Communications and Spread Spectrum”, McGraw- Hill, 1985

18MB C01

ENGINEERING ECONOMICS AND ACCOUNTANCY

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

This course aims to:

1. To demonstrate the importance of Managerial Economics in Decision Making.
2. To explain the concept of Accountancy and provide basic knowledge on preparation of Final accounts.
3. To understand the importance of Project Evaluation in achieving a firm's Objective.

Course Outcomes:

After completion of the course, student will be able to:

1. Apply fundamental knowledge of Managerial Economics concepts and tools.
2. Analyze various aspects of Demand Analysis, Supply and Demand Forecasting.
3. Understand Production and Cost relationships to make best use of resources available.
4. Apply Accountancy Concepts and Conventions and preparation of Final Accounts.
5. Evaluate Capital and Capital Budgeting decision based on any technique.

Unit-I

Introduction to Managerial Economics

Introduction to Economics and its evolution - Managerial Economics - its Nature and Scope, Importance; Relationship with other Subjects. Its usefulness to Engineers; Basic concepts of Managerial economics - Incremental, Time perspective, Discounting Principle, Opportunity Cost, Equimarginal Principle, Contribution, Negotiation Principle.

Unit-II

Demand and Supply Analysis

Demand Analysis - Concept of Demand, Determinants, Law of demand - Assumptions and Exceptions; Elasticity of demand - Price, Income and Cross elasticity - simple numerical problems; Concept of Supply - Determinants of Supply, Law of Supply; Demand Forecasting - Methods.

Unit-III

Production and Cost Analysis

Theory of Production - Production function - Isoquants and Isocosts, MRTS, Input-Output Relations; Laws of returns; Internal and External Economies of Scale.

Cost Analysis: Cost concepts – Types of Costs, Cost-Output Relationship – Short Run and Long Run; Market structures – Types of Competition, Features, Price Output Determination under Perfect Competition, Monopoly and Monopolistic Competition; Break-even Analysis – Concepts, Assumptions, Limitations, Numerical problems.

Unit-IV

Accountancy

Book-keeping, Principles and Significance of Double Entry Book Keeping, Accounting Concepts and Conventions, Accounting Cycle, Journalization, Subsidiary books, Ledger accounts, Trial Balance concept and preparation of Final Accounts with simple adjustments. Ratio Analysis.

Unit-V

Capital and Capital Budgeting: Capital and its Significance, Types of Capital, Estimation of Fixed and Working capital requirements, Methods and sources of raising finance. Capital Budgeting, Methods: Traditional and Discounted Cash Flow Methods - Numerical problems.

Essential Readings:

1. Mehta P.L., "Managerial Economics: Analysis, Problems and Cases", Sultan Chand & Son's Educational publishers, 2016.
2. Maheswari S.N. "Introduction to Accountancy", Vikas Publishing House, 11th Edition, 2013.
3. Panday I.M. "Financial Management", 11th edition, Vikas Publishing House, 2015.
4. Varshney and K L Maheswari, Managerial Economics, Sultan Chand, 2014.
5. M. Kasi Reddy and S. Saraswathi, Managerial Economics and Financial Accounting, Prentice Hall of India Pvt Ltd, 2007.
6. A. R. Aryasri, Managerial Economics and Financial Analysis, McGraw-Hill, 2013.

18EC C23

DIGITAL SIGNAL PROCESSING LAB

Instruction	2 P Hours per Week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Prerequisite: The knowledge of basics of signals, systems, linear algebra and calculus are required.

Course Objectives:

This course aims to:

1. Simulation of DFT, FFT, Digital filters and multirate concepts using MATLAB.
2. Understand spectral analysis of noisy signals using MATLAB.
3. Implementation of digital filters on DSP Processor.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Illustrate linear convolution and correlation using MATLAB.
2. Design the digital filters using MATLAB.
3. Examine the performance of multirate techniques using MATLAB.
4. Experiment with decimator and interpolator on DSP processor.
5. Implement the digital filters on DSP processor.

List of Experiments

(A) Experiments on signal processing using MATLAB.

1. Basic matrix operations and Generation of test signals.
2. Linear Convolution, circular convolution and Correlation
3. Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT)
4. FIR filter design using different windows
5. IIR filter design: Butter worth, Chebyshev type 1 and 2: LPF, HPF, BPF & BSF filter.
6. Spectral Analysis of noisy signal using Welch's method
7. Interpolation and Decimation
8. Multistage filter
9. Structured enquiry: Hum noise reduction using FIR filter
10. Open ended enquiry: Spectral Analysis of non-stationary signals.

(B) Experiments on DSK and CCS

1. Study of procedure to work in real- time
2. Solutions of difference equations
3. Linear Convolution
4. Implementation of FIR filter
5. Implementation of second order IIR filters
6. Decimation and Interpolation

Note:

1. Minimum of 6 from Part A and 4 from Part B is mandatory.
2. For Part "A", MATLAB with different toolboxes like Signal Processing, Signal Processing block set and SIMULINK/ MATHEMATICA/ any popular software can be used.

Sample Mini Projects

1. Design the best IIR band pass filter to meet the given specifications:
   Pass band cut off frequencies: [500 600] Hz
   Stop band cut off frequencies: [525 675] Hz
   Pass band ripple: < 2dB
   Stop band attenuation: >60dB
   Phase response: Approximately linear in pass band
   Consider Butterworth, Chebyshev, Elliptic and Bessel filters
2. Design the best low pass filter to meet the given specifications:
   Pass band cut off frequency: 1K Hz
   Stop band cut off frequency: 3K Hz
   Pass band ripple: < 2dB
   Stop band attenuation: >80dB
   Group Dealy: < 5ms
   Phase response: Approximately linear in pass band
   Consider FIR and Elliptic filters.
3. Design a three stage multirate filter to meet the given specifications:
   Pass band cut off frequency: 450 Hz
   Stop band cut off frequency: 500 Hz
   Pass band ripple: <3dB
   Stop band attenuation: >40dB
   Sampling frequency: 40 KHz
   Compare with single stage filter.
4. Consider a clean speech signal of length 5000 samples and compute the Power Spectrum. Now add 0dB random noise. Compute the power spectrum using Welch and Eigen value Estimation method and also compare with the original spectrum.

Suggested Reading:

1. Vinay K. Ingle and John G. Proakis, "Digital Signal Processing using MATLAB", 4/e, Cengage learning, 2011.
2. B. Venkataramani and M. Bhaskar, "Digital Signal Processor architecture, programming and application", 6/e, TMH, 2006.

18ECC24

MICROCONTROLLERS LAB

Instruction	2 P Hours per Week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Prerequisite: Basic knowledge of programming in C language.

Course Objectives:

This course aims to:

1. Develop and understand the 8051 and ARM7 C programming
2. Understand the usage of Integrated Development Environment (Keil)
3. Control the operation of various peripherals using 8051 and ARM7 microcontroller

Course Outcomes:

Upon completing this course, students will be able to:

1. Develop the programs of 8051 and ARM using their respective instruction set.
2. Understand the usage of various debugging tools available to program different microcontrollers
3. Build code for 8051 and ARM7 to interface various input/output modules
4. Analyze the hardware and software interaction and integration.
5. Design and develop the 8051 and ARM 7 based embedded systems for various applications

List of Experiments

I. 8051 Programming

1. Familiarity and use of 8051 microcontroller trainer kit, Keil IDE and simple programs under different addressing modes.
2. Assembly programming using instruction set
3. Timer and counter operations and programming using 8051.
4. Interfacing applications using LED, switch, relay and buzzer.
5. Generation of waveforms using DAC by interfacing it with 8051.
6. Stepper motor interfacing.
7. LCD interfacing.
8. Development of Embedded 'C' Code based on the module specifications. (under Structured enquiry)

II. ARM7 Programming

1. Study and use of LPC214x Microcontroller trainer kit and simple programs using its instruction set
2. Interfacing applications using LED, switch, relay and buzzer.
3. DC Motor interfacing.
4. Programming on-chip ADC.
5. Waveform generation using internal DAC.
6. Development of Embedded 'C' Code based on the module specifications. (under Structured enquiry)

III. Design an experiment related to the Embedded Application of your choice using 8051/ARM based architectures. (under Open ended enquiry)

Suggested Reading:

1. Mazidi M.A, Mazidi JG &Rolin D. Mckinlay, "The 8051 Microcontroller & Embedded Systems using Assembly and C", 2/e, Pearson Education, 2007.
2. Philips semiconductors, "ARM 7 (LPC 214x) user manual", 2005.

18ECC25

MICROWAVE ENGINEERING LAB

Instruction	2 P Hours per Week
Duration of *SEE*	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Course Objectives:

This course aims to:

1. To understand the characteristics of Reflex Klystron Oscillator (RKO) and Gunn Oscillator.
2. To learn frequency measurement techniques using cavity wave meters.
3. To determine VSWR for various loads using slotted section.
4. To calculate power ratios at ports of various microwave components.
5. To learn measurement of impedance for various microwave loads.
6. To plot the radiation pattern for an antenna.

Course Outcomes:

Upon completing this course, students will be able to:

1. Examine the characteristics of RKO and Gunn Oscillator.
2. Compare the relation between guide wavelength, free space wavelength and cut off wavelength.
3. Measure VSWR for various loads at microwave frequencies.
4. Estimate the microwave power ratios at various ports of microwave components.
5. Evaluate unknown impedance of various microwave loads.

List of Experiments

1. Characteristics of Reflex Klystron Oscillator- To find the mode numbers and efficiencies of different modes.
2. Characteristics of Gunn diode and Gunn diode oscillator.
3. Measurement of frequency and Guide wavelength: Verification of the relation between guide wavelength, free space wavelength and cut-off wavelength.
4. Measurement of VSWR for the given loads.
5. Measurement of impedance for horn antenna, matched load, slide screw tuner etc.
6. Characteristics of Directional coupler.
7. Characteristics of E-plane, H-plane and Magic Tee.
8. Characteristics of Circulator.
9. Radiation pattern of horn antenna.
10. Study of various antennas like dipoles, loops, Yagi antenna, log periodic antenna and their radiation pattern.
11. Structured enquiry: Calibration of given attenuator using microwave bench in X-band frequency.
12. Open ended enquiry: Measurement of impedance for inductive /capacitive window in X-band frequency.

Sample Mini Projects:

1. To design microwave components such as: Directional couplers, circulators and Hybrid junctions using Simulation software.
2. To design antenna arrays such as: Binomial, Chebyshev, using Simulation software.

References:

1. Department Laboratory Manual.
2. G.S. Raghu Vamsi, “Basic microwave techniques and Laboratory manual", 2nd Edition, New age international publishers, 2009.

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

AICTE Model Curriculum with effect from AY 2021-22

B.E (Electronics and Communication Engineering)

SEMESTER – VII

S. No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1	18ECC26	Computer Networks	3	-	-	3	30	70	3
2	18ECC27	VLSI Design	3	-	-	3	30	70	3
3		Program Elective-IV	3	-	-	3	30	70	3
4		Program Elective-V	3	-	-	3	30	70	3
5		Open Elective-II	3	-	-	3	30	70	3
PRACTICALS									
6	18ECC28	Computer Networks Lab	-	-	2	2	15	35	1
7	18ECC29	Electronic Design and Automation Lab	-	-	2	2	15	35	1
8	18ECC30	Electronics Measurement and Simulation Lab	-	-	2	2	15	35	1
9	18ECC31	Project: Part-1	-	-	4	-	50	-	2
Total			**15**	**-**	**10**	**-**	**245**	**455**	**20**
Clock Hours Per Week: 25									

L: Lecture **D: Drawing** **CIE: Continuous Internal Evaluation**

T: Tutorial **P: Practical/Project Seminar/Dissertation** **SEE: Semester End Examination**

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

AICTE Model Curriculum with effect from AY 2021-22

B.E (Electronics and Communication Engineering)

List of Courses in Program Elective-IV		**List of Courses in Program Elective-V**		**List of Courses in Open Elective-II**	
Course Code	Title of the Course	Course Code	Title of the Course	Course Code	Title of the Course
18ECE15	Cryptography and Blockchain Technology	18ECE20	CMOS RF IC Design	18CE O02	Disaster Mitigation and Management
18ECE16	DSP Processors and Architectures	18ECE21	Digital Image Processing	18ME O04	Entrepreneurship
18ECE17	Principles of Computational Electromagnetics	18ECE22	Embedded Systems	18CS O06	Fundamentals of DBMS
18ECE18	Semiconductor Memory Design and Testing	18ECE23	Software Defined Radio	18IT O02	Python Programming
18EC E19	Speech Processing	18EC E24	5G Communications	18EG O01	Technical Writing Skills

18EC C26

COMPUTER NETWORKS

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: A course on digital communications is required.

