Faculty of Engineering & Technology

Scheme of Instruction and Syllabus

For

B.Tech (AICTE) – I & II Semester

Of

Four Year Degree Course

In

ELECTRONICS & COMMUNICATION ENGINEERING

Mahatma Gandhi University

Nalgonda

Telangana State

508 254

SEMESTER – I

S.No	Course Code	Course Title	Scheme of Instructions				Scheme of Examinations		Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	
THEORY									
1.	BSC 101	Engineering Chemistry	3	1	0	4	30	70	4
2.	BSC 102	Mathematics – I	3	1	0	4	30	70	4
3.	ESC 101	Basic Electrical Engineering	3	1	0	4	30	70	4
4.	ESC 102	Engineering Graphics	1	0	4	5	30	70	3
PRACTICALS									
5.	BSC 101	Engineering Chemistry Lab	0	0	3	3	25	50	1.5
6.	ESC 101	Basic Electrical Engineering	0	0	2	2	25	50	1
		Total	**10**	**3**	**9**	**22**	**170**	**380**	**17.5**

L : Lectures
T : Tutorials
P : Practicals
CIE : Continuous Internal Evaluation
SEE : Semester End Examination
BSC : Basic Science Course
HS : Humanities and Social Sciences
ESC: Engineering Science Course

Course Code	Course Title						Core/Elective
BSC 101	ENGINEERING CHEMISTRY						Core
	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	1	0	0	30	70	4

Course Outcome: The concepts developed in this course will help in qualification of several concepts in chemistry that have been introduced at the 10+2 level. Technology is being increasingly based on the electronic, Atomic and Molecular level modifications. The course will enable the student to:

- Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
- Rationalise bulk properties and processes using thermodynamic considerations.
- Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques
- Gains knowledge in causes of corrosion and its prevention.
- Attains knowledge about the disadvantages of hard water for domestic and industrial purpose.

UNIT I

Periodic properties, Atomic & Molecular Structure and Spectroscopy:

Variation of s, p, d and f orbital, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electro negativity, oxidation states, coordination numbers and geometries.

Molecular Orbital Theory, Linear Combination of Atomic Orbital, Molecular Orbital energy level diagrams of diatomic molecules- O_2, N_2 and NO. Crystal Field Theory salient features, Crystal field splitting of d-orbital of transition metal complexes in Octahedral, Tetrahedral and Square planar geometries.

Principles of Spectroscopy, selection rules of Vibrational, Rotational & Electronic spectroscopy and their applications. Selection rules (Derivation not required)

UNIT II

Thermodynamics and electrochemistry:

Thermodynamics: Thermodynamics first law and its limits, Thermodynamic second law. Thermodynamic functions: Enthalpy, Entropy, Free energy and their significance. Entropy and Free energy change for isothermal process. Variation of free energy change with temperature and pressure.

Electrochemistry: Electrochemical cells- Electrolytic and Galvanic cells-notation, cell reaction and cell potentials. Types of electrodes-Calomel, Quinhydrone and Glass electrodes. Determination of P^H of a solution by using Quinhydrone electrode. Principles and applications of Conductometric and Potentiometric titrations. Nernst equation and its derivation. Application of Nernst equation to electrode potential and emf of cells. Numericals.

UNIT III

Water chemistry and corrosion:

Water chemistry: Hardness of water-Types and units of hardness, estimation of temporary and permanent hardness of water by EDTA method. Alkalinity of water and its determination. Water softening by Ion-exchange and Reverse Osmosis methods. Boiler troubles-scales and sludges formation-causes, effects and prevention. Specifications of potable water. Water treatment for drinking purpose-coagulation, sedimentation, filtration, sterilization by Chlorination and Ozanization.

Corrosion-causes and its effects. Types of corrosion-Dry or Chemical corrosion and Wet or Electrochemical corrosion and their mechanism. Electrochemical corrosion and its types. Factors influencing rate of corrosion.

Corrosion control methods: Cathodic protection methods- Sacrificial anodic and Impressed current cathodic protection method. Surface coating methods: Hot dipping-Galvanizing and Tinning. Electroplating.

UNIT-IV

Energy Sources and Nanomaterials:

Batteries: Primary batteries-Zn carbon battery. Secondary batteries-Pb- Acid battery and Ni-Cd battery. Lithium-ion batteries- advantages and applications.

Fuel cells: Concept of fuel cells and their advantages. Construction and working of H_2-O_2 and Methanol-Oxygen fuel cells.

Solar cells: Concept of solar energy conversion, photovoltaic cells.

Nanomaterials: Introduction. Properties of nanomaterials. Synthesis of nanomaterials-Top down, Bottom up approach and Sol-gel method. Applications of nanomaterials-Electronic, Telecommunications and medicine.

UNIT-V

Engineering materials:

Polymers: Introduction. Classification of polymers: Plastics, Fibers and Elastomers.

Preparation, properties and engineering applications of the following polymers:

Plastics: PVC and Bakelite

Fibres: Nylon 6:6, and Dacron.

Elastomers: Buna-S and Butyl Rubber.

Conducting polymers: Introduction. Mechanism of conduction in polymers. Intrinsic conducting polymers: Poly-acetylene and poly-aniline. Aplications of conducting polymers.

Liquid Crystals: Introduction. Classification of liquid crystals. Thermotropic, Lyotropic liquid crystals. Chemical constitution and liquid crystalline behavior. Molecular ordering in liquid crystals. Nematic, Smectic and Cholestric liquid crystals and their applications.

Text Book:

1. Jain & Jain, Engineering chemistry, Dhanpat Rai publishing Co.,16th Edition.

References:

1. B.L.Tembe,Kamaluddin and M.S.Krishnan, Engineering Chemistry(NPTELWeb-book)
2. Prashanth Rath, Engineering Chemistry, Cengage Learning.
3. M.J.Sienko and R.A.Plane, Chemistry: Principles and Applications, MGH Publishers.
4. B.H.Mahan, University Chemistry, Pearson Publishing Co., 4th Edition.
5. C.N. Banwell, Fundamentals of Molecular Spectroscopy, TMH

Course Code	Course Title						Core/Elective
BSC 102	MATHEMATICS – I						Core
	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	1	0	0	30	70	4

Course objectives:

- To introduce the concepts of sequences, series and their properties
- To Study Fourier Series and its applications.
- To introduce the concepts of functions of several variables and multiple integrals
- To study vector differential and integral calculus

Course Outcomes:

After completing this course, the students will able to

- find the nature of sequences and series
- Expand functions as a Fourier Series.
- use the knowledge of multiple integrals in finding the area and volume of any region bounded by given curves
- apply this knowledge to solve the curriculum problems

UNIT I

Sequences and Series: Sequences, Series, General properties of series, Series of positive terms, Comparison tests, tests of Convergence D'Alembert's ratio test, Cauchy's n^{th} root test, Raabe's test, Logarithmic test, Alternating series, Series of positive and negative terms, Absolute convergence and Conditional convergence ; Fourier Series, Half range Sine and Cosine Series, Parseval's theorem.

UNIT II

Calculus of one variable: Rolle's theorem, Lagrange's , Cauchy's mean value theorems (without proof) Taylor's series, Curvature, Radius of curvature, Circle of curvature, Envelope of a family of curves, Evolutes and Involutes, Evaluation of definite and improper integrals, Beta, Gamma and Error functions.

UNIT III

Multivariable Calculus (Differentiation): Functions of two variables, Limits and continuity, Partial derivatives, Total differential and differentiability, Derivatives of composite and implicit functions (Chain rule), Change of variables, Jacobian , Higher order partial derivatives, Taylor's series of functions of two variables, Maximum and minimum values of functions two variables, Lagrange's method of multipliers.

UNIT IV

Multivariable Calculus (Integration): Double integrals,Change of order of integration, Triple integrals, Change of variables in integrals and applications-areas and volumes.

UNIT V

Vector Calculus: Scalar and vector fields, Gradient of a scalar field, Directional derivative, Divergence and Curl of a vector field, Line, Surface and Volume integrals , Green's theorem in a plane, Gauss's divergence theorem, Stoke's theorem (without proofs) and their verification.

Text Books:

1. R.K.Jain & S.R.K Iyengar, *Advanced Engineering Mathematics*, Narosa Publications, 4th Edition 2014.
2. Erwin Kreyszig, *Advanced Engineering Mathematics*, John Wiley, 9th Edition, , 2012.

References:

1. B.S.Grewal, *Higher Engineering Mathematics*, Khanna Publications, 43rd Edition, 2014.
2. G.B.Thomas , Maurice Weir and Joel Hass, *Thomas' Calculus* , Peterson, 12th Edition,2010.
3. B.V. Ramana, Higher Engineering Mathematics, 23rd reprint, 2015.
4. N.P.Bali and M. Goyal, A text book of Engineering Mathematics, Laxmi Publications, 2010.
5. H.K. Dass, Er. Rajnish Varma, Higher Engineering Mathematics, Schand Technical Third Edition.

Course Code	Course Title						Core/Elective
ESC 101	BASIC ELECTRICAL ENGINEERING						Core
	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	1	0	0	30	70	4

Course Objectives:

- To understand the basic concepts and the applications of DC and AC circuits.
- To master the basics of 3-phase balanced circuits
- To understand the basics of DC machines and Induction motor.
- To understand the characteristics of series, shunt and compound motors,
- To understand the Stepper motor and Brushless DC motor.

Course Outcomes:

- To understand and analyze basic electric and magnetic circuits
- To study the working principles of electrical machines and power converters.
- To introduce the components of low voltage electrical installations

UNIT I

DC Circuits: Electrical circuit elements (R, L, C), Voltage and current sources, Kirchoff's current and voltage laws, Analysis of simple circuits using with DC excitation, super position, Thevenin's and Norton's theorems, time domian analysis of first order RL and RC circuits.