Course Objectives:

This course aims to:

1. Understand the division of network functionalities into layers and familiar with the components required to build different types of networks
2. Study the required functionality at each layer
3. Learn the Routing, congestion control algorithms and application layer protocols.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Relate the communication tasks with basic concept of networking, protocols and Service models at different layers.
2. Interpret the principle and function of each layer using protocols and services.
3. Model a network for random accessing to route the packets.
4. Examine the performance of network with routing algorithms and the congestion control approaches.
5. Explain the importance of protocols in each layer and layering concepts.

UNIT-I

Computer Networks and the Internet: Internet, Network Edge: Access Networks and Physical Media, The Network Core: Circuit Switching and Packet Switching, Protocol Layers and Their Service Models.

UNIT-II

Link Layer and Local Area Networks: The Data Link Layer: Introduction, Services. ALOHA, Multiple Access Protocols: Channel portioning protocols, Random access protocols. IEEE 802 standards, Local Area Networks, addressing, Ethernet, Hubs, Switches.

UNIT-III

Network Layer and Routing: Introduction, Virtual circuit and Datagram networks, Router, Internet Protocol, Routing algorithms, Broadcast and Multicast routing.

UNIT-IV

Transport Layer: Introduction and Transport layer services. Connectionless transport - User Datagram Protocol, Connection-oriented transport – Transmission Control Protocol.

Principles of Congestion Control: The causes and cost of congestion Control, Approaches to congestion Control.

UNIT-V

Application Layer: Principles of network applications, The Web and Hyper Text Transfer Protocol, File transfer, Electronic mail, Domain name system, Peer-to-Peer file sharing, Socket programming, Layering concepts.

Text Books:

1. J.F. Kurose and K. W. Ross, "Computer Networking – A top down approach featuring the Internet", Pearson Education, 3rd Edition, 2005.
2. Andrew Tanenbaum and D. Wetherall, "Computer networks", 5thEdition, Prentice-Hall, 2011
3. William Stallings, "Data and computer communications", Prentice Hall, 8th Edition,2007.

Suggested Reading:

1. B. A. Forouzan, "Data Communications and Networking", Tata McGraw Hill, 4th Edition,2007.
2. S. Keshav, "An Engineering Approach to Computer Networking", Pearson Education, Second Edition, 2001.
3. L. Peterson and B. Davie, "Computer Networks – A Systems Approach", Elsevier Morgan Kaufmann Publisher, 5th Edition, 2011.

18EC C27

VLSI DESIGN

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: A prior knowledge of Verilog HDL and MOS Transistor Theory.

Course Objectives:
This course aims to:
1. Study the concepts of Verilog HDL, simulation and synthesis process/concepts.
2. Learn the various characteristics of MOS transistor, process steps in IC fabrication.
3. Learn the various concepts required to obtain the digital logic layout diagrams. To know various subsystem design concepts.

Course Outcomes:
Upon completion of this course, students will be able to:
1. Model a digital design using Advanced Verilog HDL constructs.
2. Analyse the characteristic behaviour of MOSFET and discuss CMOS circuit Design Process
3. Explain various process steps involved in IC fabrication.
4. Design various NMOS and CMOS based logic circuits.
5. Discuss the concepts of subsystem designs and Testing.

UNIT-I
Advanced Verilog HDL: Review of behavioural modelling**.** Functions and tasks Switch level Modelling, UDP, Design of Mealy and Moore state models using Verilog, Logic Synthesis, Synthesis Design flow, Gate level Netlist.

UNIT–II
Introduction to MOS Technology, Basic MOS Transistor action: Enhancement and Depletion Modes. Basic electrical properties of MOS, Threshold voltage and Body Effect.
MOS and CMOS circuit Design Process: MOS Layers, Stick diagrams, Lambda based Design rules and Layout diagrams.

UNIT–III
Process steps in IC fabrication Crystal growth and wafer preparation- Czochralski process- apparatus- silicon shaping, slicing and polishing- Diffusion, Ion implantation- Annealing process- Oxidation process- Lithography- Photolithography, electron beam and x-ray lithography- Chemical vapour deposition (CVD)- epitaxial growth- reactors- metallisation and packaging.

UNIT–IV
Design of MOS inverters with different loads. Basic Logic Gates with CMOS: INVERTER, NAND, NOR, AOI and OAI gates. Transmission gate logic circuits, BiCMOS inverter, D flip flop using Transmission gates.

UNIT–V
Subsystem Design: Multiplexor, Comparator, Shifters, Programmable Logic Arrays. Memories: 1T, 3T Dynamic RAM Cell, 6T Static RAM Cell. NOR and NAND based ROM Memory Design.
Testing: Introduction to Testing, Fault models, Controllability, Observability.

Text Books:
1. Samir Palnitkar, "Verilog HDL: A guide to Digital design and synthesis", 2/e, Pearson Education, 2008.
2. Kamran Eshraghian, Douglas A. Pucknell, Sholeh Eshraghian, "Essentials of VLSI circuits and systems", PHI, 2011.
3. Neil H E Weste, David Harris, Ayan Banerjee "CMOS VLSI Design –A circuit and System Perspective", 3/e, Pearson Education, 2006.
4. S. M. Sze, VLSI Technology, McGraw-Hill, 2nd Edition, 1988.

Suggested Reading:
1. Michael D. Ciletti, "Advanced Digital Design with Verilog HDL", PHI, 2005.
2. John P. Uyemura, "Introduction to VLSI Circuits and systems", John Wiley & Sons, 2011.
3. Sung-Mo Kang & Yusuf Leblebici, CMOS Digital Integrated Circuits Analysis and Design, McGraw-Hill, 1998.

18EC E15

CRYPTOGRAPHY AND BLOCKCHAIN TECHNOLOGY

(Program Elective-IV)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Data Structures and Algorithms, Introduction to Programming.

Course Objectives:

This course aims to:

1. Provide conceptual understanding of basic concepts of cryptography.
2. Describes the Blockchain technology and its applications.
3. Introduce cryptocurrency transactions using Blockchain technology.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Comprehend the key concepts of fundamental cryptography techniques which are required for Blockchain Technology.
2. Describe the key concepts and compare various models of Blockchain Technology.
3. Understand consensus mechanism in Blockchain.
4. Acquire knowledge regarding cryptocurrency transactions and their validation.
5. Apply the concepts of Blockchain technology in real world scenario.

Unit-I

Overview of Cryptography: Introduction to Cryptography, History and development of cryptography; Cryptanalysis; Classical cryptosystems: shift, substitution and Vigenere ciphers; Attacks on shift, substitution and Vigenere ciphers; Designing a provably secure system, One -Time pads.

Basic Crypto Primitives: Cryptographic Hash Function, Properties of a hash function, Hash pointer and Merkle tree, Digital Signature, Public Key Cryptography: RSA Algorithm, Elliptical Curve Cryptography, A basic Cryptocurrency and example.

Unit-II

Introduction to Blockchain Technology:

Introduction to client-server architecture, distributed computing and their limitations. Evolution of Blockchain and how it is changing the landscape of digitalization, Block in a Blockchain, Working principles of blockchain technology.

Types of Blockchain: Public, Private and Consortium, Permissioned Model of Block chain, Public Ledgers, Smart Contracts, Transactions, Mining Mechanism, Consensus.

Unit-III

Introduction to digital wallet and types of wallets: Desktop, mobile and Meta mask/Browser based wallets.

Introduction to Bitcoin Blockchain, Working with Consensus in Bitcoin**:** Distributed consensus in open environments, Consensus in a Bitcoin network, Proof of Work (PoW), HashcashPoW, Bitcoin PoW, Attacks on PoW and the monopoly problem, Proof of Stake, Proof of Burn and Proof of Elapsed Time, The life of a Bitcoin Miner, Mining Difficulty, Mining Pool.

Unit-IV

Bitcoin versus Ethereum, Ethereum and Smart Contracts, The Turing Completeness of Smart Contract Languages and verifications, using smart contracts to enforce legal contracts, Introduction to Hyperledger and Truffle.

Unit-V

Applications: Blockchain Technologies for IoT, Supply Chain Management in Agriculture using Blockchain and IoT.

Suggested Books

1. Paar Christof, Pelzl Jan, "Understanding Cryptography A Textbook for Students and Practitioners", Springer, 2010.
2. Joseph J. Bambara, Paul R. Allen, “Blockchain A Practical Guide to Developing Business, Law, and Technology Solutions”, 1st Edition, Mc. Graw Hill, 2018.
3. Daniel Drescher, “Block Chain Basics”, Apress; 1st edition, 2017.
4. Shiho Kim, Ganesh Chandra Deka, "Advanced Applications of Blockchain Technology", Springer, 2020.

Additional Reading

1. Imran Bashir, “Mastering Block Chain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained”, Packt Publishing, 2018.
2. Ritesh Modi, “Solidity Programming Essentials: A Beginner’s Guide to Build Smart Contracts for Ethereum and Block Chain”, Packt Publishing, 2018.

18EC E16

DSP PROCESSORS AND ARCHITECTURES

(Program Elective-IV)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Knowledge of Digital Signal Processing**.**

Course Objectives:

This course aims to:

1. Learn the architectural differences between DSP and General-purpose processor.
2. Study the fixed point.
3. Study the various applications of DSP Processors.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Classify the differences between DSP Processor and General-Purpose processor.
2. Understand the basic architectural needs of Programmable DSPs
3. Explain the architecture features of TMS320C55XX processor.
4. Develop on interface with TMS320C55XX processor to external peripherals.
5. Design and implement of various signal processing algorithms using 55xx processor.

UNIT- I

Introduction to DSP Processors: Differences between DSP and other microprocessor architectures. Number formats- Fixed point, Floating point and block Floating point formats, IEEE-754 Floating point, Dynamic range and precision, Relation between data word size and instruction word size, Q-notation. Basic elements of real time DSP systems, DSP Hardware

UNIT-II

Fundamentals of Programmable DSPs: Multiplier and Multiplier Accumulator, Modified Bus structures and memory access in PDSPs – Multiple access memory, multiport memory, SIMD, VLIW Architectures, Pipelining, Special addressing modes in PDSPs, On-chip peripherals.

UNIT-III

Overview of TMS320C55X: Architecture of TMS320C55X Processor, Buses, Memory map, addressing modes, Instruction set, Pipeline and parallelism, Mixed C and Assembly language programming and on-chip peripherals.

UNIT-IV

Interfacing Memory and Parallel I/O Peripherals to Programmable DSP Devices: Memory space organization, External bus interfacing signals, Memory interface, Parallel I/O interface, Programmed I/O, Interrupts and I/O, Direct Memory Access (DMA). Software Development Tools-Code Composer Studio (CCS), C compiler, Assembler and Linker.

UNIT-V

Application Programs: Implementation of algorithms on DSP processors – Sine wave generators, Convolution, Correlation, FFT, FIR filter, IIR filter, Decimation and Interpolation and sub band coding of signals.

Text Books:

1. Sen M. Kuo and WoonSergGan, "Digital Signal Processors Architectures, Implementation and Application", Pearson Practice Hall, 2013.
2. Avatar Singh and S. Srinivasan, "Digital Signal Processing Implementations Using DSP Microprocessors", Thomson Brooks, 2012.

Suggested Reading:

1. B.Ventakaramani, M. Bhaskar, "Digital Signal Processors Architecture Programming and Applications", Tata McGraw Hill, 10th reprint,2015.
2. RulphChassaing, "Digital Signal Processing and Application with the C6713 and C6416 DSK", A John Wiley & sons, Inc, Publication,2005.
3. Sen M. Kuo, Bob H. Lee, Wenshun Tian, "Real Time Digital Signal Processing: Implementations and Applications", Second Edition, John Wiley and sons ltd, 2006.

18ECE17

PRINCIPLES OF COMPUTATIONAL ELECTROMAGNETICS

(Program Elective-IV)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Student must have completed a course on Electromagnetic waves and transmission lines.

Course Objectives:

This course aims to:

1. Learn the fundamental concepts of computational electromagnetics
2. Understand variational methods for simplifying the integral/differential equations.
3. Study MoM and FEM for solving static and scatter problems.

Course Outcomes:

Upon completing this course, students will be able to:

1. Understand the basic concepts of computational Electromagnetics
2. Interpret the variational methods.
3. Apply the process of moment methods using appropriate weighing functions
4. Devise Quasi Static, Scattering and Radiation problems using Method of Moments.
5. Solve the Laplace's equation, Poisson's equation and wave equations using finite element methods.

UNIT-I

Analytical methods and numerical methods; Low frequency and high frequency methods; Full-wave Electromagnetics; Frequency versus Time domain methods, Differential versus Integral equation methods. Time varying potentials, time harmonic fields and boundary conditions.

UNIT-II

Variational Methods: Introductions, Operators in Linear Spaces, Calculus of Variations, Construction of Functionals from PDEs, Rayleigh-Ritz Method, Galerkin's Method.