UNIT II

AC Circuits: Representation of Sinusoidal wave forms, Phasor representation of sinusoidal quantities, Peak and rms values, Active power, Reactive power, apparent power, analysis of single phase AC circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance, 3-phase balanced circuits, voltage and current relations in star and delta connections.

UNIT III

Tranformers: Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency, auto transformer, 3-phase transformer connections.

UNIT IV

Electrical machines:

Generation of rotating magnetic field, Construction and working of 3-phase induction motors, significance of torque slip characteristics, loss components and efficiency, Methods of starting and Speed control of induction motors, single phase induction motor.

Construction, working, torque speed characteristic and speed control of separately excited DC motor.

Construction and working of synchronous generators

UNIT V

Electrical installations: Components of LT switch gear: Switch fuse unit (SFU), MCB, ELCB, MCCB, types of wires and cables, earthing. Types of batteries, important characteristics for batteries, elementary calculations for energy consumption, power factor improvement and battery bachup.

Text Books:

1. V.K.Mehta, *Principles of Electrical Engineering*, S.Chand & Co.,1995
2. Kothari and Nagrath, *Basic Electrical Engineering*, Tata McGraw Hill, 2nd Edition, 2006.

References:

1. D. C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, 2009.
2. L. S. Bobrow, “Fundamentals of Electrical Engineering”, Oxford University Press, 2011.
3. E. Hughes, “Electrical and Electronics Technology”, Pearson, 2010.
4. V. D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India, 1989.

Course Code	Course Title						Core/Elective
ESC 102	ENGINEERING GRAPHICS						Core
	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	1	0	0	4	30	70	3

Course Objective:

- To prepare you to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- To prepare you to communicate effectively
- To prepare you to use the techniques, skills, and modern engineering tools necessary for engineering practice

Course Outcome: The student will learn

- Introduction to engineering design and its place in society
- Exposure to the visual aspects of engineering design
- Exposure to engineering graphics standards
- Exposure to computer-aided geometric design
- Exposure to creating working drawings
- Exposure to engineering communication

UNIT I

Introduction to Engineering Drawing: Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only), Cycloid, Epicycloid, Hypocycloid and Involute, Scales – Plain, Diagonal.

UNIT II

Orthographic Projections: Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes, Projections of planes inclined Planes - Auxiliary Planes;

UNIT III

Projections of Regular Solids: Inclined to both the Planes- Auxiliary Views, Draw simple annotation, dimensioning and scale.

Sections and Sectional Views of Right Angular Solids: Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone;

UNIT IV

Isometric Projections: Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions.

UNIT V

Overview of Computer Graphics with CAD (For Internal Evaluation Weightage only):

Computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids].

Suggested Text/ Reference Books:

1. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
2. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
3. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
4. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers CAD Software Theory and User Manuals.
5. Computer Aided Engineering Drawing – K Balaveera Reddy- CBS Publishers.

Course Code	Course Title						Core/Elective
BSC 101	ENGINEERING CHEMISTRY LAB						Core
	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	0	0	0	3	25	50	1.5

Course Objective:

- The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering.

Course Outcome: The students will learn to

- Estimate rate constants of reactions from concentration of reactants/products as a function of time
- Measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc
- Synthesize a small drug molecule and analyse a salt sample

I. VOLUMETRIC ANALYSIS

1. Estimation of Hardness of sample water by EDTA method
2. Estimation of alkalinity of sample water

II. INSTRUMENTAL ANALYSIS CONDUCTOMETRY

1. Conductometric and acid-base strong acid vs strong base titration.
2. Conductometric weak acid vs strong base titration.
3. Conductometric mixture of acids vs strong base titration.
4. Conductometric precipitation titration-barium chloride against sodium sulphate

III. POTENTIOMETRY

1. Potentiometric acid-base titration –strong acid vs strong base, using Quinhydrone electrode.
2. Potentiometric redox titration-$KMnO_4$vs Fe^{+2}

IV. pH METRY

1. pH Metry strong acid vs strong base titration.
2. pH Metry weak acid vs strong base titration

V. COLORIMETRY

1. Verification of Beer's Law –using Potassium permanganate.
2. Estimation of $KMnO_4$(Mn) in the given solution
3. Estimation of iron in cement

VI. KINETICS

1. First order reaction-hydrolysis of methyl acetate
2. Second order reaction-potassium iodide and persulphate

Text Books:

1. Senior practical Physical Chemistry, BD Khosla, A.Ghulati, VC.Garg., R.Chand and Co., New Delhi 10th ed. 2001.
2. Practical Physical Chemistry, B.Vishwanathan, P.S Raghavan, Viva Books Private Limited.

Course Code	Course Title						Core/Elective
ESC 101	BASIC ELECTRICAL ENGINEERING LAB						Core
	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	0	0	0	2	25	50	1

Course Objective:

- To acquaint with practical electric AC &DC circuits implementation

Course Outcomes: On successful completion of the course, the student will acquire the ability to:

- Awareness about various electric safety rules to be followed while working with electrical equipment's.
- Explore themselves in designing basic electric circuits
- Identify requirements for electric machines for domestic and industrial purpose

List of Experiments:

1. Verification of Kirchhoff's Laws.
2. Verification of Thevinin's & Norton's Theorems.
3. Study of Three-phase Balanced Circuits.
4. Measurement of Power by Two-Wattmeter Method.
5. Study of Single-Phase RLC Series Circuits.
6. Magnetization Curve of a Separately Excited DC Generator.
7. Load Characteristics of Shunt Generator.
8. Performance Characteristics of shunt Motor.
9. Speed Control of DC Shunt Motor.
10. O.C and S.C Test on Single-Phase Transformer.
11. Load Test on Single-Phase Transformer.
12. Load Test on Three-Phase Induction Motor.

Note: At least ten experiments should be conducted in the Semester

SEMESTER – II

S.No	Course Code	Course Title	Scheme of Instructions				Scheme of Examinations		Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	
THEORY									
1.	BSC 202	Engineering Physics	3	1	0	4	30	70	4
2.	BSC 201	Mathematics –II	3	1	0	4	30	70	4
3.	ESC 201	Programming for Problem Solving	3	0	0	3	30	70	3
4.	HSMC 201	English	2	0	0	2	30	70	2
PRACTICALS									
5.	BSC 101	Engineering Physics Lab	0	0	3	3	25	50	1.5
6.	ESC 201	Programming for Problem Solving Lab	0	0	4	4	25	50	2
7.	ESC 202	Workshop Practice	0	0	6	6	25	50	3
8.	HSMC 201	English Lab	0	0	2	2	25	50	1
		Total	**11**	**2**	**15**	**28**	**220**	**480**	**20.5**

L: Lectures

T: Tutorials

P: Practicals

CIE: Continuous Internal Evaluation

SEE: Semester End Examination

BSC: Basic Science Course

HS: Humanities and Social Sciences

ESC: Engineering Science Course

Course Code	Course Title						Core/Elective
BSC 202	ENGINEERING PHYSICS						Core
	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	1	0	0	30	70	4

Prerequisites:

- Nil

Course objectives:

- The aim of the course to acquire the knowledge on the basic concepts in the wave mechanics, Lasers, Fiber optics, Ultrasonics, Dielectric materials, Superconductivity, Magnetic materials and Electromagnetic theory.
- To understand the properties of Semiconductors. Also get introduction to basics of Thin films and Nanomaterials

Course Outcomes:

- On the completion of course the student will acquire the basic knowledge and understanding on the concepts that are involved in the contents incorporated in the syllabus and students will be able use them in Engineering fields.

UNIT I

Wave mechanics: matter waves-de-Broglie wavelength, properties of wave function, Physical significance-Schrodinger time dependent and time in-dependent wave equation. Particle in a 1-D box.

Electromagnetic theory: Basic laws of electricity and magnetism – Maxwell's equations in integral and differential forms – Conduction and displacement current – Relation between D, E and P – Electromagnetic waves : Equation of plane wave in free space – Poynting theorem.

UNIT II

Fibre Optics : Introduction – Propagation of light through an optical fiber – Acceptance angle – Numerical aperture (NA) – Types of optical fibers and refractive index profiles Fibre drawing process (double crucible method) – Application of optical fibers.

Lasers: Characteristics of lasers – Spontaneous and stimulated emission of radiation – Einstein's coefficients – Population inversion – Ruby laser – Helium – Neon laser – Semiconductor laser-Applications of lasers.

Ultrasonics: Introduction to Ultrasonics waves – Production of ultrasonic waves by Piezoelectric method – Detection of ultrasonic waves: Piezoelectric detector – Properties of Ultrasonics – Wavelength of Ultrasonics by Debye-Sears method – Applications.

UNIT III

Semiconductors : Intrinsic and Extrinsic semiconductors – Concept of a hole – carrier concentration and conductivity in intrinsic semiconductors – Formation of P-N junction diode and its I-V characteristics – Thermistor and its characteristics – Hall effect and its applications.

Dielectric Materials : Dielectrics – Types of polarizations- Electronic, Ionic, Orientational and Space charge polarizations – Expression for Electronic polarizability –Frequency and temperature dependence of dielectric polarizations- Determination of dielectric constant by capacitance Bridge method – Ferro electricity – Barium titanate – Applications of Ferroelectrics.

UNIT IV

Superconductivity: Introduction – Genera properties of super conductors – Meissner effect –Type I and Type II superconductors – BCS theory (Qualitative) – Introduction to High T_c superconductors – Applications of superconductors.

Magnetic Materials: Classification of magnetic materials: dia, para, ferro, antiferro and ferromagnetic materials – Weiss molecular field theory of ferromagnetism – Magnetic domains Hysteresis curve – Soft and hard magnetic materials – Ferrites: Application of ferrites.

UNIT V

Thin Films: Distinction between bulk and thin films **–** Thin film preparation techniques : Thermal evaporation methods, Electron beam evaporation – Construction and working of Solar cell – Applications.

Nanomaterials : Introduction – Properties of materials at reduced size – Surface to volume ratio at nano scale – Classification of nanomaterials – Preparation of nanomaterials : bottom up methods (sol gel and CVD), Top-down methods (ball milling) – Basic ideas of carbon nanotubes – Applications nanomaterials and their health hazards.

Text Books:

1. B.K. Pandey and S. Chaturvedi, Engineering Physics, Cengage Learning 2012.
2. C. Kittel – Introduction to Solid State Physics, Wiley Eastern Ltd., 5th Edition, 1976.

References:

1. S.L. Gupta and V.Kumar – Solid State Physics, K. Nath & Co., 8th Edition, 1992.
2. A. Goswami – Thin Film Fundamentals, New Age International, 2007.
3. A.K. Bhandhopadhya – Nono Materials, new Age International, 1st Edition, 2007.
4. M.S. Avadhanulu and P.G. Kshirasagar – Engg. Physics, S.Chand & Co., 1st Edition, 1992.
5. C.M. Srivastava and C. Srinivasan – Science of Engg. Materials, New Age International, 2002.

Course Code	Course Title						Core/Elective
BSC 201	MATHEMATICS – II						Core
	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	1	0	0	30	70	4

Course objectives:

- To study matrix algebra and its use in solving system of linear equations and in solving eigen value problems
- To provide an overview of ordinary differential equations
- To study special functions like Legendre and Bessel functions
- To introduce the concept of functions of complex variable and their properties

Course Outcomes: After completion of course, the students will be able to

- solve system of linear equations and eigen value problems
- solve certain first order and higher order differential equations
- determine the analyticity of complex functions and expand functions as Taylor and Laurent series
- evaluate complex and real integrals using residue theorem

UNIT I

Matrices: Elementary row and column operations, Rank of a matrix, Echelon form, System of linear equations, Linearly dependence and independence of vectors, Linear transformation,Orthogonal transformation,Eigenvalues, Eigenvectors, Properties of eigenvalues , Cayley-Hamilton theorem, Quadratic forms, Diagonalization of Matrices, Reduction of quadratic form to canonical form by orthogonal transformation , Nature of quadratic forms.

UNIT II

First Order Ordinary Differential Equations: Exact first order differential equations , Integrating factors, Linear first order equations , Bernoulli's , Riccati's and Clairaut's differential equations, Orthogonal trajectories of a given family of curves.

UNIT III

Differential Equations of Higher Orders: Linear independence and dependence, Solutions of second and higher order linear homogeneous equations with constants coefficients, Method of reduction of order for the linear homogeneous second order differential equations with variable coefficients , Solutions of non-homogeneous linear differential equations, Method of variation of parameters, solution of Euler-Cauchy equation, Simultaneous linear differential equations, Power Series

solution, Legendre Polynomial of first kind, Bessel's function of first kind and their properties.

UNIT IV

Functions of a Complex Variable: Limits and continuity of a function, differentiability and analyticity, Elementary Analytic functions, Necessary and Sufficient conditions for a function to be analytic,Cauchy- Riemann equations in polar form, harmonic functions, complex integration, Cauchy's integral theorem, extension of Cauchy's integral theorem for multiply connected regions, Cauchy's integral formula,Cauchy's inequality, Cauchy's formula for derivatives, Liouville's theorem, Maximum Modulus principle (without proof)and its applications

UNIT V

Residue Calculus: Power series, Taylor's series, Laurent's series, zeros and singularities, residues, residue theorem, evaluation of real integrals using residue theorem, Argument principle, Rouche's Theorem and their applications, conformal mapping Bilinear transformations. (**All Theorems without Proof)**

Text Books:

1. R.K. Jain & S.R.K. lyengar, *Advanced Engineering Mathematics*, Narosa Publications, 4th Edition,2014.
2. Erwin Kreyszig, *Advanced Engineering Mathematics*, John Wiley , 9th Edition, , 2012.

References:

1. Dr.B.S.Grewal, *Higher Engineering Mathematics*, Khanna Publications, 43rd Edition, 2014.
2. Dr.M.D.Raisinghania, *Ordinary and Partial differential equations*, S.CHAND, 17th Edition 2014.
3. James Brown, R.V Churchill, Complex Variables and applications, Mc GrawHill 9th Edition 2013.
4. B.V. Ramana, Higher Engineering Mathematics, 23rd reprint, 2015.
5. S.L Ross, Differential Equations 3rd Edition, Wiley India.
6. G.F. Simmons and S.G. Krantz, Differential Equations, Tata Mc Graw Hill, 2007.
7. N. Bali, M.Goyal, A text book of Engineering Mathematics,Laxmi publications,2010
8. H.K. Dass, Er. Rajnish Varma, Higher Engineering Mathematics, Schand Technical Third Edition.

Course Code	Course Title						Core/Elective
ESC 201	PROGRAMMING FOR PROBLEM SOLVING						Core
	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	0	0	0	30	70	3

Course Objectives:

- To acquire problem solving skills
- To be able to develop flowcharts
- To understand structured programming concepts
- To be able to write programs in C Language
- To understand different type of data representations (Arrays, Structures and Files).
- To understand different types of sorting and searching techniques.

Course Outcome:

- Able to design algorithms for different problems
- Able to write program for various problems.
- Able to write program for matrix representation.
- Able to perform file handling operations.

UNIT I

Introduction to Programming: Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.)**.**

Introduction to Algorithm: steps to solve logical and numerical problems. Representation of Algorithm**:** Flowchart/Pseudocode with examples. From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code

UNIT II

Arithmetic expressions and precedence, Conditional Branching and Loops, Writing and evaluation of conditionals and consequent branching, Iteration and loops

Introduction to Arrays: Arrays, Representation of Arrays (1-D, 2-D), Character arrays and Strings

UNIT III

Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

Introduction to Pointers: Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)

UNIT IV

Introduction to Function: Functions (including using built in libraries), Parameter passing in functions, call by value, passing arrays to functions: idea of call by reference

Introduction to Recursion: Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc.

UNIT V

Introduction to Structure: Structures, Defining structures, Array of Structures and Union

Introduction to File: File handling (only if time is available, otherwise should be done as part of the lab)

Text Books:

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
2. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill

References:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

Course Code	Course Title						Core/Elective
HSMC 201	ENGLISH						Core
	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	2	0	0	0	30	70	2

Course Objectives:

- Communicate clearly, accurately and appropriately
- Know and use verbal and non-verbal communication appropriately
- Infer information from texts
- Learn basic grammar of the English language
- Use appropriate idiomatic expressions, one word substitutes etc.

UNIT I

Vocabulary Building:

1.1. Word Formation

1.2. Synonyms, Antonyms, Abbreviations and Acronyms

1.3. One word Substitutes

1.4. Words and their categorizations

1.5. Foreign words and Silent letters

UNIT II

Remedial English and Common Errors:

2.1. Tense and Aspects

2.2. Conjuncts and Connectives

2.3. Voice

2.4. Concord

2.5. Degrees of comparison and Question Tags

UNIT III

Writing Practices:

3.1. Sentence Structure

3.2. Use of phrase and clauses in sentence

3.3. Coherence

3.4. Writing sample sentence

3.5. Paragraph-précis and expansion

Textbook:

1. E. Suresh Kumar, Engineering English, Orient Blackswan, 2014.

References:

1. E. Suresh Kumar et al., Communication Skills and Soft Skills,Pearson, 2011.
2. Sanjay Kumar and Pushp Lata, Communication Skills, OUP, 2011.
2. Kavita Tyagi and Padma Misra, Professional Communication, PHI, 2011.
3. Meenakshi aman and Sangeeta Sharma, Technical Communication: Principles and Practice, OUP, 2011.

Course Code	Course Title						Core/Elective
BSC 101	ENGINEERING PHYSICS LAB						Core
	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	0	0	0	3	25	50	1.5

List of Experiments:

1. To calculate the Numerical aperture (NA) acceptance angle of a given optical fibre.
2. Determination of wavelength of LASER using diffraction grating.
3. Determination of Velocity of ultrasonic waves in a liquid by Debye-Sears method.
4. To draw the I-V characteristics of P-N Junction diode and to evaluate the value of potential barrier of the diode.
5. Determination of carrier concentration, Mobility and Hall Coefficient of Ge Crystal using Hall Effect Experiment.
6. To draw the curve between the magnetizing field and the intensity of magnetization of the specimen (soft iron rod) and to find out i) Coercivity ii) Retentivity and iii) Hysteresis loss.
7. To draw the I-V Characteristics of a solar cell and to calculate the i) Fill factor ii) Efficiency and iii) Series resistance.
8. To find the values of Electrical conductivity and energy gap of Ge Crystal by Four probe method.
9. To determine the Dielectric Constant and Phase transition temperature of Lead Zirocnium Titanate (PZT).
10. To determine the constants of A, B and a using Thermistor characteristics.

Course Code	Course Title						Core/Elective
ESC 201	PROGRAMMING FOR PROBLEM SOLVING LAB						Core
	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	0	0	0	4	25	50	2

Course Outcome: The student will be able

- To formulate the algorithms for simple problems
- To translate given algorithms to a working and correct program
- To correct syntax errors as reported by the compilers
- To identify and correct logical errors encountered at run time
- To write iterative as well as recursive programs
- To represent data in arrays, strings and structures and manipulate them through a program
- To declare pointers of different types and use them in defining self-referential structures.
- To create, read and write to and from simple text files

List of Programs:

1. **Tutorial 1:** Problem solving using computers:
   Lab1: Familiarization with programming environment
2. **Tutorial 2:** Variable types and type conversions:
   Lab 2: Simple computational problems using arithmetic expressions
3. **Tutorial 3:** Branching and logical expressions:
   Lab 3: Problems involving if-then-else structures
4. **Tutorial 4:** Loops, while and for loops:
   Lab 4: Iterative problems e.g., sum of series
5. **Tutorial 5:** 1D Arrays: searching, sorting:
   Lab 5: 1D Array manipulation
6. **Tutorial 6:** 2D arrays and Strings
   Lab 6: Matrix problems, String operations
7. **Tutorial 7:** Functions, call by value:
   Lab 7: Simple functions

8. **Tutorial 8 &9:** Numerical methods (Root finding, numerical differentiation, numerical integration):

   Lab 8 and 9: Programming for solving Numerical methods problems
9. **Tutorial 10:** Recursion, structure of recursive calls

   Lab 10: Recursive functions
10. **Tutorial 11:** Pointers, structures and dynamic memory allocation

    Lab 11: Pointers and structures
11. **Tutorial 12:** File handling:

    Lab 12: File operations

Note: The laboratory should be preceded or followed by a tutorial to explain the approach or algorithm to be implemented for the problem given.