UNIT-III

Moment Methods: Introduction, Differential Equations, Integral Equations, Differential and Integral Equations, Greens Functions.

UNIT- IV

Applications of Moment Method: Quasi Static Problems and Scattering Problems, Radiation Problems: Hallen's and Pocklington's Equations.

UNIT-V

Finite Element Method: Introduction, Solution for Laplace's Equations, Poisson's Equation and Wave equation. Automatic Mesh generation: Rectangular Domains.

Text Book:

1. Matthew N.O.Sadiku, "Computational Electromagnetics with MATLAB", CRC Press, Taylor &Francis Group, Fourth Edition, 2019.

Suggested Reading:

1. C A Balanis, "Advanced Engineering Electromagnetics", John Wiley & Sons, Inc, 2nd Edition, 2012.

2. Walton C. Gibson, "The Method of Moments in Electromagnetics", Champan&Hall/CRC Taylor & Francis Group, Second Edition, 2014.

18EC E18

SEMI CONDUCTOR MEMORY DESIGN AND TESTING

(Program Elective-IV)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Student is expected to have knowledge of digital circuits.

Course Objectives:

This course aims to:

1. Explain the structure and working of, basic SRAM and DRAM cell built using MOSFET, and Bipolar transistors.
2. Teach various techniques used for testing semiconductor memories.
3. Familiarize students with advanced Semiconductor memory technologies and High-Density packaging technologies.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Comprehensive Understanding of Static Random-Access Memory (SRAM) and Dynamic Access Memory (DRAM).
2. Design of Non-Volatile Memory Architectures and their future comparison.
3. Applying the memory Fault modelling and memory for testability.
4. Analyze the Memory Fault Modelling, Testing of memory design.
5. Enhance the advanced memory technologies and packaging technologies.

UNIT- I

Random Access Memory Technologies: SRAM – SRAM Cell structures, MOS SRAM Architecture, MOS SRAM Cell and peripheral circuit operation, Bipolar SRAM technologies, SOI technology, Advanced SRAM architectures and technologies, Application specific SRAMs. DRAM – DRAM technology development, CMOS DRAM, DRAM Cell theory and advanced cell structures, BiCMOS DRAM, advanced DRAM design and architecture, application specific DRAMs.

UNIT-II

Non-Volatile Memories: Masked ROMs, High density ROM, PROM, Bipolar121 ROM, CMOS PROMS, EPROM, Floating gate EPROM cell, One-time programmable PROM, EEPROM, EEPROM technology and architecture, Non - volatile SRAM, Flash Memories (EPROM or EEPROM), advanced Flash memory architecture.

UNIT- III

Memory Fault Modelling Testing and Memory Design for Testability and Fault Tolerance: RAM Fault modelling, Electrical testing, Pseudo Random testing, Megabit DRAM Testing, non-volatile memory modelling and testing, IDDQ fault modelling and testing, Application specific memory testing, RAM fault modelling, BIST techniques for memory.

UNIT-IV

Semiconductor Memory Reliability and Radiation Effects: General reliability issues, RAM failure modes and mechanism, Non-volatile memory reliability, reliability modelling and failure rate prediction, Design for Reliability, Reliability Test Structures, Reliability Screening and qualification, Radiation effects, Single Event Phenomenon (SEP), Radiation Hardening techniques, Radiation Hardening Process and Design Issues ,Radiation Hardened Memory characteristics, Radiation Hardness Testing.

UNIT-V

Advanced Memory Technologies and High-Density Memory Packing Technologies: Ferroelectric RAM^{s} (FRAMs), GaAs FRAMs, Analog memories, magneto resistive RAMs (MRAMs), Experimental memory devices, Memory Hybrids and MCMs (2D), Memory MCM testing, High Density Memory Packaging Future Directions

Text Books:

1. Ashok K.Sharma, "Semiconductor Memories Technology", Wiley, 2002.
2. Chenming C Hu, "Modern Semiconductor Devices for Integrated Circuits", Prentice Hall, 1st edition, 2010.

Suggested Reading:

1. Ashok Sharma, "Advanced Semiconductor Memories – Architecture, Design and Applications", Wiley, 2002.
2. Jack Luecke, William N.Carr, "Semiconductor memory design and Applications", Mc. GrawHill, Inc., US,1974.

18ECE19

SPEECH PROCESSING

(Program Elective-IV)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: The student should have knowledge of digital signal processing.

Course Objectives:

This course aims to:

1. Provide students with the knowledge of basic characteristics of speech signal in relation to production and hearing of speech by humans.
2. Describe basic algorithms of speech analysis and pitch extraction.
3. Learn the various algorithms for speech recognition like HMM and Dynamic warping.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Understand the basic characteristics of speech signal in relation to production and hearing of speech by humans.
2. Analyze speech and extract features for speech applications.
3. Design the various applications like recognition, synthesis, and coding of speech.
4. Make use of HMM for speech recognition.
5. Implement dynamic warping technique in real time problems.

UNIT – I

Fundamentals of Digital Speech Processing: Discrete time signals and systems, Transform representation of signals and systems (Z-transform, FT and DFT), fundamentals of digital filters (IIR and FIR), Sampling theorem. Decimation and interpolation of sampled waveforms, Mechanism of speech production: Vocal track and physiology.

UNIT - II

Time Domain Models of Speech processing: Time dependent processing of speech, Short –time Energy and average magnitude, short time average Zero crossing rate, Speech versus Silence Discrimination using Energy and Zero crossing, Pitch period estimation, short time auto correlation estimation, Short time average magnitude difference function, median smoothing and speech processing.

UNIT – III

Digital Representation of the Speech Waveform: Sampling speech signals, review of statistical model of speech signal, Instantaneous Quantization, Adaptive Quantization, Differential quantization. Qualitative treatment for Delta modulation and Differential PCM. Comparison of systems, LDM to PCM conversion and PCM to ADPCM conversion.

UNIT-IV

Homomorphic Speech Processing: Introduction, Homomorphic systems for convolution - properties of the complex Cepstrum, computational considerations, complex cepstrum of speech, Pitch detection, Formant estimation, The homomorphic Vocoder. Introduction to Text-to-speech and Articulator speech synthesis.

UNIT-V

Linear Predictive Analysis: Solution of the LPC equations, Comparisons between the methods of the solutions of LPC Analysis equations, Frequency Domain of LPA, Applications of the LPC parameters Speaker recognition systems, Problems in Automatic speech recognition, Dynamic warping, Hidden Markow models, speaker Identification / verification.

Text Books

1. Rabiner L.R and Schafer R. W, "Digital Processing of Speech Signals", PHI,1978.
2. Owens F.J., "Signal Processing of Speech", Macmillan, New Electronics, 1/e,2000.

Suggested Reading:

1. Daniel Jurefsky and James H. Martin, "Speech and Language Processing", PHI, 2/e, 2003.
2. Papamchalis, "Practical Approaches to speech coding", PHI, 1987.
3. Rabiner and Bernard Gold, "Theory and Application of Digital Signal Processing", 2nd edition, PHI, 1988.

18ECE20

CMOS RF IC DESIGN

(Program Elective-V)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Student should have knowledge on analog circuits and communication systems.

Course objectives:

This course aims to:

1. Understand the applications of transistor as a switch and an amplifier.
2. Analyse the BJT and FET in various configurations using small signal equivalent models.
3. Know the concept and frequency response of various amplifiers.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Define the characteristics RF systems, Tuned circuits, LNA, Mixers.
2. Understand the behaviour of RF systems, Reflection Coefficient and Noise in RF Systems.
3. Apply the concepts of noise and reflection coefficient to characterize RF Systems.
4. Analyse different Wideband Amplifies, LNA, Mixers and Power Amplifiers.
5. Design and Development of LNA, Power amplifier, PLL.

UNIT-I

RF Tuned Circuits: RF systems: Basic architectures, Maximum Power Transfer, Passive RLC Networks, Parallel RLC tank, Q, Series RLC networks, Matching: Pi match and T match. Passive components in IC: Resistors, capacitors, Inductors, Transceiver Architectures

UNIT-II

Nonlinearity and Reflection Coefficient: Nonlinearity and Time Variance of system, Sensitivity and Dynamic range, Review of MOS Device Physics, MOS device review, Distributed Systems, Transmission lines, reflection coefficient, the wave equation Lossy transmission lines, Smith charts – plotting gamma, Noise in FET: Thermal noise, flicker noise review.

UNIT-III

High Frequency Amplifier Design: High Frequency Amplifier Design: Bandwidth estimation using open-circuit time constants, Bandwidth estimation using short-circuit time constants, bandwidth, Zeros to enhance bandwidth, Shunt-series amplifiers, Noise figure, Intrinsic MOS noise parameters, LNA Design, Power match versus noise match

UNIT-IV

RF Power Amplifiers: Multiplier based mixers, Sub-sampling mixers & Mixer Design, Classification of mixers, double balanced mixer, passive mixer, Introduction to RF Power Large signal performance Amplifier.

UNIT-V

PLL: Voltage controlled oscillators, Resonators, Negative resistance oscillators, Phase locked loops, Linearized PLL models, Phase detectors, charge pumps, Loop filters, PLL design examples, Frequency synthesis and oscillator Frequency division, integer-N, Synthesis Fractional frequency synthesis.

Text Books:

1. Thomas H. Lee, "The Design of CMOS Radio-Frequency Integrated Circuits", Cambridge University Press, 2004.
2. Behzad Razavi, "RF Microelectronics", Prentice Hall, 1997.

Suggested Reading:

1. Steve C.Cripps, "RF Amplifiers power for wireless communications", Artech House, 2nd edition, 2006.
2. Peter Staric and Erik Margan, "Wide band amplifiers", Springer Publications, ISBN -13 978-0-387-28431-8.
3. Wladyslaw Grabinski, BartNauwelaers, Dominique Schreurs "Transistor level modeling for Analog/RF IC Design", Spriger Publications

18EC E21

DIGITAL IMAGE PROCESSING

(Program Elective-V)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

This course aims to:

1. Understand the image formation and its digital representation.
2. Learn representation of images in frequency domain and enhancement techniques.
3. Students would be able to solve the problems related to image compression and restoration.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Describe basic concepts of image processing system.
2. Summarize and compare various digital image transform techniques.
3. Demonstrate and survey digital image enhancement in practical applications.
4. Analyse the case study related to various techniques of image restoration.
5. Apply compression techniques on digital image.

UNIT – I

Elements of Digital Image Processing Systems, Digital image representation, elements of visual perception, Image sampling and Quantization, Basic Relationships between pixels.

UNIT – II

Properties and Applications of Fourier Transform: FFT, Discrete cosine transform, Hadamard transform, Haar transform, Slant transform, DWT and Hotelling transform.

UNIT – III

Spatial Enhancement Techniques: Histogram equalization, direct histogram specification, Local enhancement. Frequency domain techniques: Low pass, High pass and Homomorphic Filtering, Image Zooming Techniques.

UNIT – IV

Image Degradation model, Algebraic approach to restoration, inverse filtering, Least mean square filter, Constrained least square restoration and interactive restoration. Speckle noise and its removal techniques.

UNIT – V

Redundancies for image compression, Huffman Coding, Arithmetic coding, Bit- plane coding, loss less and lossy predictive coding. Transform coding techniques: Zonal coding and Threshold coding.

Text Books:

1. Gonzalez R.C. and Woods R.E., “Digital Image Processing” 2/e, PHI, 2005.
2. A.K.Jain, “Fundamentals of Digital Image processing”, PHI, 1989.

Suggested Reading:

1. Madhuri A, Joshi, “Digital Image Processing: An algorithmic Approach”, PHI, 2006.
2. U Qidwai, C.H.Chen, “Digital Image Processing”, CRC Press, (Taylor & Francis), Yesdee Publications, First Indian Reprint 2013.
3. S.Jayaraman, S.Esakkirajan and T.Veerakumar, "Digital Image Processing", Tata McGraw Hill publishers, 2009

18ECE22

EMBEDDED SYSTEMS

(Program Elective-V)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisites: Computer Architecture, Microprocessors and Microcontrollers.

Course Objectives:

This course aims to:

1. Learn about fundamentals of the embedded systems
2. Understand the hardware and software details of the embedded systems.
3. Acquire knowledge on the serial, parallel and network communication protocols.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Understand the fundamentals of the embedded systems
2. Analyze the hardware and software details of the embedded systems.
3. Design interfacing of the systems with other data handling / processing systems.
4. Evaluate the performance of an embedded system using various debugging tools.
5. Apply embedded design approach for various applications.

UNIT – I

Introduction to Embedded Systems: Embedded systems versus General Computing Systems, History of embedded systems, classifications, applications areas, characteristics and quality attributes of embedded systems, Design metrics and challenges in embedded system design.