Course Code	Course Title						Core/Elective
ESC 202	WORKSHOP PRACTICE						Core
	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	0	0	0	6	25	50	3

Course Objectives:

- To study of different hand operated power tools, uses and their demonstration.
- To gain a good basic working knowledge required for the production various engineering products.
- To provide hands on experience about use of different engineering materials, tools, equipments and processes those are common in the engineering field.
- To develop a right attitude, team working precision and safety at work place.
- Upon completion of this course, the students will gain knowledge of the different manufacturing processes which are commonly employed in the industry, to fabricate components using different materials.

Course Outcomes: The student will able to

- Fabricate components with their own hands.
- Get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.
- Assembling different components, they will be able to produce small devices of their interest.
- Apply basic electrical engineering knowledge for house wiring practice.

I Lectures & videos:

1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods.
2. CNC machining, Additive manufacturing
3. Fitting operations & power tools
4. Electrical &Electronic
5. Carpentry
6. Plastic moulding, glass cutting
7. Metal casting
8. Welding (arc welding & gas welding), brazing

II. Workshop Practice (Two from each trade):

1. Machine shop
2. Fitting shop
3. Carpentry
4. Electrical house wiring
5. Welding
6. Black Smithy
7. Tin Smithy
8. Glass Cutting (Demo)

Note:- Examinations could involve the actual fabrication of simple components, utilizing one or more of the techniques covered above.

Text Books:

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
2. Workshop manual / K.Venugopal /Anuradha

References:

1. Gowri P. Hariharan and A. Suresh Babu,"Manufacturing Technology – I" Pearson Education, 2008.
2. Workshop manual – P. Kannaiah / K.L. Narayana / Scitech
3. Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGrawHill House, 2017.

Course Code	Course Title						Core/Elective
HSMC 201	English Lab						Core
	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	0	0	0	2	25	50	1

Course Objectives:

- To enable the students to
- learn the sound systems of English
- learn the word stress in English
- learn the rhythm and intonation of English
- improve their articulation skills and participation skills

Note: While teaching the following items, emphasis may be laid on intensive practice in the language lab. Lecturing may be avoided as far as possible.

1. **Pronunciation:** Introduction to Phonetics (speech sounds), Vowels sounds, Consonant Sounds, Consonant clusters etc.
2. **Stress:** Primary stress, Secondary stress, functional stress, rules of word stress
3. **Intonation:** Introduction of Intonation, Major patterns of intonation in English with their semantic implications.
4. **Introduction to Rhythm:** Definition and types of Rhythm. Repetition, Alternation, Gradation.
    1. **Regular Rhythm**
    2. **Flowing Rhythm**
    3. **Progress Rhythm**
5. **Listening Comprehension:** Listening for specific details, Listening Comprehension Tests.
6. **Descriptions, Narrations, Giving Directions**
7. **Group Discussions, Interview Skills, Mock Interviews.**

Lab Manual Recommended:

- E. Suresh Kumar. A Handbook for English Language Laboratories (with CD). Revised edition, Cambridge University Press India Pvt. Ltd. 2014

Text Books:

1. T. Balasubramanian. A Text book of English Phonetics for Indian Students. Macmillan, 2008.
2. Edgar Thorpe. Winning at Interviews. Pearson Education, 2006.
3. J. Sethi et al., A Practical Course in English Pronunciation (with CD). Prentice Hall of India, 2005.
4. Hari Mohan Prasad. How to Prepare for Group Discussions and Interviews. Tata McGraw Hill, 2006.

Faculty of Engineering & Technology

Scheme of Instruction and Syllabus

for

B. Tech (CBCS) III and IV semester (AICTE MODEL)

of

Four Year Degree Course

in

ELECTRONICS AND COMMUNICATION ENGINEERING

(WITH EFFECT FROM THE ACADEMIC YEAR 2019-20)

Mahatma Gandhi University

Nalgonda - TS - 508 254

SCHEME OF INSTRUCTION

B. Tech (ELECTRONICS & COMMUNICATION ENGINEERING)

CBCS-AICTE MODEL CURRICULUM

Proposed from the Academic year 2019-20

III - SEMESTER

S.No.	Course Code	Course Title	Scheme of Instruction			Contact hr/week	Scheme of Examination		Credits
			L	T	P		CIE	SEE	
Theory									
1	BS 303 MT	Mathematics – III	3	1	0	4	30	70	4
2	HS 901 MB	Managerial Economics and Accountancy	3	0	0	3	30	70	3
3	PC 301 EC	Electronic Devices and Circuits	3	0	0	3	30	70	3
4	PC 302 EC	Digital System Design	3	0	0	3	30	70	3
5	PC 303 EC	Signal Analysis and Transform Techniques	3	0	0	3	30	70	3
6	PC 304 EC	Network Analysis and Synthesis	3	0	0	3	30	70	3
Practical									
7	PC 351 EC	Electronic Devices and Circuits Laboratory	0	0	2	2	25	50	1
8	PC 352 EC	Networks and Logic Design Laboratory	0	0	2	2	25	50	1
Total			**18**	**1**	**4**	**23**	**230**	**520**	**21**

L	:	Lectures	CIE	:	Continuous Internal Evaluation
T	:	Tutorials	SEE	:	Semester End Examination
P	:	Practical	ES	:	Engineering Sciences
BS	:	Basic Sciences	PC	:	Professional Core
HS	:	Humanities and Social Sciences			

Mathematics – III

(Partial Differential Equations and Numerical Methods)

Credits:4

Instruction: (3L +1T) hrs per week
CIE: 30 Marks

Duration of SEE: 3 hours
SEE: 70 Marks

Course Objectives:

- *Apply general methodology to solve linear first order and second order partial differential equations*
- *To study the classification of second order partial differential equations and solve them by using separation of variables methods*
- *To introduce a few numerical methods to solve non linear equations and system of linear equations*
- *To provide the necessary basic concepts of numerical differentiation, numerical integration and differential equations*

Course Outcomes:

After completion of this course the students able to

- *Find solutions of the heat equation, wave equation, and the Laplace equation subject to boundary conditions*
- *Solve non linear equations, system of linear equations and differential equations numerically*
- *Perform numerical differentiation and numerical integration*

UNIT-I

Definition of Partial Differential Equations, Formation of First order partial differential equations, Solutions of first order linear PDEs, Solution to homogenous and non-homogenous linear partial differential equations of second order by complimentary function and particular integral method.

UNIT-II

Second-order linear equations and their classification, Initial and boundary conditions, D'Alembert's solution of the wave equation, Heat diffusion and vibration problems, Separation of variables method to Solve simple problems in Cartesian coordinates. The one-dimensional diffusion equation and its solution by separation of variables.

UNIT-III

Bisection method, Newton-Raphson method, Solution of linear system of equations- Gauss elimination method, LU decomposition method, Gauss-Jacobi and Gauss-Seidel iteration methods

UNIT-IV

Interpolation, Lagrange's interpolation, Newton's divided difference interpolation, Newton's Forward and Backward difference interpolations, Numerical differentiation, Interpolation approach, Numerical Integration-Trapezoidal rule, Simpson's 1/3 rule

UNIT: V

Taylor's series method, Euler's method, Picard's method of successive approximations, Runge-Kutta method of 4th order.

Suggested Readings:

1. R.K.Jain & S.R.K Iyengar, *Advanced Engineering Mathematics*, Narosa Publications, 4th Edition 2014.
2. B.S.Grewal, *Higher Engineering Mathematics*, Khanna Publications, 43rd Edition.
3. M.K.Jain,S.R.K.Iyengar and R.K.Jain, *Numerical methods for scientific and engineering computation* ,6th edition , New Age International Limited., 2012.
4. S.S.Sastry, *Introductory Methods of Numerical Analysis*, 5th edition , PHI Private Limited, 2012.

HS 901 MB

Managerial Economics and Accountancy

Credits:3

Instruction: 3L hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

Course Objectives:

- *To learn important concepts of Managerial Economics and apply them to evaluate business decisions.*
- *To understand various parameters that determines the consumer's behaviour.*
- *To evaluate all the factors that affect production.*
- *To understand the concepts of capital budgeting and payback period.*
- *To study the concepts of various book-keeping methods.*

Course Outcomes:

Student will be Able to

- *Apply the fundamental concepts of managerial economics to evaluate business decisions.*
- *Understand types of demand and factors related to it.*
- *Identify different types of markets and determine price-output under perfect competition.*
- *Determine working capital requirement and payback period.*
- *Analyze and interpret financial statements through ratios.*

UNIT – I

Meaning and Nature of Managerial Economics: Managerial Economics and its usefulness to Engineers, Fundamental Concepts of Managerial Economics-Scarcity, Marginalism, Equimarginalism, Opportunity costs, Discounting, Time perspective, Risk and Uncertainty, Profits, Case study method.

UNIT – II

Consumer Behavior: Law of Demand, Determinants, Types of Demand; Elasticity of Demand (Price, Income and Cross-Elasticity); Demand Forecasting, Law of Supply and Concept of Equilibrium. (Theory questions and small numerical problem can be asked).

UNIT – III

Theory of Production and Markets: Production Function, Law of Variable Protection, ISO quants, Economics of Scale, Cost of Production (Types and their measurements), Concept of Opportunity cost, Concept of Revenue, Cost-Output relationship, Break-Even Analysis, Price-Output determination under perfect Competition and Monopoly (Theory and problems can be asked).