UNIT – II

Embedded Hardware and Software: Processor embedded into a system, Processor selection for embedded system, embedded hardware units and devices in a system, embedded software in a system and an overview of programming languages, challenges and issues related to embedded software development.

UNIT – III

Communication Protocols: I^2C, CAN, Firewire-IEEE 1394 Bus standard, advanced serial high-speed buses. Parallel Bus device protocols: ISA, PCI, PCI-X, Internet Enabled Systems-Network protocols: Ethernet.

UNIT – IV

Embedded Software Development Process: Embedded System design and co-design issues in system development process, Design cycle in the development phase for an Embedded Systems. Embedded software development tools: Host and Target Machines, Linker/Locators for embedded software, Embedded Software into the Target system. Issues in hardware and software design and co-design

UNIT – V

Testing, Debugging Techniques and Applications: Integration and testing of embedded hardware, testing methods, debugging techniques, Laboratory tools and target hardware debugging: Logic Analyzer, simulator, emulator and In-circuit emulator, IDE Case Study: Embedded Systems design for automatic vending machines and digital camera.

Text Books:

1. Raj Kamal, "Embedded Systems-Architecture, Programming and Design",3/e, McGraw Hill Education,2015.
2. J.W. Valvano, "Embedded Microcomputer System: Real Time Interfacing", Brooks/Cole, 2000.

Suggested Reading:

1. Shibu K V, "Introduction to Embedded systems", 1/e McGraw Hill Education,2009.
2. David E.Simon, "An Embedded software primer", Pearson Education,2004.

18EC E23

SOFTWARE DEFINED RADIO

(Program Elective-V)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: The students should have the knowledge of analog and digital communications.

Course Objectives:

This course aims to:

1. Make the students understand the differences between Super-heterodyne Radio, Software Defined Radio and Cognitive Radio.
2. Give the Knowledge to students about FPGA based architectures and processors with low power consumption.
3. Understand the single node Cognitive radio techniques and basics of Co-operative Spectrum sensing and the applications of CR.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Understand and compare the Super-heterodyne receiver, SDR and CR.
2. Analyze the basic architecture of SDR
3. Determine the processor based on the application.
4. Evaluate and choose the various spectrum sensing methods based on application.
5. Choose the USRP and WARP boards based on the facilities required for a SDR application.

UNIT-I

Introduction to SDR

What is Software-Defined Radio, The Requirement for Software-Defined Radio, Legacy Systems, The Benefits of Multi-standard Terminals, Economies of Scale, Global Roaming, Service Upgrading, Adaptive Modulation and Coding, Operational Requirements, Key Requirements, Reconfiguration Mechanisms, , Handset Model, New Base-Station and Network, Architectures, Separation of Digital and RF, Tower-Top Mounting, BTS Hoteling, Smart Antenna Systems, Smart Antenna System Architectures, Power Consumption Issues, Calibration Issues, Projects and Sources of Information on Software Defined Radio.

UNIT-II

Basic Architecture of a Software Defined Radio

Software Defined Radio Architectures, Ideal Software Defined Radio Architecture, Required Hardware Specifications, Digital Aspects of a Software Defined Radio, Digital Hardware, Alternative Digital Processing Options for BTS Applications, Alternative Digital Processing Options for Handset Applications, Current Technology Limitations, A/D Signal-to-Noise Ratio and Power Consumption, Derivation of Minimum Power Consumption, Power Consumption Examples.

UNIT-III

Signal Processing Devices and Architectures

General Purpose Processors, Digital Signal Processors, Field Programmable Gate Arrays, Specialized Processing Units, Tilera Tile Processor, Application-Specific Integrated Circuits, Hybrid Solutions, Choosing a DSP Solution, Comparison of all processors.

UNIT-IV

Cognitive Radio: Techniques and Signal Processing

History and background, Communication policy and Spectrum Management, Cognitive radio cycle, Cognitive radio architecture, SDR architecture for cognitive radio, Spectrum sensing Single node sensing: energy detection. Introduction and challenges of Co-operative spectrum sensing.

UNIT-V

Cognitive Radio: Hardware and Applications

Spectrum allocation models. Spectrum handoff, Cognitive radio performance analysis. Hardware platforms for Cognitive radio (USRP, WARP), details of USRP board, Applications of Cognitive radio.

Text books:

1. Eugene Grayver, "Implementing Software Defined Radio", Springer, New York Heidelberg Dordrecht London, ISBN 978-1-4419-9332-8 (eBook) 2013.
2. Bruce A. Fette, "Cognitive Radio Technology", Elsevier, ISBN 10: 0-7506-7952-2, 2/e, 2006.

Suggested Reading:

1. Peter B. Kenington, "RF and Baseband Techniques for Software Defined Radio", Artech House Publishers, Inc © 2005.
2. HüseyinArslan, "Cognitive Radio, Software Defined Radio and Adaptive Wireless Systems", Springer, ISBN 978-1-4020-5541-6 HB, 2007.

18EC E24

5G COMMUNICATIONS

(Program Elective-V)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Knowledge of Mobile Cellular Communication.

Course Objectives:

This course aims to:

1. Understand the requirements & concepts of 5G.
2. Expose the architecture and radio access technologies of 5G.
3. Learn Massive MIMO concepts.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Recall the requirements and used cases of 5G technology.
2. Illustrate the architecture of 5G.
3. Apply the 5G concepts to D2D communications.
4. Compare various Radio-Access Technologies.
5. Explain the concept of massive MIMO.

Unit-I

Overview of 5G: An Overview of 5G Requirements, 5G frequency bands: below 6GHz and above 6GHz, Spectrum Sharing for 5G: Introduction, Spectrum sharing scenario. Use cases and requirements: Autonomous vehicle control, Emergency communication, High-speed train, Shopping mall, Stadium, Smart city. 5G system concept: Extreme mobile broadband, Massive machine-type communication, Ultra-reliable machine-type communication.

Unit-II

5G Architecture: Introduction: NFV and SDN. Basics about RAN architecture, High-level requirements for the 5G architecture. Functional architecture and 5G flexibility: Functional split criteria, Functional split alternatives, Functional optimization for specific applications, Integration of LTE and new air interface to fulfill 5G requirements, Enhanced Multi-RAT coordination features. Physical architecture and 5G deployment: Deployment enablers, Flexible function placement in 5G deployments.

Unit-III

Device-to-device (D2D) communications: D2D: from 4G to 5G. Radio resource management for mobile broadband D2D.Multi-hop D2D communications for proximity and emergency services. Multi-operator D2D communication.

Unit - IV

5G Radio-Access Technologies: Access design principles for multi-user communications, Multi-carrier with filtering: a new waveform, Non-orthogonal schemes for efficient multiple access: NOMA, SCMA & IDMA. Radio access for dense deployments, Radio access for V2X communication, Radio access for massive machine-type communication.

Unit-V

Massive Multiple-Input Multiple-Output (MIMO) Systems: Introduction, Theoretical background: single user and multi-user MIMO, capacity of massive MIMO, Resource allocation and transceiver algorithms for massive MIMO, Fundamentals of baseband and RF implementations in massive MIMO.

Text Books:

1. Wei Xiang, Kan Zheng, Xuemin (Sherman) Shen, "5G Mobile Communications", Springer publications-2016.
2. Afif Osseiran, Jose F. Monserrat, Patrick Marsch, "5G Mobile and Wireless Communications Technology" Cambridge University Press-2016.

Suggested Reading:

1. Jonathan Rodriguez, "Fundamentals of 5G Mobile Networks" first edition, John Wiley & Sons, 2015.
2. Saad Z. Asif, "5G Mobile Communications Concepts and Technologies" CRC Press, 2019.
3. Angeliki Alexiou, "5G Wireless Technologies", IET Publications, 2017.

18CE O02

DISASTER MITIGATION AND MANAGEMENT

(Open Elective-II)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

This course aims to:

1. Equip the students with the basic knowledge of hazards, disasters, risks and vulnerabilities.
2. Impart knowledge in students about the nature, causes, consequences and mitigation measures of the various Hydro-meteorological disasters.
3. Introduce the concepts of causes, consequences and mitigation measures of the various Geographical disasters.
4. Enable the students to understand risks, vulnerabilities and human errors associated with human induced disasters.
5. Equip the students with the knowledge of the impacts of disaster, chronological phases in a disaster management cycle and to create awareness about the disaster management framework and legislations in the context of Central and State Level Authorities.

Course Outcomes:

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

1. Identify and understand the fundamental terminologies in disaster management.
2. Distinguish between the Hydro-meteorological disasters and apply the concepts of structural and non- structural mitigation measures.
3. Categorize different Geographical Disasters and apply the knowledge in utilizing the early warning systems.
4. Analyze various mechanisms and consequences of human induced disasters.
5. Develop an awareness of disaster management phases and formulating effective disaster management plans, ability to understand various participatory roles of stakeholders- Central and State Government bodies at different levels.

UNIT- I:

Introduction: Basic definitions- Hazard, Disaster, Vulnerability, Risk, Resilience, Mitigation, Management; classification of types of disaster- Natural and man-made; International Decade for natural disaster reduction (IDNDR); International strategy for disaster reduction (ISDR), National disaster management authority (NDMA).

UNIT- II:

Natural Disasters: Hydro meteorological disasters: Causes, Early warning systems- monitoring and management, structural and non-structural measures for floods, drought and Tropical cyclones; Geographical based disasters: Tsunami generation, causes, zoning, Early warning systems- monitoring and management, structural and non-structural mitigation measures for earthquakes, tsunami, landslides, avalanches and forest fires. Case studies related to various hydro meteorological and geographical based disasters.

UNIT- III:

Human Induced Hazards: Chemical disaster- Causes, impacts and mitigation measures for chemical accidents, Risks and control measures in a chemical industry, chemical disaster management; Case studies related to various chemical industrial hazards eg: Bhopal gas tragedy; Management of chemical terrorism disasters and biological disasters; Radiological Emergencies and case studies; Case studies related to major power break downs, fire accidents, traffic accidents, oil spills and stampedes, disasters due to double cellar construction in multistoried buildings.

UNIT- IV:

Disaster Impacts: Disaster impacts- environmental, physical, social, ecological, economical, political, etc.; health, psycho-social issues; demographic aspects- gender, age, special needs; hazard locations; global and national disaster trends; climate change and urban disasters.

UNIT- V:

Concept of Disaster Management: Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; risk analysis, vulnerability and capacity assessment; Post-disaster environmental response- water, sanitation, food safety, waste management, disease control; Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programmes in India and the activities of National Disaster Management Authority.

Text Books:

1. Pradeep Sahni," Disaster Risk Reduction in South Asia", Prentice Hall, 2003.
2. B. K. Singh," Handbook of Disaster Management: techniques & Guidelines", Rajat Publication, 2008.

Suggested Reading:

1. Ministry of Home Affairs". Government of India, "National disaster management plan, Part I and II",
2. K. K. Ghosh," Disaster Management", APH Publishing Corporation, 2006.
3. http://www.indiaenvironmentportal.org.in/files/file/disaster_management_india1.pdf
4. http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of Home Affairs)
5. Hazards, Disasters and your community: A booklet for students and the community, Ministry of home affairs.

18ME O04

ENTREPRENEURSHIP

(Open Elective-II)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

This course aims to:

1. Concept and procedure of idea generation.
2. The nature of industry and related opportunities and challenges.
3. Elements of business plan and its procedure.
4. Project management and its techniques.
5. Behavioral issues and Time management.

Course Outcomes:

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

1. Understand the concept and essence of entrepreneurship.
2. Identify business opportunities and nature of enterprise.
3. Analyze the feasibility of new business plan.
4. Apply project management techniques like PERT and CPM for effective planning and execution of projects.
5. Use behavioural, leadership and time management aspects in entrepreneurial journey

UNIT-I

Entrepreneurship: Definition, functions of entrepreneurship, qualities of entrepreneurs, identification and characteristics of entrepreneurs, entrepreneur vs. intrapreneur, first generation entrepreneurs, women entrepreneurs, conception and evaluation of ideas and their sources.

UNIT-II

Indian industrial environment: Competence, opportunities and challenges, entrepreneurship and economic growth, small scale industry in India, objectives, linkage among small, medium and heavy industries, types of enterprises, corporate social responsibility.

UNIT-III

Business plan: Introduction, elements of business plan and its salient features, business model canvas, technical analysis, profitability and financial analysis, marketing analysis, feasibility studies, executive summary, selection of technology and collaborative interactions.

UNIT-IV

Project Management: During construction phase, project organization, project planning and control using CPM, PERT techniques, Human aspects of project management, Assessment of tax burden

UNIT-V

Behavioral Aspects of Entrepreneurs: Personality, determinants, attributes and models, Leadership concepts and models, Values and attitudes, Motivation aspects, Time Management: Approaches of time management, their strengths and weaknesses. Time management matrix and the urgency addiction.

Text Books:

1. Vasant Desai, "Dynamics of Entrepreneurial Development and Management", Himalaya Publishing House, 1997.
2. Prasanna Chandra, "Project-Planning, Analysis, Selection, Implementation and Review", Tata McGraw Hill Publishing Company Ltd. 1995.
3. S.S. Khanka, "Entrepreneurial Development", S. Chand & Co. Pvt. Ltd., New Delhi

Suggested Reading:

1. Robert D. Hisrich, Michael P. Peters, "Entrepreneurship", 5/e, Tata Me Graw Hill Publishing Company Ltd., 2005
2. Stephen R. Covey and A. Roger Merrill, "First Things First", Simon and Schuster Publication, 1994.

18CS O06

FUNDAMENTALS OF DBMS

(Open Elective-II)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: File Structures.

Course Objectives:

This course aims to:

1. Learn data models, conceptualize and depict a database system using E-R diagram.
2. Understand the internal storage structures in a physical DB design.
3. Know the fundamental concepts of transaction processing techniques.

Course Outcomes:

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

1. Classify the difference between FMS and DBMS; describe the roles of different users and the structure of the DBMS. Design the database logically using ER modeling
2. Outline the schema of the relational database and key constraints. Develop queries using DDL, DML and DCL of SQL.
3. Identify the inference rules for functional dependencies and apply the principles of normal forms to decompose the relations in a database.
4. Summarize the concepts of dense, sparse, ISAM and B+ tree indexing and get familiar with states and properties of transactions.
5. Interpret the locking, time stamp, graph and validation-based protocols for concurrency control.
6. Summarize log-based recovery techniques to increase the robustness of the database, identify to resolve the deadlocks in the transactions.

UNIT - I

Introduction: Database System Applications, Purpose of Database Systems, View of Data, Database Languages, Database Users and Administrators Database System Architecture, Application Architectures.

Database Design and E-R Model: Basic concepts, Constraints, E-R Diagrams, E-R Design Issues, Extended E-R Features, Specialization and Generalization.

UNIT - II

Relational Model: Structure of Relational Databases, Database Schema, Keys.

Structured Query Language: Overviews, SQL Data Types, SQL Queries, Data Manipulation Language Set Operations, Aggregate Functions, Data Definition Language, Integrity Constraints, Null Values, Views, Join Expression. Index Definition in SQL.

UNIT - III

Relational Database Design: Undesirable Properties in Relational Database Design, Functional Dependencies, Trivial and Nontrivial Dependencies, Closure of Set of Functional Dependencies, Closure of Set of Attributes, Irreducible Set of Functional Dependencies, Normalization – 1NF, 2NF, and 3NF, Dependency Preservation, BCNF, Comparison of BCNF and 3NF.

UNIT - IV

Indexing: Basic concepts, Dense and Sparse Indices, Secondary Indices, Tree-Structured Indexing, Indexed Sequential Access Method (ISAM), B+ Tree Index Files.

Transaction Management: Transaction Concept – ACID Properties, States of Transaction, Implementation of Atomicity and Durability, Serializability, Recoverability.

UNIT - V

Concurrency Control: Lock-Based Protocols, Timestamp-Based Protocols, Validation-Based Protocols.

Deadlocks Handling: Deadlock Prevention, Deadlock Detection and Recovery.

Recovery System: Failure Classification, Storage Structure, Recovery and Atomicity, Log-Based Recovery.

Text Books:

1. Abraham Silberschatz, Henry F Korth, S Sudarshan, "Database System Concepts", Sixth Edition, McGraw-Hill International Edition, 2011.
2. Date CJ, Kannan A, Swamynathan S, "An Introduction to Database Systems", Eight Edition, Pearson Education, 2006.

Suggested Reading:

1. Raghu Ramakrishnan, Johnnes Gehrke, "Database Management Systems", Third Edition, McGraw Hill, 2003.
2. Ramez Elmasri, Durvasul VLN Somayazulu, Shamkant B Navathe, Shyam K Gupta, "Fundamentals of Database Systems", Fourth Edition, Pearson Education,2006.

18IT O02

PYTHON PROGRAMMING

(Open Elective-II)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

This course aims to:

1. Facilitate learning to use lists, tuples and dictionaries in Python programs.
2. Familiarize with Python file handling.
3. Impart knowledge of exception handling in Python.
4. Introduce GUI Programming.
5. Familiarize with data visualization.

Course Outcomes:

Upon completing this course, students will be able to:

1. Understand the fundamental concepts and control structures of python programming.
2. Write user defined iterative & recursive functions, identify appropriate predefined functions and perform file handling Operations.
3. Use suitable data structures such as sequences, dictionaries and sets in python programming.
4. Apply concepts of OOP, exception handling and build regular expressions using Python.
5. Design and Develop GUI based applications and visualize the data.

UNIT-I

Introduction to Python Programming: Using Python, The IDLE Programming Environment, Input and Output Processing, Displaying Output with the Print Function, Comments, Variables, Reading Input from the Keyboard, Performing Calculations, More About Data Output: New line, Item Separator, Escape Characters, Formatting parameters.

Decision Structures and Boolean Logic: if, if-else, if-elif-else Statements, Nested Decision Structures, Comparing Strings, Logical Operators, Boolean Variables.

Repetition Structures: Introduction, while loop, for loop, Sentinels, Input Validation Loops, Nested Loops.

UNIT-II

Functions: Introduction, Defining and Calling a Function, designing a Program to Use Functions, Local Variables, Passing Arguments to Functions, Global Variables and Global Constants, Value-Returning Functions Generating Random Numbers, Writing Our Own Value-Returning Functions, the math Module, Random Module, Time Module and Storing Functions in Modules.

Python File Input-Output: Opening and closing file, various types of file modes, reading and writing to files, manipulating directories

UNIT-III

Lists and Tuples: Sequences, Introduction to Lists, List slicing, Finding Items in Lists with the in Operator, List Methods and Useful Built-in Functions, Copying Lists, Processing Lists, Two-Dimensional Lists, Tuples.

Strings: Basic String Operations, String Slicing, Testing, Searching, and Manipulating Strings.

Dictionaries and Sets: Dictionaries, Sets, Serializing Objects.

Recursion: Introduction, Problem Solving with Recursion, Examples of Recursive Algorithms.

UNIT-IV

Classes and Object-Oriented Programming: Procedural and Object-Oriented Programming, Classes, Working with Instances, Techniques for Designing Classes

Exception Handling: What is exception, various keywords to handle exception such try, catch, except, else, finally, raise

Regular Expressions: The match() Function, The search() Function, The sub() Function, The findall() and finditer() Functions, Flag Options

UNIT-V

GUI Programming: Graphical User Interfaces, Using the tkinter Module, Display text with Label Widgets, Organizing Widgets with Frames, Button Widgets and Info Dialog Boxes, Getting Input with Entry Widget, Using Labels as Output Fields, Radio Buttons, Check Buttons.

Introduction to Plotting in Python – Basic Plots- Line and Scatter Plot, box plot, bar plots, Histograms and plotting data contained in files.

Text Book:

1. Tony Gaddis, "Starting Out with Python", 3rd Edition, Pearson, 2015.

Suggested Reading:

1. Reema Thareja "Python Programming", Oxford Press, 2017
2. Kenneth A. Lambert, "Fundamentals of Python", Delmar Cengage Learning, 2013.
3. Fabio Nelli, "Python Data Analytics (With Pandas, NumPy, and Matplotlib)", Apress, 2nd Edition, 2018.
4. James Payne, "Beginning Python using Python 2.6 and Python 3", wrox programmer to programmer, 2010.
5. Paul Gries, "Practical Programming: An Introduction to Computer Science using Python", 3rd Edition, 2016.

Web Resource:

1. https://www.python.org/

18EGO01

TECHNICAL WRITING SKILLS

(Open Elective-II)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

This course aims to:

1. Process of communication and channels of communication in general and technical writing.
2. Technical Writing and also contextual use of technology specific words.
3. Business letters and technical articles.
4. Technical reports and technical proposals.
5. Transferring data from verbal to graphic and vice versa and making technical presentations.

Course Outcomes:

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

1. Understand the channels of communication and define nature and aspects of Technical communication
2. Compare and contrast technical communication to that of general communication while constructing error free sentences applying features of technical writing.
3. Analyze data, draw inferences to write Journal articles and conference papers and to compose business letters.
4. Evaluate data to draft technical reports and technical proposals.
5. Design a technical presentation by understanding the nuances of presentation skills and also transfer data from verbal to graphic and vice versa.

UNIT I

Communication – Nature and process.
Channels of Communication – Downward, upward and horizontal and lateral communication. Barriers to communication.
Technical Communication – Definition; oral and written communication. Importance and need for Technical communication. Nature of Technical Communication. Aspects and forms of Technical communication. Technical communication Skills – Listening, Speaking, Reading & Writing.

UNIT II

Technical Writing – Techniques of writing. Selection of words and phrases in technical writing. Differences between technical writing and general writing. Abstract and specific words. Sentence structure and requisites of sentence construction. Paragraph length and structure.

UNIT III

Business correspondence – Sales letters, letters of Quotation, Claim and Adjustment letters.
Technical Articles: Nature significance and types of technical articles. Writing an abstract. Journal articles and Conference papers. Elements of technical articles.

UNIT IV

Technical Reports: Types, significance, structure, style and writing of reports. Routine reports, Project reports.
Technical Proposals: Definition, types, characteristics, structure and significance.

UNIT V

Information Transfer – Graphic to verbal(written) and verbal to graphic.
Technical Presentations: Important aspects of oral and visual presentations.

Text Book:

1. Meenakshi Raman & Sangeeta Sharma, "Technical Communications-Principles and Practice", Oxford University Press, Second Edition, 2012.
2. M Ashraf Rizvi, "Effective Technical Communication", Tata McGraw Hill Education Pvt Ltd, 2012.

Suggested Reading:

1. Kavita Tyagi & Padma Misra, "Basic Technical Communication", PHI Learning Pvt Ltd, 2012.
2. R.C Sharma & Krishna Mohan, "Business Correspondence and Report Writing", Tata McGraw Hill, 2003.

Web Resources:

1. https://onlinecourses.nptel.ac.in/noc18_mg13/preview
2. https://www.technical-writing-training-and-certification.com/
3. https://academy.whatfix.com/technical-writing-skills

18EC C28

COMPUTER NETWORKS LAB

Instruction	2 P Hours per Week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Prerequisite: Knowledge on Digital communications and familiarity with anyone programming language like C.

Course Objectives:

This course aims to:

1. Understand Link layer concepts.
2. Understand routing algorithms in Network layer.
3. Understand the network simulator environment and visualize a network topology and observe its performance.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Apply fundamental principles of computer networking.
2. Examine the performance of design issues of Link layer.
3. Construct a network and measure its performance with different routing algorithms.
4. Create a wired and wireless Network using NS-2.
5. Analyze performance of various Network protocols using NS-2

List of Experiments

1. Implement the data link layer framing methods such as character, character stuffing and bit stuffing.
2. Implementation of Error Detection / Error Correction Techniques.
3. Construct Dijkstra's algorithm to compute the shortest path through a graph.
4. Create a subnet graph with weights indicating delay between the nodes and find routing table for any one node using link state routing algorithm.
5. Construct a broadcast tree using a subnet.
6. Create a wired network and data transmission between the nodes with at least four nodes using NS2.
7. Implementation of Stop & Wait Protocol using NS2
8. Implementation of Go Back N Protocol using NS2
9. Implementation of Selective Reject/Repeat Protocol using NS2
10. Implementation of Distance Vector Routing Protocol using NS2
11. Creation of a wireless network and data transmission between the nodes with at least four nodes using NS2.
12. Simulation of the data transfer between the nodes using TCP/UDP using for loop in NS2.

Additional Experiments based on

Structured Inquiry

13. Evaluate the performance of Data link/Network/Transport layer protocols.

Open-ended Inquiry

14. Design a Wireless Ad hoc Network and evaluate its performance.

Suggested Reading:

1. Behrouz A. Forouzan, "Data Communication and Networking", 4thEdition, McGraw-Hill Forouzan Networking Series, McGraw-Hill, 2007.
2. S. Keshav, "An Engineering Approach to Computer Networking", 2ndEdition, Addison-Wesley Professional Pearson Education, 2001.

18EC C29

ELECTRONIC DESIGN AND AUTOMATION LAB

Instruction	2 P Hours per Week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Prerequisite: Digital design fundamentals and synthesis & simulation concepts

Course Objectives:

This course aims to:

1. Simulate and synthesize combinational and sequential logic circuits
2. Simulate switch level modules
3. Learn implementation procedure for any design on FPGA and to study the speed, power and area constraints of FPGA/CPLD

Course Outcomes:

Upon completion of this course, students will be able to:

1. Demonstrate the process steps required for simulation /synthesis
2. Develop HDL codes/scripts with appropriate syntax
3. Apply an appropriate modelling style to describe various combinational and sequential circuits in Verilog HDL
4. Examine the successful execution of the codes/ schematic using various Simulation Tools
5. Build various digital circuits on hardware boards like FPGA.