UNIT – IV

Capital Management: Significance, determination and estimation of fixed and working capital requirements, sources of capital, Introduction to capital budgeting, methods of payback and discounted cash flow methods with problems. (Theory questions and numerical problems on estimating working capital requirements and evaluation of capital budgeting opportunities can be asked).

UNIT – V

Book-keeping: Principles and significance of double entry book keeping, Journal, Subsidiary books, Ledger accounts, Trial Balance, concept and preparation of Final Accounts with sample adjustments, Analysis and interpretation of Financial statements through Ratios.

(Theory questions and numerical problems on preparation of final accounts, cash book, pretty cash book, bank reconciliations statement, calculation of some ratios).

PC 301 EC

Electronic Devices and Circuits

Credits:3

Instruction: 3L hrs per week
CIE : 30 Marks

Duration of SEE: 3 hours
SEE : 70 Marks

Course Objectives:

- *Study semiconductor physics and Analyze the behavior of Semiconductor diodes in Forward and Reverse bias*
- *Develop Half wave and Full wave rectifiers with L, C, LC & CLC Filters*
- *Explain V-I characteristics of Bipolar Junction Transistor in CB, CE & CC configurations*
- *Design DC Biasing techniques and evaluate A.C parameters for BJT in Amplifier Applications*
- *Explore V-I characteristics of FETs, MOSFETs*

Course Outcomes:

- *Interpret the characteristics and apply diode models to analyze various applications of diodes*
- *Identify the merits and demerits of various filters, formulate and design rectifier circuits with filters Calculate ripple factor, efficiency and % regulation of rectifier circuits.*
- *Discriminate the BJT configurations to recognize appropriate transistor configuration for any given application and design the biasing circuits with good stability*
- *Analyze, compare and design of BJT amplifiers with various biasing circuits*
- *Distinguish the working principles of BJT and FET also between FET & MOSFET*

UNIT –I

Semiconductor Diode: Qualitative Theory of P-N Junction, P-N Junction as a Diode, Diode Equation, Volt-Ampere Characteristics, Temperature dependence of V-I characteristic, Ideal versus Practical – Resistance levels (Static and Dynamic), Transition and Diffusion Capacitances, Diode Equivalent Circuits, Load Line Analysis, Breakdown Mechanisms in Semiconductor Diodes, Zener Diode Characteristics and Applications.

UNIT-II

Semiconductor Diode Applications: Half wave, Full wave and Bridge rectifiers – their operation, performance characteristics and analysis. Filters (L, C, LC and CLC filters) used in power supplies and their ripple factor calculations, design of Rectifiers with and without Filters.

Special Diodes (Qualitative Treatment only): Tunnel Diode, Varactor Diode, Schottky Diode, Light Emitting Diode, Photo Diode and Solar cells.

UNIT-III

Bipolar Junction Transistor: Transistor Junction formation (collector-base, base-emitter Junctions), Transistor biasing – band diagram for NPN and PNP transistors, current components and current flow in BJT, Ebers moll model, Modes of transistor operation, BJT V-I characteristics in CB, CE, CC configurations, BJT as an amplifier, BJT biasing techniques, operating point stabilization against temperature and device variations, Bias stabilization and compensation techniques, Biasing circuits design.

UNIT-IV

Small Signal Transistors equivalent circuits: Small signal low frequency h-parameter model of BJT, Approximate model, Analysis of BJT amplifiers using Approximate model for CB, CE and CC configurations; High frequency - Π model, Relationship between hybrid -Π and h –parameter model.

UNIT-V

Junction Field Effect Transistors (JFET): JFET formation, operation & current flow, V-I characteristics of JFET,

MOSFETs: Enhancement & Depletion mode MOSFETs, current equation, V-I characteristics, DC-biasing, Low frequency small signal model of FETs. Analysis of CS, CD and CG amplifiers, MOS Capacitor.

Suggested Reading:

1. Jacob Millman, Christos C. Halkias, and Satyabrata Jit, "Electronic Devices and Circuits", 3rd ed., Mc-Graw Hill Education, 2010.
2. Robert Boylestad and Louis Nashelsky, Electronic Devices and Circuit Theory, 11th ed., Pearson India Publications, 2015.
3. Salivahanan.S, Suresh Kumar.N "Electronic Devices and circuits", 3rd edition, Tata McGraw-Hill, 2012.

PC 302 EC

Digital System Design

Credits:3

Instruction: 3L hrs per week | *Duration of SEE : 3 hours*

CIE : 30 Marks | *SEE : 70 Marks*

Course Objectives: *This course provides in-depth knowledge of switching theory and the design techniques of digital circuits, which is the basis for design of any digital circuit. The main objectives are:*

- *To learn basic techniques for the design of digital circuits and fundamental concepts used in the design of digital systems.*
- *To understand common forms of number representation in digital electronic circuits and to be able to convert between different representations.*
- *To implement simple logical operations using combinational logic circuits and design of sequential logic circuits.*
- *To impart to student the concepts of sequential circuits, enabling them to analyze sequential systems in terms of state machines.*
- *To implement synchronous state machines using flip-flops.*

Course Outcomes: Upon *completion of the course, students should possess the following skills:*

- *Be able to manipulate numeric information in different forms, e.g. different bases, signed integers, various codes such as ASCII, Gray, and BCD.*
- *Be able to manipulate simple Boolean expressions using the theorems and postulates of Boolean algebra and to minimize combinational functions.*
- *Be able to design and analyse small combinational circuits and to use standard combinational functions/building blocks to build larger more complex circuits.*
- *Be able to design and analyze small sequential circuits and devices and to use standard sequential functions/building blocks to build larger more complex circuits.*

UNIT-I

Number System and Logic Simplification: Number Systems, Base Conversion Methods and Complements of Numbers. Review of Boolean algebra and De Morgan's Theorem, SOP & POS forms, Canonical forms, Karnaugh map up to 5 variables, Tabular method.

UNIT-II

Combinational Logic Design: Half and Full Adders, Subtractors, Serial and Parallel Adders, BCD Adder, Barrel Shifter, ALU, Comparators, Multiplexers, De-multiplexers, Encoder, Decoder, Driver & Display Devices, Code Converters.

UNIT-III

Sequential Logic Design: Building blocks like S-R, JK and Master-Slave JK Flip-flops, D and T Flip-Flops. Ripple and Synchronous Counters, Shift Registers, Finite State Machines, Design of synchronous FSM, Algorithmic State Machine charts. Designing synchronous circuits like Pulse train generator, Pseudo Random Binary Sequence generator, Clock generation.

UNIT-IV

Logic Families: Design of TTL Logic family, Specifications, Noise margin, Propagation delay, fan-in, fan-out, Tristate TTL, ECL, CMOS Logic families and their interfacing. Logic implementation using PLDs-PROM, PAL and PLA. Introduction to CPLD and FPGA.

UNIT-V

Verilog HDL: Introduction to HDL, Verilog HDL Basics: Module Concept, Lexical Conventions, Value Set, Constants, Data Types, Primitives, Module modeling styles: Structural, Data flow and Behavioral.

Suggested Reading:

1. R.P.Jain, "Modern Digital Electronics", Tata McGraw Hill, 4th Edition, 2009.
2. M.Morris Mano, Michael D. Ciletti, "Digital Design", Pearson, 4th Edition, 2012.
3. Ming-Bo Lin, "Digital System Design and Practices Using Verilog HDL and FPGAs", Wiley India Pvt. Ltd., 2012.

With effect from the Academic year 2019-2020

PC 303 EC

Signal Analysis and Transform Techniques

Credits:3

Instruction : 3L hrs per week
CIE : 30 Marks

Duration of SEE : 3 hours
SEE : 70 Marks

Course Objectives:

- *To learn basic concepts related to signals & systems.*
- *To familiarize with basic operations on signals mathematical representation of periodic aperiodic signals continuous discrete systems.*
- *To understand convolution, correlation operations on continuous signals.*
- *To analyze the response of systems on application of step, ramp inputs using Fourier & Z-transforms.*

Course Outcomes:

Students will be

- *Be able to describe signals mathematically and understand how to perform mathematical operations on signals.*
- *Understand and resolve the signals in frequency domain using Fourier series and Fourier transforms.*
- *Be able to compute the output of an LTI system given the input and impulse response through convolution sum and convolution integral*
- *Understand the sampling theorem and the process of reconstructing a continuous signal Random its samples*
- *Be able to solve a linear constant coefficient difference equation using Z transform techniques*

UNIT-I

Introduction to Signals & Systems: Classification of signals, Operations on signals, types of systems, Exponential and Trigonometric Fourier series, Dirichlet's condition.

UNIT-II

Fourier Transform: Representation of aperiodic signal, Introduction of Fourier transform, Convergence, properties of Fourier Transform, Fourier transform of periodic signals, Singularity function, Parseval's theorem, Energy spectral density, Development of Discrete Time Fourier transform, Convergence issues associated with the DTFT.

UNIT-III

Sampling: Sampling of continuous time signals, sampling theorem, Aliasing effect, reconstruction of a signal and its samples.

Convolution & Correlation of signals: Convolution integral, Properties of convolution, Graphical method of convolution, Convolution of Discrete time signals, overlap-add and overlap-

save method of discrete convolution, Definition of correlation, Auto correlation, Properties of Autocorrelation, Cross correlation of signals.

UNIT-IV

Laplace Transform: Review of Laplace transforms, region of convergence and properties, poles and zeros, relation between Laplace and Fourier transforms, properties of Laplace transform, inverse Laplace transform, Solutions to differential equation and system behavior.

UNIT-V

Z Transform: Definition of Z-Transform, Properties of Z-Transform, Region of convergence of Z-Transform, Inverse Z Transform using Inspection, Partial fraction expansion, Power series Expansion, Contour integration methods, Parseval's relation analysis of discrete time systems using Z-Transform. Realization of discrete time system using Direct form, Cascade parallel forms.