List of Experiments

Part A

Write VERILOG Code, Simulate and Implement the following on FPGA:

1. Code Converters.
2. Encoders, Decoders, Priority Encoder and Comparator.
3. Registers/Counters.
4. Sequence Detector using Mealy and Moore type state machines.
5. Any application of UDP.
6. Tasks and Functions.

Note:

1. All the codes should be implemented appropriately using Gate level, Dataflow and Behavioural Modelling.
2. All the programs should be simulated using test benches.

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Part B

Switch Level Modelling of CMOS circuits:

1. Basic Logic Gates: Inverter, NAND and NOR.
2. Half Adder and Half Subtractor.
3. 4x1 Multiplexer.
4. 2x4 Decoder.
5. Design of NAND Gate using Simulation tool.
6. Design of NOR Gate using Simulation tool.
7. Design and layout of Inverter using Simulation tool.

Structured Enquiry Program:

1. Design and simulate a high-speed adder using Verilog HDL

Open- ended Enquiry:

1. Simulate a design using System Vivado and implement the same on Zynq Evaluation Development Board.

Suggested Reading:

1. Michal D.Ciletti, "Advanced digital design with Verilog HDL", Pearson Edition, 2011.
2. Samir Palnitkar, "Verilog HDL-A Guide to Digital Design and Synthesis", Pearson 2nd edition, 2003.
3. Cadence Design Systems (Ireland) Ltd., "Cadence manual", 2013.

18EC C30

ELECTRONICS MEASUREMENT AND SIMULATION LAB

Instruction	2 P Hours per Week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Prerequisite: Concepts of Electronic Instrumentation and expected to have logical and programming skills.

Course Objectives:

This course aims to:

1. Demonstrate various Bridges & transducers using hardware set ups.
2. Understand the importance and applications of virtual instrumentation
3. Develop real time applications using LabVIEW.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Understanding of the operational features of various analog and digital test and measurement equipment.
2. Analysis of various standard bridges and ability to measure temperature
3. Learn how to develop basic applications in the LabVIEW graphical programming environment.
4. Develop ability for programming in LabVIEW using various data structures, program structures, plotting the graphs and charts for system monitoring, processing and controlling.
5. Apply knowledge of mathematics and engineering to formulate and study or solve engineering problems, including problems at the interface of engineering.

List of Experiments

1. Designing DC bridge for Resistance measurement (Quarter, Half and Full bridge).
2. Designing of AC bridge circuit for capacitance measurement.
3. Designing of signal conditioning circuit for Temperature measurement
4. Experimental study for the characteristics of ADC and DAC.
5. Familiarization with LabVIEW simulation tool.
6. Loops, Structures and Math-script in LabVIEW.
7. Implementation of Combinational circuits (Multiplexer and Demultiplexer) using my RIO.
8. Design of Sequential circuits (Flip flops and counters) with LabVIEW.
9. FIR and IIR Filter design in LabVIEW.
10. Implementation of Analog modulation and Demodulation schemes (AM and FM) using myRIO.
11. Digital carrier modulation and demodulation schemes (ASK, FSK and PSK) with LabVIEW
12. State variable analysis with LabVIEW.
13. Frequency domain analysis (Nyquist and Bode plots) with LabVIEW.
14. Sensor data acquisition using myDAQ.
15. Voltage / Current Sweep generation using myDAQ.

Additional Experiments based on

Structured enquiry

a) Digital IIR Notch filter design / ALU design / PLL design using LabVIEW

Open-ended enquiry

b) Develop any application in Control Systems/Signal Processing/ Communication Systems using LabVIEW

Suggested Reading:

1. Nakra B.C, and Chaudhry K.K, "Instrumentation Measurement and analysis", Tata McGraw Hill Publications, 2013.
2. Jeffrey Travis, Jim Kring, "LabVIEW for Everyone: Graphical programming Made Easy and Fun", 3rd Edition, Prentice Hall, 2007.

18EC C31

PROJECT: PART - 1

Instruction	4 P Hours per Week
Duration of SEE	--
SEE	--
CIE	50 Marks
Credits	2

Prerequisite: Knowledge of preparing slides by using power point presentations, Capable of searching for suitable literature and Presentation skills.

Course Objectives:
This course aims to:

1. The student takes up investigative study in the broad field of Engineering / Technology, either fully theoretical/practical or involving both theoretical and practical.
2. The work to be assigned by the Department on an individual basis or two/three students in a group, under the guidance of a supervisor.
3. This is expected to provide a good initiation for the student(s) towards R&D.

Course Outcomes:
Upon completion of this course, students will be able to:

1. List the various approaches to the selected problem.
2. Interpret the advantages and disadvantages of various approaches.
3. Apply the selected approach for simulating / modelling / designing the problem.
4. Analyse and write a report on the results of the simulation / modelling of the problem selected.
5. Justify and present the results of the simulation / model / design before the departmental committee.

The objective of Project Part-1 is to enable the student take up investigative study in the broad field of Engineering/Technology, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an individual basis or two/three students in a group, under the guidance of a supervisor. This is expected to provide a good initiation for the student(s) towards R&D. The work shall include:

1. Survey and study of published literature on the assigned topic;
2. Working out a preliminary Approach to the Problem relating to the assigned topic;
3. Conducting preliminary Analysis/Modelling/Simulation/Experiment/Design/Feasibility;
4. Preparing a Written Report on the Study conducted for Presentation to the Department;
5. Final Seminar, as oral Presentation before a departmental Committee.

Guidelines for the award of Marks: Max. Marks: 50

Evaluation by	Max. Marks	Evaluation Criteria / Parameter
Supervisor	20	Project Status / Review
	5	Report
Departmental Committee	5	Relevance of the Topic
	5	PPT Preparation
	5	Presentation
	5	Question and Answers
	5	Report Preparation

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

AICTE Model Curriculum with effect from AY 2021-22

B.E (Electronics and Communication Engineering)

SEMESTER – VIII

S. No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1		Program Elective-VI	3	-	-	3	30	70	3
2		Open Elective-III	3	-	-	3	30	70	3
PRACTICALS									
3	18EC C32	Technical Seminar	-	-	3	-	50	-	1
4	18EC C33	Project: Part-2	-	-	10	Viva-Voce	100	100	10
		Total	**06**	**-**	**13**	**-**	**210**	**240**	**17**
Clock Hours Per Week: 28									

List of Courses in Program Elective-VI		List of Courses in Open Elective-III	
Course Code	**Title of the Course**	**Course Code**	**Title of the Course**
18EC E25	IoT and its Applications	18CS O07	Basics of Cyber Security
18EC E26	Principles of GNSS	18EG O02	Gender Sensitization
18EC E27	Principles of Wireless Sensor Networks	18PY O01	History of Science and Technology
18EC E28	Real Time Operating Systems	18CS O10	Machine Learning using Python
		18ME O01	Robotics

L: Lecture **D: Drawing** **CIE: Continuous Internal Evaluation**

T: Tutorial **P: Practical/Project Seminar/Dissertation** **SEE: Semester End Examination**

18ECE25

IOT AND ITS APPLICATIONS

(Program Elective-VI)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Knowledge on Programming and Problem Solving, Computer Organization and Embedded systems.

Course Objectives:

This course aims to:

1. Provide an overview of Internet of Things, building blocks of IoT and the real-world applications.
2. Introduce Python Programming language and packages.
3. Introduce Raspberry Pi device, its interfaces and Django Framework.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Understand the terminology, enabling technologies and applications of IoT
2. Apply the concept of M2M and understand the basics of modern networking with the concepts of SDN and NFV.
3. Understand the basics of Python Scripting Language which is used in many IoT devices.
4. Describe the steps involved in IoT system design methodology.
5. Design simple IoT systems using Raspberry Pi board with sensors, actuators and develop web applications using python-based framework called Django.

UNIT-I

Introduction and Concepts: Introduction to Internet of Things, Definitions and Characteristics of IoT, Physical Design of IoT: Things in IoT, IoT Protocols, Logical Design of IoT, IoT Functional Blocks, IoT Communication Models, IoT Communication APIs, IoT Enabling Technologies, Wireless Sensor Networks, Cloud Computing, Communication Protocols, IoT Levels & Deployment Templates.

UNIT-II

Domain Specific IoTs: IoT applications for Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, health and Lifestyle.

IoT and M2M: Introduction, M2M, Differences between IoT and M2M, Software Defined Networking, Network Function Virtualization.

UNIT-III

Introduction to Python: Motivation for using Python for designing IoT systems, Language features of Python, Data types: Numbers, Strings, Lists, Tuples, Dictionaries, Type Conversions, Data Structures: Control of flow-if, for, while, range, break/continue, pass, functions, modules, packaging, Python packages of Interest for IoT: JSON, XML, HTTPLib, URLLib, SMTPLib.

UNIT-IV

IoT Platforms Design Methodology: Introduction, IoT Design Methodology Steps-Purpose and Requirements Specification, Process Specification, Domain Model Specification, Information Model Specification, Service Specifications, IoT Level Specification, Functional View Specification, Operational View Specification, Device and Component Integration, Application Development, Case Study on IoT System for Weather Monitoring.

UNIT-V

IoT Physical Devices and End Points: Basic building blocks of an IoT device, Raspberry Pi- about the Raspberry Pi board, Raspberry Pi interfaces, Serial, SPI, I2C.

IoT Physical Servers and Cloud Offerings: Introduction to cloud storage models and Communication APIs, WAMP: AutoBahn for IoT, Xively cloud for IoT.

Python Web Application Framework: Django Framework-Roles of Model, Template and View

Text Books:

1. ArshdeepBahga and Vijay Madisetti, “Internet of Things - A Hands-on Approach”, Universities Press, 2015.
2. Tony Gaddis, “Starting out with Python”, 3rd edition, Pearson, 2015.

Suggested Reading:

1. Francis daCosta, “Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”, 1st edition, press Publications, 2013.
2. Matt Richardson, Shawn Wallace, O'Reilly, “Getting Started with Raspberry Pi”, SPD, 2014.
3. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", 1st edition, 2017

18ECE26

PRINCIPLES OF GNSS

(Program Elective-VI)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Fundamental concepts of communication are required.

Course Objectives:

This course aims to:

1. Explain the basic principle of operation of GPS, GPS ephemerides and signal structure.
2. Make the students to understand various coordinate systems and highlight the effect of various errors affecting GPS signals.
3. Make the students to appreciate the significance of other GNSS systems, principle of DGPS and augmentation systems.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Demonstrate the fundamental concepts of communications in understanding of GPS architecture, operation and signal structure.
2. Apply the principles of orbital mechanics, time references, coordinate systems and range measurements in estimating user position.
3. Examine the effect of various error sources and satellite geometry on position estimates and analyze the suitability of a given data format.
4. Compare the architecture and working of other GNSS systems and make use of GNSS systems in a variety of civilian and defense applications.
5. Relate the knowledge of DGPS techniques in understanding augmentation systems.

UNIT-I

GPS Fundamentals: GPS System Segments: space, control and user segments, Principle of operation, Current status of GPS satellite constellation. Orbital Mechanics: GPS ephemeris data, algorithm for computation of satellite's position from ephemeris data. Time References: solar and sidereal days, UTC time, GPS time.

UNIT-II

GPS Signals: Legacy GPS signals: Signal structure, Operating frequencies, C/A and P-Code, Navigation message, Modernized GPS signals: list of signals and their significance. Range measurements: code and carrier measurements, User position estimation with PRN codes.

Coordinate systems: Earth Centered Earth Fixed (ECEF) coordinate system, Earth Centered Inertial (ECI) coordinate system, Geodetic coordinate system, Ellipsoid and Geoid, Regional and Global Datum, World Geodetic System (WGS-84).

UNIT-III

GPS Error Sources: Satellite clock error, ephemeris error, Receiver clock errors, satellite and receiver instrumental bias, Multipath error, receiver measurement noise, ionospheric error and tropospheric error, Klobuchar model, ionospheric delay estimation using dual frequency measurements and UERE. Dilution of precision: HDOP, VDOP, TDOP, PDOP & GDOP.

UNIT-IV

Data Formats: RINEX Observation and Navigation Data formats

GNSS: Architecture, operation and signals of other global navigational satellite systems Galileo, Beidou and GLONASS.

IRNSS: Architecture, signals, limitations and advantages.

UNIT-V

Differential GPS (DGPS): Principle of DGPS, Types of DGPS: Local Area DGPS (LADPS), Wide Area DGPS (WADGPS). **GPS Augmentation Systems:** Principle of operation of Satellite Based Augmentation system (SBAS) and Ground Based Augmentation System (GBAS).

GNSS Applications: Surveying, Mapping, Marine, air and land Navigation, Military and Space Application.

Text Books:

1. Elliot D Kaplan and Christopher J Hegarty, "Understanding GPS principles and applications", Artech House Publishers, 2/e Boston & London 2005.
2. Prata pMisra and Per Enge, "Global Positioning System Signals, Measurement, and Performance", Ganga- Jamuna Press, 2/e, Massachusetts, 2010.

Suggested Reading:

1. B.Hofmann-Wellenhof, H.Lichtenegger, and J.Collins, "GPS Theory and Practice", Springer Verlog, 5/e, 2008.
2. Ahmed El-Rabbany, "Introduction to GPS", Artech House Publishers, 2/e, Boston 2006.
3. Bradford W.Parkinson and James J. Spilker, "Global Positioning system: Theory and Application", Vol. II, American Institution of Aeronautics and Astronautics Inc., Washington, 1996.

18ECE27

PRINCIPLES OF WIRELESS SENSOR NETWORKS

(Program Elective-VI)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: The student must have taken a course on data communication and computer networks.

Course Objectives:

This course aims to:

1. Obtain a broad understanding about the network architecture of wireless sensor network, characteristics of wireless sensor networks and sensor nodes.
2. Understand different constraints of wireless sensor network, like coverage, power management etc. and the principles of data transmission, clustering algorithm and routing protocols.
3. Design and development of new network architecture and MAC protocols.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Recall the features, characteristics, Technology, Data transmission, protocols and design issues of wireless Sensor networks.
2. Illustrate the function of Network architecture, Routing, Protocol structure, and node problems
3. Apply the appropriate protocols and routing algorithms to solve issues in Network.
4. Analyze data processing, aggregation and routing, Protocol overheads, Throughput, Security challenges in a WSN.
5. Compare the performance of WSN in terms of topologies, technology, protocols, design principles, and security

UNIT–I

Introduction to Wireless Sensor Networks.: Features, Design challenges, Network architecture, Applications, Sensor deployment mechanism, Topologies and characteristics of Wireless Sensor Networks, Advantages of WSN.

UNIT–II

Network and Component Technologies: Mobile Adhoc Networks (MANETs)**,** Sensors, Coverage, Physical layer, Sensor platforms, Reliable data transport, Radio energy consumption model, Power management, Synchronization, Localization.

UNIT–III

Data Transmission and Routing: Data processing and aggregation, Data storage, Node discovery algorithms, Wireless sensor network routing, Proactive and Reactive routing.

UNIT–IV

Protocols: Frame structure, Network clustering protocols, Medium access control protocols, Multi-hop communication protocols, Congestion control and rate control protocols, Protocol overheads.

UNIT–V

Dependability Issues: Collisions, Collision avoidance mechanism, Hidden node and exposed node problems, Data congestions, Throughput, Security challenges. Design Principles of WSNs, Concepts of Gateway.

Text Books:

1. Holger Karl and Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", Wiley-2011.
2. Yan Zhang, Jijun Luo, Honglin Hu, "Wireless Mesh Networking, Architecture, Protocols and Standards", 1st edition, Auerbach Publications, 2006.
3. Edgar H. Callaway Jr. and Edgar H. Callaway, "Wireless Sensor Networks: Architectures and Protocols", 1st edition, Auerbach Publications, 2003.

Suggested Reading:

1. Yang, Shuang-Hua, "Wireless Sensor Networks Principles, Design and Applications", Springer, 2014.
2. KazemSohraby, Daniel Minoli, TaiebZnati, "Wireless Sensor Networks: Technology, Protocols and Applications", Wiley, 2007.
3. Mohammad S. Obaidat, SudipMisra, "Principles of Wireless Sensor Networks", Cambridge University Press, 2014.

18ECE28

REAL TIME OPERATING SYSTEMS

(Program Elective - VI)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisites: Prior knowledge of Computer Organization and Architecture is required.

Course Objectives:

This course aims to:

1. Learn about the fundamental need of Real Time operating systems.
2. Understand the concepts of different RTOS.
3. Study the Linux based target system design process.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Understand Real-time operating system requirements and applications.
2. Categorize different scheduling approaches for real time scheduler.
3. Differentiate various RTOS features and POSIX standards
4. Analyze the inter task communication in RTOS.
5. Apply the Linux based embedded system design process.

UNIT-I

Introduction to Operating Systems: Operating System objectives and functions, Evolution of operating systems, Developments leading to modern Operating Systems, Virtual machines, OS design consideration for multiprocessor and multicore, Overview on traditional and modern Unix OS, Differences between GPOS and RTOS

UNIT-II

Real Time System Basics: Basic model of a real time system, characteristics, applications, types of real time tasks, timing constraints, Uniprocessor Scheduling: Criteria for scheduling, scheduling algorithms: FCFS, SJF, Priority, Round Robin. **Real Time Task Scheduling:** Earliest Deadline First (EDF): Implementation, shortcoming. Rate Monotonic Algorithm (RMA): Implementation, issues associated with RMA

UNIT-III

Commercial Real Time Operating System: Time services, Features of RTOS, Unix as a RTOS, Non pre-emptive kernel, dynamic priority levels, POSIX: genesis of POSIX, Overview, Real Time POSIX standard, Priority inversion, priority ceiling and priority Inheritance protocols , a survey of contemporary RTOS: PSOS, VRTX, QNX, µC-OS-II and RT-Linux,

UNIT-IV

Introduction to VxWorks: Salient Features, Multitasking, Task state transition, Task Control: Task Creation and Activation, Task Stack, Task Names and IDs, Task Options, Task Information, Task Deletion and Safety, Semaphore and message queues related functions

UNIT-V

Linux Development Process: Types of Host /Target Development and debug setup, Generic Architecture of an Embedded Linux System, System start up, Types of Boot configurations, System Memory Layout, Development Tools: Project Workspace, IDE, GNCC cross platform, selecting and configuring kernel, setting up boot loader.

Text Books:

1. William Stallings, “Operating Systems Internals and Design Principles,” 7/e, Pearson Education, 2014.
2. Rajib Mall, “Real Time Systems”, Pearson Education, 2/e, 2007.
3. KarimYaghmour, “Building Embedded Linux Systems” O'Reilly, 2003.

Suggested Reading:

1. Silberschatz, Galvin, Gange “Operating Systems Concepts” 8/edition, Wiley Education, 2007.
2. Wind River Systems Inc., “VxWorks Programmers Guide”, 1997.
3. Andrew S.Tanenbaum, Herbert Bos, "Modern Operating Systems",4th edition, 2014.

18CSO07

BASICS OF CYBER SECURITY

(Open Elective-III)

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Operating System, Computer Network, Cryptography.

Course Objectives:

This course aims to:

1. Identify and present indicators that a cybercrime has occurred and understand methods and tools used in cybercrimes.
2. Collect, Process, Analyze and Present Computer Forensics Evidence.
3. Understand the legal perspectives and Organizational implications of Cyber Security

Course Outcomes:

Upon completion of this course, students will be able to:

1. List the different types of cybercrimes and analyze legal frameworks to handle cybercrimes.
2. Identify the Tools and Methods used in cybercrimes.
3. Analyze and resolve cyber security issues and laws governing Cyberspace.
4. Describe the need of Digital Forensics and the importance of digital evidence in prosecution.
5. Interpret the commercial activities in the event of significant information security incidents in the Organization.
6. Discuss the vulnerabilities in networking protocols and their mitigation techniques.

UNIT - I

Introduction to Cyber Crime: Cyber Crime: Definition and Origins of the Word, Cybercrime and Information Security, Classification of Cyber Crimes, Cyber Crime: The Legal Perspective, Cyber Crime: An Indian Perspective, A Global Perspective of Cyber Crime.

UNIT - II

Cyber Offenses: Introduction, How Criminals plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector.

Tools and Methods Used in Cybercrime: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horse and Backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow.

UNIT - III

Cyber Security: The Legal Perspectives: Cyber Crime and the Legal Landscape around the World, Need of Cyber laws: the Indian Context, The Indian IT Act, Challenges to Indian Law and Cyber Crime Scenario in India, Digital Signatures and the Indian IT Act, Cyber Crime and Punishment, Cyber Law, Technology and Students: The Indian Scenario.

UNIT - IV

Understanding Cyber Forensics: Introduction, Digital Forensics Science, Need for Computer Forensics, Cyber Forensics and Digital Evidence, Forensics Analysis of Email, Digital Forensics Life Cycle, Chain of Custody Concept, Network Forensics, Approaching a Cyber Forensics Investigation, Challenges in Computer Forensics.

UNIT - V

Cyber Security: Organizational Implications: Introduction, Cost of Cybercrimes and IPR issues, Web threats for Organizations, Security and Privacy Implications, Social media marketing: Security Risks and Perils for Organizations, Social Computing and the associated challenges for Organizations.

Text Books:

1. Sunit Belpre and Nina Godbole, Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley India Pvt.Ltd, 2011.
2. Kevin Mandia, Chris Prosise, Incident Response and computer forensics, Tata McGraw Hill, 2006.

Suggested Reading:

1. Alfred Basta, Nadine Basta, Mary Brown, Ravinder Kumar, Cyber Security and Cyber Laws, Paperback – 2018.
2. Mark F Grady, FransescoParisi, The Law and Economics of Cyber Security, Cambridge university press, 2006.

Online Resources:

1. https://www.edx.org/learn/cybersecurity
2. https://www.coursera.org/courses?query=cyber%20security
3. https://swayam.gov.in/course/4002-cyber-law

18EGO02

GENDER SENSITIZATION

(Open Elective-III)

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives

This course aims to:

1. Sensibility regarding issues of gender in contemporary India.
2. A critical perspective on the socialization of men and women.
3. Popular debates on the politics and economics of work while helping them reflect critically on gender violence.

Course Outcomes

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

1. Understand the difference between "Sex" and "Gender" and be able to explain socially constructed theories of identity.
2. Recognize shifting definitions of "Man" and "Women" in relation to evolving notions of "Masculinity" and "Femininity".
3. Appreciate women's contributions to society historically, culturally and politically.
4. Analyze the contemporary system of privilege and oppressions, with special attention to the ways gender intersects with race, class, sexuality, ethnicity, ability, religion, and nationality.
5. Demonstrate an understanding of personal life, the workplace, the community and active civic engagement through classroom learning.

UNIT- I

Understanding Gender:

Gender: Why Should We Study It? (Towards a World of Equals: Unit -1)

Socialization: Making Women, Making Men (Towards a World of Equals: Unit -2)

Introduction. Preparing for Womanhood. Growing up Male. First lessons in Caste. Different Masculinities.

UNIT- II

Gender and Biology:

Missing Women: Sex Selection and Its Consequences (Towards a World of Equals: Unit -4)

Declining Sex Ratio. Demographic Consequences.

Gender Spectrum: Beyond the Binary (Towards a World of Equals: Unit -10) Two or Many? Struggles with Discrimination.

UNIT- III

Gender and Labour:

Housework: The Invisible Labour (Towards a World of Equals: Unit -3)

"My Mother doesn't Work." "Share the Load."

Women's Work: Its Politics and Economics (Towards a World of Equals: Unit -7)

Fact and Fiction. Unrecognized and Unaccounted work. Additional Reading: Wages and Conditions of Work.

UNIT-IV

Issues of Violence

Sexual Harassment: Say No! (Towards a World of Equals: Unit -6)

Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment- Further Reading: "Chupulu".

Domestic Violence: Speaking Out (Towards a World of Equals: Unit -8)

Is Home a Safe Place? -When Women Unite [Film]. Rebuilding Lives. Additional Reading: New Forums for Justice.

Thinking about Sexual Violence (Towards a World of Equals: Unit -11)

Blaming the Victim - "I Fought for my Life…." - Additional Reading: The Caste Face of Violence.

UNIT – V

Just Relationships: Being Together as Equals (Towards a World of Equals: Unit -12)
Mary Kom and Onler. Love and Acid just do not Mix. Love Letters. Mothers and Fathers.
Additional Reading: Rosa Parks-The Brave Heart.

Text Books:

1. A. Suneetha, Uma Bhrugubanda, Duggirala Vasanta, Rama Melkote, Vasudha Nagaraj, Asma Rasheed, Gogu Shyamala, Deepa Sreenivas and Susie Tharu "Towards a World of Equals: A Bilingual Textbook on Gender" published by Telugu Akademi, Hyderabad, Telangana State, 2015.

Suggested Reading:

1. Menon, Nivedita. Seeing like a Feminist. New Delhi: Zubaan-Penguin Books, 2012.
2. Abdulali Sohaila. "I Fought for My Life…and Won. "Available online at: http://www.thealternative.in/lifestyle/i-fought-for-my-lifeand-won-sohaila-abdulal/

Web Resources:

1. https://aifs.gov.au/publications/gender-equality-and-violence-against-women/introduction
2. https://theconversation.com/achieving-gender-equality-in-india

Note: Since it is an Interdisciplinary Course, Resource Persons can be drawn from the fields of English Literature or Sociology or Political Science or any other qualified faculty who has expertise in this field from engineering departments.