Suggested Readings:

1. Alan V. Oppenheim, Alan.S.Willsky, S Hamid Nawab, *Signals and Systems*, 2nd edition, Prentice Hall of India, 2007.
2. Lathi B.P., *Signals Systems Communications*", 1st edition, B.S. Publications, 2006.
3. Simon Haykin and Van veen, "Signal and system", Willy, second edition.

PC 304 EC

Network Analysis and Synthesis

Credits:3

Instruction : 3L hrs per week
CIE : 30 Marks

Duration of SEE : 3 hours
SEE : 70 Marks

Course Objectives:

- *To introduce basic circuit elements, their terminal characteristics, DC Circuit analysis techniques, RMS Average values of periodic signals, Network Theorems.*
- *To introduce the concepts of Two Port networks, study about the different two port parameter representations and principles of two port network parameters topologic description of networks*
- *To introduce the concepts of impedance, phase, phasor, resonance, complex frequency, Transient Analysis.*
- *To Analyze and Design different LC filters and Attenuators.*
- *To Design concepts of network synthesis.*

Course Outcomes:

Student will be

- *Able to Learn how to develop and employ circuit models for elementary electronic components and to adapt using various methods of circuit analysis, including simplified methods such as Series-parallel reductions, voltage and current dividers, superposition and Thevenin-Norton equivalent circuits etc.*
- *Able to Analyze given Electrical Circuit in terms of A,B,C,D and Z,Y Parameter Model and Solve the circuits and how they are used in real time applications. Able to analyze the topologic description of networks. Ability to Solve Circuits using Tree, Node, Branch, Cutset, Tie Set Methods.*
- *Able to analyze small RLC circuits Series and parallel Resonance of RC, RL and RLC circuits. Able to solve Transient Analysis.*
- *Able to design different types of filters and Attenuator.*
- *Able to synthesize the RL, RC & RLC networks Foster and Cauer Forms.*

UNIT – I

Network Theorems: Circuit Elements, Dependent and Independent Sources, Passive Elements, R, L, C, Energy Stored in L, C, Wye-Delta transformation, Nodal and Mesh analysis, Tellegen's Theorem and Maximum Power Transfer Theorem.

Network Topology: Graph, Tree, Tie set, cut set matrix, Impedance matrix formulation of node loop equations using tie-set, cut-set analysis.

UNIT – II

Two port networks: Z, Y, h, g, ABCD parameters, equivalence of two ports, Condition for Symmetry and Reciprocity. T-PI transformations, inter connection of two ports networks, Brune's test for interconnection.

UNIT – III

Response of R, L, C Networks: DC and AC excitations of RL, RC and RLC circuits, Transient Analysis. Resonance-Series and parallel. Quality factor, Bandwidth of Resonant Circuits, Steady state sinusoidal analysis using phasors, active power, reactive power and power triangle.

UNIT – IV

Filters and Attenuators and Equalizers: Constant K filters, LP, HP, BPF, BSF, m-derived composite filter design, lattice filters. Symmetrical, Asymmetric T, PI sections networks, Characteristic Impedance, Image Impedances, Iterative Impedance and propagation constant. Design of Attenuators-Symmetrical T, Pi, Lattice and Bridge-T.

UNIT – V

Network Synthesis: Fosters reactance theorems, Positive real function, Hurwitz polynomial, Driving point Impedance and admittance. Synthesis of one port RC, RL and LC networks using Foster and Cauer forms.

Suggested Readings:

1. Van Valkenberg M.E, *Network Analysis,* 3rd edition, Prentice Hall of India, 1996
2. Hayt W H, Kemerly J E Durbin, *Engineering Circuit Analysis,* 7th edition, Tata McGraw Hill, 2006.
3. Smarajit Ghosh, *Network Theory Analysis and Synthesis,* PHI Learning private Limited,2013

PC 351 EC

Electronic Devices and Circuits Laboratory

Credits: 1

Instruction : 2P per week
CIE : 25 Marks

Duration of SEE : 3 hours
SEE : 50 Marks

Course Objectives:

- *Study the characteristics of PN diode.*
- *Learn the characteristics of BJT in CE, CB and CC configurations.*
- *Plot characteristics of FET in CS and CD configurations.*
- *Observe the parameters of BJT and FET amplifiers.*

Course Outcomes:

- *Understand characteristics of Diodes*
- *Plot the characteristics of BJT in different configurations.*
- *Record the parameters of BJT and FET amplifiers.*
- *Understand biasing techniques of BJT.*
- *Use the SPICE software for simulating electronic circuits.*

List of Experiments

1. Measurement of static and dynamic resistances of Silicon and Germanium diodes.
2. Zener diode Characteristics and its application as voltage regulator.
3. Design, realization and performance evaluation of half wave rectifiers without and with filters.
4. Design, realization and performance evaluation of full wave rectifiers without and with filters.
5. Static characteristics of Bipolar-junction Transistor CB configuration
6. Static characteristics of Bipolar-junction Transistor CE configuration
7. Design of Self Bias Circuit
8. Drain and Transfer Characteristics of JFET
9. Design of JFET Common Source Amplifier
10. Design of Common Emitter BJT amplifier
11. Characteristics of UJT
12. Simulate any two experiments using PSPICE

Note: A minimum of 10 experiments should be performed

Suggested Reading:

1. Paul B. Zbar, Albert P. Malvino, *Micheal A. Miller, Basic Electronics, A text – Lab Manual*, 7th Edition, TMH 2001.

With effect from the Academic year 2019-2020

PC 352 EC

Networks and Logic Design Laboratory

Credits: 1

Instruction : 2P per week
CIE : 25 Marks

Duration of SEE : 3hours
SEE : 50 Marks

Course Objectives:

- *To design and test different theorems.*
- *To design and understand of two-port networks and resonance circuits.*
- *To Study of frequency response of LPF and HPF.*
- *To design combinational circuits and sequential circuits.*
- *To design counters and shift register.*

Course Outcomes:

Students will be

- *Able to analyse and verify Different Network theorems.*
- *Able to understand two-port networks and resonance circuits*
- *Able to calculate frequency response curves of LPF, HPF.*
- *Able to understand and verify truth table of combinational circuits and sequential circuits.*
- *Able to understand and verify counters and shift register.*

List of Experiments

1. Verification of Reciprocity and Tellegen's Theorems
2. Verification of Maximum Power Transfer and Superposition Theorems
3. Two-Port Parameters
4. Series and Parallel Resonance
5. Design of Constant K Low Pass and High Pass filter
6. Design of m-Derived low pass and high pass filter
7. Design Half Adder, Full Adder and 4-bit Parallel Adder
8. Design 3 to 8 Decoder using logic gates
9. Design and Application of Multiplexers
10. Implementation of flip-flops using logic gates
11. Design a Counter circuit
12. Design a Shift Register

Suggested Reading:

1. Hayt W H, Kemerly J E Durbin, *Engineering Circuit Analysis*, 7th edition, Tata McGraw-Hill, 2006.
2. M.Morris Mano, Michael D. Ciletti, "Digital Design", Pearson, 4th Edition, 2012.

With effect from the Academic year 2019-2020

SCHEME OF INSTRUCTION

B. Tech (ELECTRONICS AND COMMUNICATION ENGINEERING)
CBCS-AICTE MODEL CURRICULAM
Proposed from the Academic year 2019-20

IV - SEMESTER

S.No.	Course Code	Course Title	Scheme of Instruction			Contact hr/week	Scheme of Examination		Credits
			L	T	P		CIE	SEE	
Theory									
1	PC 401 EC	Analog Electronic Circuits	3	0	0	3	30	70	3
2	PC 402 EC	Probability Theory and Stochastic Processes	3	0	0	3	30	70	3
3	PC 403 EC	Electromagnetic Waves and Transmission Lines	3	0	0	3	30	70	3
4	PC 404 EC	Pulse and Integrated Circuits	3	0	0	3	30	70	3
5	BS 404 MT	Mathematics-IV	3	0	0	3	30	70	3
6	ES 401 ME	Elements of Mechanical Engineering	3	0	0	3	30	70	3
7	MC 201 HS	Environmental Science	3	0	0	3	30	70	0
Practicals									
8	PC 451 EC	Analog Electronic Circuits Laboratory	0	0	2	2	25	50	1
9	PC 452 EC	Pulse and Integrated Circuits Laboratory	0	0	2	2	25	50	1
Total			**21**	**0**	**4**	**25**	**260**	**590**	**20**

L : Lectures
T : Tutorials
P : Practicals
PC : Professional Core
CIE : Continuous Internal Evaluation
SEE : Semester End Examination
BS : Basic Sciences

With effect from the Academic year 2019-2020

PC 401 EC

Analog Electronic Circuits

Credits:3

Instruction : 3L hrs per week
CIE : 30 Marks

Duration of SEE : 3 hours
SEE : 70 Marks

Course Objectives:

- *Analyze frequency response of Amplifiers in different frequency ranges.*
- *Familiarize with concept and effect of negative feedback*
- *Study positive feedback and Design different types of oscillators.*
- *Design Power Amplifiers and calculate their efficiencies.*
- *Familiarize with concept of tuned Amplifiers.*

Course Outcomes:

- *Design and Analyze low frequency, mid frequency and high frequency response of small signal single stage and Multistage RC coupled and Transformer Amplifiers using BJT and FET.*
- *Identify the type of negative feedback, Analyze and design of negative feedback amplifiers.*
- *Design Audio Frequency and Radio Frequency oscillators*
- *Distinguish between the classes of Power Amplifiers and their design considerations.*
- *Compare the performance of single and double Tuned Amplifiers.*

UNIT-I

Small Signal Amplifiers: Introduction to Hybrid-π model, relationship between hybrid-π & h-parameter model; Classification of amplifiers, mid-frequency, Low-frequency and high frequency analysis of single and multistage RC coupled amplifier with BJT and FET. Analysis of transformer coupled amplifier in mid frequency, Low frequency and high frequency regions with BJT.