18PY O01

HISTORY OF SCIENCE AND TECHNOLOGY

(Open Elective-III)

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

This course aims to:

1. Gain the knowledge about origin of science in the Stone Age and its progress during Antiquity period.
2. Familiar with scientific views in the Medieval period and during the Industrial revolution.
3. Aware of modern scientific developments from 19th century onwards.

Course Outcomes:

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

1. Demonstrate the process of beginning of science and civilization, knowledge acquisition and philosophical approach of science and its advancements in the Stone Ages and Antiquity period.
2. Illustrate the advancements in science and technology in the medieval period across Asia and Arab countries and decline and revival of science in Europe.
3. Explain the scientific approach and its advances of the Europeans and how the role of engineer during the industrial revolution and the major advancements.
4. Make use of the advancements in the field of science and technology by adopting new philosophies of 19th and first half of 20th century in finding ethical solutions to the societal problems.
5. Interpret the changes in specializations of science and the technology and build the relation between information and society from second half of 20th century onwards.

UNIT-I

Science - The Beginning (through 599 BC): The Stone Ages, Knowledge among hunter gatherers, Agricultural Revolution and other revolutions, Civilization, Major advances.

Science in Antiquity (600 BC - 529 AD): Philosophy, a precursor to science, Hellenistic world and the Roman Empire, Other cultures of the period, major advances.

UNIT-II

Medieval Science (530 AD - 1452 AD): The decline of science in Europe, Science in China, Science and mathematics in India, Arab science, revival of science in Europe, technology revolution of the Middle ages, Major advances.

The Renaissance and the Scientific Revolution (1453 AD – 1659 AD): Renaissance, Scientific Revolution, Technology, Major advances.

UNIT-III

Scientific Method: Measurement and Communication (1660 AD – 1734): European domination, The scientific method, Major advances.

The Industrial Revolution (1735 AD – 1819 AD): Industrial Revolution, Rise of the engineer, Major Advances.

UNIT-IV

Science and Technology in the 19th Century (1820 AD – 1894 AD): Philosophical basis of 19th-century science, Science and the public, Science and technology, Major advances.

Rise of Modern Science and Technology (1895 AD – 1945 AD): The growth of 20thcentury science, New philosophies, Quantum reality, Energy sources, Electricity: a revolution in technology, Major advances.

UNIT-V

Big Science and the Post-Industrial Society (1946 AD – 1972 AD): Big science, Specialization and changing categories, Technology changes society, Major advances.

The Information Age (1973 AD – 2015 AD): Information and society, Globalization, The post-industrial society, Problems of the Information age, Major Advances.

Text Books:

1. Bryan Bunch and Alexander Hellemans, "The History of Science and Technology", Houghton Mifflin Company (New York), 2004.
2. JD Bernal, "Science in History", 4 Volumes, Eklavya Publishers, 2012.

Suggested Reading:

1. "The 100 Most Influential Scientists of All Time", Edited by Kara Rogers, Britannica Educational Publishing, 2010.
2. Alberto Hernandez, "A Visual History of Science and Technology", The Rosen Publishing Group, 2016.

18CS O10

MACHINE LEARNING USING PYTHON

(Open Elective-III)

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

This course aims to:

1. Get an idea of Machine Learning algorithms to solve real world problems.
2. Study various machine learning algorithms.
3. Analyze data using machine learning techniques.

Course Outcomes:

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

1. Define the basic concepts related to Python and Machine Learning
2. Describe the feature engineering methods, regression techniques and classification methods
3. Apply Python packages for data visualization. text and time series data analysis using NLP toolkit
4. Evaluate and interpret the results of the various machine learning techniques
5. Solve real world problems using deep learning framework

UNIT - I

Introduction to Machine Learning: Introduction, Machine Learning process.

Introduction to Python: Features, sources and installation of Python, IDEs, Basics of Python, Data Structures and loops.

UNIT - II

Feature Engineering: Introduction to Features and need of feature Engineering, Feature extraction and selection, Feature Engineering Methods, Feature Engineering with Python.

Data Visualization: Various charts, histograms, plots.

UNIT - III

Regression: Simple and multiple regressions, Model assessment, various types of errors, errors, ridge regression, Lasso regression, non-parameter regression.

Classification: Linear classification, logistic regression, Decision Trees, Random Forest, Naïve Bayes.

UNIT - IV

Unsupervised Learning: Clustering, K-Means clustering, Hierarchical clustering.

Text Analysis: Basic text analysis with Python, regular expressions, NLP, text classification.

Time Series Analysis: Date and time handling, window functions, correlation, time series forecasting.

UNIT - V

Neural Network and Deep Learning: Neural network- gradient descent, activation functions, parameter initialization, optimizer, loss function, deep learning, deep learning architecture, memory, deep learning framework.

Recommender System: Recommendation engines, collaborative filtering.

Text Books:

1. Abhishek Vijavargia "Machine Learning using Python", BPB Publications, 1st Edition, 2018
2. Tom Mitchel "Machine Learning", Tata McGraw Hill, 2017
3. Reema Thareja "Python Programming", Oxford Press, 2017.

Suggested Reading:

1. Yuxi Liu, Python Machine Learning by Example, 2nd Edition, PACT, 2017.

Online Resources:

1. https://www.guru99.com/machine-learning-tutorial.html
2. https://www.tutorialspoint.com/machine_learning_with_python/index.htm
3. https://www.tutorialspoint.com/python/
4. https://docs.python.org/3/tutorial/
5. https://www.geeksforgeeks.org/machine-learning/

18ME O01

ROBOTICS

(Open Elective-III)

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

This course aims to:

1. Principle of working of a robot, types and specifications, configuration, work envelop and motion controls and applications.
2. Transformations, kinematics and dynamics of robots.
3. Singularities, Jacobian and trajectory planning of a robot to prepare the robot for various tasks
4. Design of end effectors, drives, working of sensors and controllers for finding position and orientation.
5. Robot vision for image acquisition and processing and plan for various tasks and various Languages and Programming methods of robot.

Course Outcomes:

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

1. Describe the basic components, specifications and applications of the Robots.
2. Understand transformations, direct and inverse kinematics of robots.
3. Calculate forces in links and joints of a robot and find the singularities,Jacobian and trajectory planning of a robot for various tasks.
4. Classify drives, sensors and grippers for various applications.
5. Program a robot to predict motions for a given task with machine vision and sensors.

UNIT- I

Introduction to robotics: History and evolution of robots, basic configuration, degree of freedom, work envelope, motion control methods, various applications in industry, material handling, loading & unloading, processing, welding & painting, assembly, and inspection, requirements and specifications of robots.

UNIT- II

Rigid motions and homogeneous transformations: Rotation matrix, homogenous transformation matrix, Denavit-Hartenberg convention, Euler angles, RPY representation, direct and inverse kinematics for industrial robots for position and orientation.

UNIT- III

Velocity kinematics – the manipulator Jacobian: joint, end effect or velocity, direct and inverse velocity analysis. Trajectory planning: Interpolation, cubic polynomial, linear segments with parabolic blending, static force and moment transformation, solvability, stiffness, singularities.

UNIT- IV

Robot dynamics: Lagrangian Formulation for link inertia tensor and manipulator inertia tensor, Newton-Euler formulation for RR & RP manipulators.

Control: Individual, joint and computed torque.

UNIT -V

End effectors: Position and velocity measurement.

Sensors: Proximity and range, tactile, force and torque,

Drives for Robots: Electrical, Hydraulic and Pneumatic.

Robot vision: Introduction to technique, image acquisition and processing, introduction to robot programming languages.

Text Books:

1. Spong and Vidyasagar, "Robot Dynamics and Control", John Wile and Sons, 1990
2. R.K. Mittal, I.J. Nagrath, "Robotics and control", Tata McGraw-Hill Publishing Company Ltd. 2003
3. Groover, "Industrial Robotics", McGraw-Hill Publishing Company Ltd. 2003

Suggested Reading:

1. Asada and Slotine, "Robot analysis and Intelligence", Wiley Interscience, 1986
2. K.S. Fu Gon ZalezRC., lEEc.S.G., "Robotics, Control Sensing Vision and Intelligence", McGraw Hill, Int. Ed., 1987

18EC C32

TECHNICAL SEMINAR

Instruction	3 P Hours per Week
Duration of SEE	--
SEE	--
CIE	50 Marks
Credits	1

Prerequisite: Student must have completed Project: Part - 1

Course Objectives:

1. To introduce students to critical reading, understanding, summarizing, explaining and preparing report on state-of-the-art topics in a broad area of his/her specialization.
2. Seminar topics may be chosen by the students with advice from the faculty members and the student shall read further relevant articles in the domain.
3. Documenting the seminar report in a prescribed format.

Course Outcomes:
Upon completion of this course, students will be able to:

1. Collect, Organize, Analyze and Consolidate information about emerging technologies from the literature.
2. Exhibit effective communication skills, stage courage, and confidence.
3. Demonstrate intrapersonal skills.
4. Explain new innovations/inventions in the relevant field.
5. Prepare and experience in writing the Seminar Report in a prescribed format.

The goal of a seminar is to introduce students to critical reading, understanding, summarizing, explaining and preparing report on state-of-the-art topics in a broad area of his/ her specialization. Seminar topics may be chosen by the students with advice from the faculty members and the student shall read further relevant articles in the domain.

The seminar must be clearly structured and the power point presentation shall include following aspects:

1. Introduction to the field
2. Literature survey
3. Consolidation of available information
4. Summary and Conclusions
5. References

Each student is required to:

1. Submit a one-page synopsis of the seminar talk for display on the notice board.
2. Deliver the seminar for a maximum duration of 30 minutes, where the presentation should be for 20 minutes in PowerPoint, followed by Question and Answers session for 10 minutes.
3. Submit the detailed report of the seminar in spiral bound in a précised format as suggested by the department.

Seminars are to be scheduled from 3rdweek to the last week of the semester and any change in schedule shall be discouraged.

For the award of sessional marks, the students are judged by three (3) faculty members and are based on oral and written presentations as well as their involvement in the discussions during the oral presentation.

Note: Topic of the seminar shall be preferably from any peer reviewed recent Journal publications.

Guidelines for awarding marks (CIE): Max. Marks: 50		
S. No	**Description**	**Max. Marks**
1	Contents and relevance	10
2	Presentation skills	10
3	Preparation of PPT slides	05
4	Questions and answers	05
5	Report in a prescribed format	20

18EC C33

PROJECT: PART-2

Instruction	10 P Hours per Week
Duration of SEE	Viva Voce
SEE	100 Marks
CIE	100 Marks
Credits	10

Prerequisite: Student must have earned the credit of 'Project: Part - 1'.

Course Objectives:

1. The object of Project: Part2 is to enable the student extend further the investigative study, either fully theoretical/practical or involving both theoretical and practical work.
2. The work shall be carried out under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry.
3. Preparing an Action Plan for conducting the investigation, including team work;

Course Outcomes:

Upon completion of this course, students will be able to:

1. Recall the details of the approach for the selected problem.
2. Interpret the approach to the problem relating to the assigned topic.
3. Determine the action plan to conduct investigation.
4. Analyze and present the model / simulation /design as needed.
5. Evaluate, present and report the results of the analysis and justify the same.

The objective of 'Project: Part-2' is to enable the student extend further the investigative study taken up, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership. The assignment to normally include:

1. In depth study of the topic assigned;
2. Review and finalization of the Approach to the Problem relating to the assigned topic;
3. Preparing an Action Plan for conducting the investigation, including team work;
4. Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed;
5. Final development of product/process, testing, results, conclusions and future directions;
6. Preparing a paper for Conference presentation/ Publication in Journals, if possible;
7. Preparing a Dissertation in the standard format for being evaluated by the Department.
8. Final Seminar presentation before Departmental Committee.

Guidelines for awarding marks in CIE: (**Max. Marks: 100**)

Evaluation by	Max. Marks	Evaluation Criteria / Parameter
Department Review Committee	10	Review 1
	15	Review 2
	25	Submission
Supervisor	10	Regularity and Punctuality
	10	Work Progress
	10	Quality of the work which may lead to publications
	10	Report Preparation
	10	Analytical / Programming / Experimental Skills

Guidelines for awarding marks in **SEE**: (**Max. Marks: 100**)

Evaluation by	**Max. Marks**	**Evaluation Criteria / Parameter**
External and Internal Examiners together	20	Power Point Presentation
	40	Thesis Evaluation
	20	Quality of the project • Innovations • Applications • Live Research Projects • Scope for future study • Application to society
	20	Viva-Voce