UNIT-II

Feedback Amplifiers Analysis and Design: 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, Local Versus global feedback.

UNIT-III

Oscillators Analysis and Design: Positive feedback and conditions for sinusoidal oscillations, RC oscillators, LC oscillators, Crystal oscillator, Amplitude and frequency stability of oscillator. **Regulators:** Transistorized series and shunt regulators.

UNIT-IV

Large Signal Amplifiers: BJT as large signal audio amplifiers, Classes of operation, Harmonic distortion, power dissipation, efficiency calculations. Design considerations of transformer coupled and transform less push-pull audio power amplifiers under Class-A. Class-B, Class D and Class-AB operations.

UNIT-V

RF Voltage Amplifiers: General consideration, Analysis and design of single tuned and double tuned amplifiers with BJT, Selectivity, gain and bandwidth. Comparison of multistage, single tuned amplifiers and double tuned amplifiers. The problem of stability in RF amplifiers, neutralization & uni-laterisation, introduction to staggered tuned amplifiers.

Suggested Reading:

1. Jacob Millman, Christos C. Halkias, and Satyabrata Jit, Electronic Devices and Circuits, 3rd ed., McGraw Hill Education, 2010.
2. David A. Bell, Electronic Devices and Circuits, 5th ed., Oxford University Press, 2009.
3. S Salivahanan, N Kumar, and A Vallavaraj, Electronic Devices and Circuits, 2nd ed., McGraw Hill Education, 2007.
4. Jacob Millman, Christos Halkias, Chetan Parikh, Integrated Electronics, 2nd ed., McGraw Hill Education (India) Private Limited, 2011.
5. Donald L Schilling & Charles Belove, Electronics Circuits, Discrete & Integrated, 3rd ed., McGraw Hill Education (India) Private Limited, 2002.

With effect from the Academic year 2019-2020

PC 402 EC

Probability Theory and Stochastic Processes

Credits:3

Instruction : 3L hrs per week
CIE : 30 Marks

Duration of SEE : 3 hours
SEE : 70 Marks

Course Objectives:

- *To understand different types of Random variables their density distribution functions.*
- *To learn one Random variable characteristic functions of different variables using their density functions.*
- *To learn the concepts of sequences of Random variables, Properties of Random vectors.*
- *To understand elementary concepts of the Random Processes or distribution functions.*
- *To understand the functions of two Random variables probability density distribution of the joint Random variables.*

Course Outcomes:

Student will be

- *Able to solve using an appropriate sample space by the concepts of probabilities and understand multiple random variables, relate the same through examples to real problems.*
- *Able to Understand the usefulness of stochastic processes in their professional area.*
- *Able to Characterize the response of LTI systems driven by a stationary random process using autocorrelation and power spectral density functions.*
- *Able to Application of these principles in areas where presence of noise is a serious challenge.*

UNIT-I

Concepts of Probability Random Variable: Definitions, Probability Induction, Causality versus Randomness, Review of Set Theory, Probability Space, Conditional Probability. Repeated Trials Combined Experiments, Bernoulli Trials, Bernoulli's Theorem Games of Chance. Random Variable: Definition, Distribution Density Functions, Specific Random Variables their probability density distribution functions: Normal, Exponential, Gamma, Chi-Square, Raleigh, Nakagami-m, Uniform, Beta, Cauchy, Laplace Maxwell, Bernoulli, Binomial, Poisson, Geometric, Negative Binomial Conditional Distributions, Asymptotic Approximations for Binomial Random Variable.

UNIT-II

Functions of One Random Variable: Function of a Random Variable g(x), The Distribution of g(x), Mean, Variance, Moments Characteristic Functions of Random variables with the above distributions.

UNIT -III

Two Random Variables: Bi-variate Distributions, One Function of Two Random Variables, Two Functions of Two Random Variables, Joint Moments, Joint Characteristic Functions, Conditional Distributions, Conditional Expected Values.

UNIT-IV

Sequences of Random Variables: General Concepts, Conditional Densities, Characteristic Functions, Normality, Mean Square Estimation, Stochastic Convergence Limit Theorems. Random Numbers. Applications of Random numbers.

UNIT-V

Stochastic Processes: General elementary concepts definitions of stationary, ergodic, Random processes independence, spectral density, white color noise, response to linear systems stochastic inputs, Markov Processes.

Suggested Readings:

1. A Papoulis, S.U. Pillai, "Probability, Random Variables Stochastic Processes", 4th edition, Tata McGraw-Hill, 2008.
2. Peyton Z Peebles, "Probability, Random Variables & Random Signal Properties", 4th edition, Tata McGraw-Hill, 2001.
3. Richard H. Williams, "Probability, Statistics, Random Processes for Engineers", Thomson Learning, 1st edition, 2003.

With effect from the Academic year 2019-2020

PC 403 EC

Electromagnetic Theory and Transmission Lines

Instruction : 3L hrs per week *Credits:3*

CIE : 30 Marks

Duration of SEE : 3 hours

SEE : 70 Marks

Course Objectives:

- *To become familiar with the fundamental concepts of electrostatics and magneto statics laws their applications.*
- *To familiar with the four Maxwell's equations used to study time varying EM or dynamic fields to apply them to solve practical EM problems.*
- *To acquaint with theoretical analysis of the characteristics of electromagnetic waves in a wide variety of Practical Mediums.*

Course Outcomes:

Students will be

- *Able to express and elaborate Maxwell's Equations in differential and integral forms and the constitutive relations between the flux densities and field intensities of the electrostatics, magneto-statics and electrodynamics fields.*
- *Able to derive the Helmholtz wave equations in its various forms and the wave nature of their solutions for time-harmonic waves in various mediums.*
- *Able to apply fundamental electromagnetic concepts in applications such as Transmission Lines and Antennas.*

UNIT-I

Electrostatics: Review of Vector Calculus and Coordinate systems and Transformation, Coulomb's Law, Electric Field Intensity, Electric field due to different charge distributions - Electric Field due to Line Charge, Sheet Charge and Volume Charge Distribution. Electric Flux, Flux Density, Gauss's Law and Applications. Energy and Potential, Potential Field of a Point Charge, System of Charges, potential gradient, Energy density in Electrostatic fields, Electric Dipole, convection and conduction currents, continuity equation and relaxation time, Poisson's and Laplace's Equations, Capacitance and Capacitors.

UNIT-II

Magnetostatics: Biot-Savart Law, Ampere's Circuital Law, Applications of Ampere's Law, Magnetic Flux Density, Magnetic Scalar and Vector Potentials, Forces due to magnetic fields, Magnetic Dipole, Magnetization, Inductors and Inductances, Magnetic Energy.

UNIT-III

Time Varying Fields and Maxwell's Equations: Faraday's Law, Transformer and Motional EMF's, Displace Current, Maxwell's Equations in Differential and Integral Forms, Time-Varying Potentials, Electromagnetic Boundary Conditions, Time-Harmonic Fields.

UNIT-IV

EM Wave Propagation: Uniform Plane Wave, Wave Propagation in Free Space, Dielectrics, Good Conductors-Skin Effect. Poynting's Theorem and Wave Power, Poynting Vector, Instantaneous, average and complex pointing vector, Wave Polarization-Linear, Circular and Elliptical polarizations, Reflection of Uniform Plane Waves at Normal incidence and Oblique incidence angles, Reflection coefficient, Transmission coefficient, power and energy calculations.

UNIT-V

Transmission Lines: Circuit representation, Equations of voltage and current on transmission line, propagation constant and characteristic impedance, Lossless Line, Distortion less Line, Infinite line concepts, Input impedance relations of open and short-circuited transmission lines, reflection coefficient and VSWR. The Smith Chart, Transmission Line Impedance Matching-Impedance Matching by Quarter wave Transformer, Single Stub Matching and Double Stub Matching.

Suggested Readings:

1. Matthew N,O. Sadiku, *Principles of Electromagnetics*, Oxford University Press, 2009, 4th edition.
2. David K.Cheng, *Field and Wave Electromagnetics*, Pearson Education, 2001, 2nd edition.
3. W.H.Hayt,Jr. and J.A Buck, *Engineering Electromagnetics*, Tata McGraw-Hill, 2006, 7th edition.

With effect from the Academic year 2019-2020

PC 404 EC

Pulse and Integrated Circuits

Credits:3

Instruction : 3L hrs per week
CIE : 30 Marks

Duration of SEE : 3 hours
SEE : 70 Marks

Course Objectives:

- *Analyze the behavior of Linear and non-linear wave shaping circuits*
- *Understand the operation of OP-AMP and its internal circuits*
- *Understand various digital ICs*
- *Analyze the applications of OPAMP and 555 Timer*
- *Explain the operation of various data converter circuits.*

Course Outcomes:

- *Construct different linear networks and analyze their response to different input signals*
- *Understand, Analyze and design multi vibrators and sweep circuits using transistors.*
- *Analyze DC and AC characteristics for Single/Dual input Balanced/Unbalanced output configurations using BJTs.*
- *Distinguish various linear and non-linear applications of Op-Amp.*
- *Analyze the operation of the most commonly used D/A and A/D converter types.*

UNIT- I

Linear Wave Shaping: High pass, low pass RC circuits, their response for sinusoidal, step, pulse and ramp inputs. RC network as differentiator and integrator, attenuators, its applications in CRO probe.

Non-Linear Wave Shaping: Diode clippers, Transistor clippers, clipping at two independent levels. Clamping operation and Clamping circuit theorem.

UNIT-II

Differential amplifiers: Classification, DC and AC Analysis of Single/Dual input Balanced and Unbalanced output configurations using BJTs. Level Translator.

Operational Amplifier: OP AMP Block diagram, ideal Op-amp characteristics, features, parameters and their Measurement, Input and Output Offset voltages and currents, Slew rate, CMRR, PSRR, Frequency response and Compensation Techniques.

UNIT-III

OPAMP Applications: Inverting and Non-inverting Amplifiers, Integrator and differentiator, summing amplifier, precision rectifier. Active filters: Low pass, high pass, band pass and band stop filters.

UNIT-IV

Digital Logic families: characteristics of digital ICs, RTL, TTL family IC's, characteristics and comparison among various series of TTL Family IC's, ECL family-operation and characteristics, CMOS logic family, comparison among CMOS series, Interfacing TTL and CMOS IC's

UNIT-V

555 Timer: Functional Diagram, Monostable, Astable and Schmitt Trigger Applications.

Voltage regulators: Fixed and variable voltage regulators (78XX and 79XX).

Data Converters: Digital-to-analog converters (DAC): Weighted resistor, inverted R-2R ladder, Analog-to-digital converters (ADC): dual slope, successive approximation, flash type. Specifications of Data Converters.

Suggested Reading:

1. J. Millman and H. Taub, Pulse, Digital and Switching Waveforms - McGraw-Hill, 1991.
2. David A. Bell, Solid State Pulse circuits - PHI, 4th Edn., 2002.
3. J.V. Wait, L.P. Huelsman and GA Korn, Introduction to Operational Amplifier theory and applications, McGraw Hill, 1992.
4. D.Roy Chowdhury, Shail B.Jain, "Linear Integrated Circuits", 4/e, New / Age International (P) Ltd., 2008.
5. Ramakanth A Gayakwad, —Op-Amps and Linear Integrated Circuitsl, 3rd Edition, Prentice-Hall of India Limited, New Delhi, 1995.

BS 404 MT

Mathematics-IV
(Vector Spaces and Statistics)

Credits:3

Instruction : 3L hrs per week
CIE : 30 Marks

Duration of SEE : 3 hours
SEE : 70 Marks

Course objectives :

- *Introduce the concept of Vector Spaces and linear transformations.*
- *To provide the knowledge of probability distributions, tests of significance, correlation and regression.*

Course Outcomes :

At the end of the course students will be able to

- *Learn vector spaces and linear transformations.*
- *apply various probability distributions to solve practical problems, to estimate unknown parameters of populations and apply the tests of hypotheses*
- *perform a regression analysis and to compute and interpret the coefficient of correlation*

Unit-I

Vector spaces, subspaces, properties with examples, basis, dimension, linear transformations and their representations by matrices

Unit-II

Rank, Nullity of transformation, Inverse of linear transformation, rank-nullity theorem (with out proof), inner product spaces, Gram Schmidt orthogonalization process

Unit-III

Measures of Central tendency: moments skewness and Kurtosis – probability distribution: Binomial, Poisson and Normal – evaluation of statistical parameters for these three distributions.

Unit-IV

Curve fitting by the method of least squares – fitting of straight lines, second degree parabolas and more general curves. Correlation and regression – Rank correlation

Unit-V

Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of standard deviation. Test for single mean, difference of means and correlation coefficients, test for ratio of variances- Chi-square test for goodness of fit and independence of attributes.

With effect from the Academic year 2019-2020

Text books / References:

1. R. K. Jain & S.R.K.Iynengar, "Advanced Engineering Mathematics" Narosa publications, 4th Edition, 2014.
2. B.S.Grewal, "Higher Engineering Mathematics," Khanna Publications, 43rd Edition.
3. S.C.Gupta & Kapoor, "Fundamentals of mathematical statistics," Sultan Chand & sons, New Delhi.
4. Erwin Kreyszig, "Advanced Engineering Mathematics", 9th Edition, john Wiley & sons, 2006.
5. N.P. Bali and Manish Goyal, "A text book of Engineering Mathematics", Laxmi publications, Reprint, 2010.
6. Veerarajan T., "Engineering Mathematics" (for semester III), Tata McGraw-Hill, New Delhi, 2010.
7. S.Ross "A first course in probability," Pearson Edition India, 2002.

With effect from the Academic year 2019-2020

ES 401 ME

Elements of Mechanical Engineering

Credits: 3

Instruction: 3L hrs per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*

Course Objectives:

- *To understand basic concepts of thermodynamics.*
- *To understand practical application of thermal engineering concepts in various energy consumption and energy conversion systems*
- *To understand the working principles of I.C. engines, Reciprocating compressors and Refrigeration systems*
- *To familiarize the design and working principles of transmission drive systems.*
- *To understand various manufacturing processes.*

Course outcomes:

After completion of the course, students will be able to

- *Differentiate between heat and work transfers and relates them with enthalpy changes*
- *Formulate various power cycles, represents them on p-V, T-S diagrams and also study their feasibility in practical applications*
- *Understand the work saving methods in functioning of Compressors and refrigeration cycles*
- *Design belt drives and gear drives and formulate methods for balancing of rotating masses*
- *Demonstrate the working of various welding processes and gain knowledge of working of unconventional methods of manufacturing.*

UNIT- I

Statements of zeroth law, 1st, 2nd and 3rd Laws of thermodynamics with their applications. Representation of thermodynamic processes on p-V and T-s plots. Ideal gas equation. Relations for internal energy and entropy changes, heat and work transfers for closed systems. Steady flow energy equation for an open systems-derivation and applications in turbines, compressors, nozzles and diffusers. Relations for enthalpy changes, heat and work transfers for open systems.

UNIT-II

Power Cycles: Concept of air standard cycles- Carnot cycle, Otto, Diesel, Joule cycles with applications. Representation of Cycles on P-V and T-s plots. Calculation of Cycle efficiencies.

IC Engines: Classification of IC Engines. Mechanical components of IC Engines. Working Principles of four stroke and two stroke cycle engines. Differences between petrol and diesel engines. Calculation of engine parameters -IP, BP, Specific fuel consumption, mechanical and thermal efficiencies.

UNIT-III

Working principles of reciprocating air compressors-single and double acting, single stage and two stage. Effect of clearance. Conditions for maximum efficiency. Isentropic and isothermal efficiencies. Problems on work input, power required and efficiencies of single and two stage compressors. Methods for improving efficiency –use of intercooler and after cooler.

Refrigeration: Working of vapour compression refrigeration system and window Air conditioners. COP calculation. Common refrigerants in use, environmental impacts of refrigerants.

UNIT-IV

Belt drives: Velocity ratio, effect of slip. Length of open and cross belts. Ratio of tensions, centrifugal tension and its effect on power transmission. **Gear drives**: Nomenclature and types of gears. Problems on simple and compound gear trains. **Governors**: Working of Watt, Porter and Hartnell governors. Effect and power of governor. Stability of governor and isochronism. Balancing of several masses in one plane and in several planes.

UNIT- V

Production Techniques: Principles of Arc, Gas and Resistance welding, soldering and Brazing, working mechanism of Lathe, milling and drilling machines by simple sketches. Working principle of NC machines. Basic principles of USM, EDM, LBM and ECM. Principles of sand casting and die casting. Plastics and their moulding methods

Suggested Reading

1. R.K. Rajput, "*Thermal Engineering*", Laxmi Publications, New Delhi, Eighth Edition, 2010.
2. P.K. Nag, " *Basic and Applied Thermodynamics*", Tata Mc-Graw Hill, Eigth Reprint, 2006.
3. Thomas Bevan, "*Theory of Machines*", College Book Store (CBS) Publishers, 3rd Edn., 1986.
4. Hajra Choudary, "*Elements of Workshop Technology-Vel. I and 2*, Asian Publishers, 6th Edn., 1993.
5. P. N. Rao, "*Manufacturing Technology*", Vol. I &2, Tata McGraw- Hill, 2nd Edn., 2009.

With effect from the Academic year 2019-2020

MC 201 HS

Environmental Science

Credits: 0

Instruction: 3L hrs per week | *Duration of SEE: 3 hours*
CIE: 30 marks | *SEE: 70 marks*

Course Objectives:

- *To know the Natural resources and their importance.*
- *To understand and realize significance of Ecosystems and Biodiversity.*
- *To understand the types of pollution, abatement practices and Disaster Management.*
- *To sensitize the students, about the global issues, mitigation techniques.*
- *To built the awareness regarding sustainable future.*

Course Outcomes:

- *Rational utilization of natural resource can be expected.*
- *Protection and conservation of ecosystems and biodiversity.*
- *Development of New technologies for the abatement of pollution.*
- *Mitigative techniques will come from the students.*
- *Sustainability can be achieved.*

UNIT-I

Environmental studies: Definition, scope and importance, need for public awareness. Natural resources: Water resources use and exploitation of Surface and Ground water. Floods, Drought, Conflicts over water, Dams-merits and demerits.

Land Resources: Land as a resource, Effects of modern Agriculture, Fertilizer-pesticide problems, Water logging and Salinity, land degradation, soil erosion and Desertification.

Energy resources: Growing energy needs, renewable and non-renewable energy resources.

UNIT-II

Ecosystems and Biodiversity: Concept of Ecosystem, structure and function of an ecosystem, producers, consumers and decomposers, energy flow in ecosystem, food chains, food web, ecological pyramids, aquatic ecosystem (ponds, lakes, streams, rivers, oceans, estuaries) **Biodiversity:** Genetic species and ecosystem diversity, bio-geographical classification of India. Value of biodiversity, threats to biodiversity, endangered and endemic species of India, conservation of biodiversity.

UNIT-III

Environmental Pollution: Causes, effects and control measures of air pollution, water pollution, soil pollution, noise pollution, Thermal pollution. Solid waste management, Municipal solid waste management, Biomedical waste management and, hazardous wastemanagement.

Disaster management: Types of disasters, impact of disasters on environment, infrastructure, and development.

UNIT-IV

Environmental protection and Global issues: Environmental protection acts: Air, Water, Forest and wild life Acts, enforcement of Environmental legislation. Water conservation, watershed management, and Environmental ethics. Climate change, Global warming, acid rain, ozone layer depletion.

UNIT-V

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

Suggested Readings:

1. De A.K., "*Environmental Chemistry*", Wiley Eastern Ltd., 1989.
2. Odum E.P., "*Fundamentals of Ecology*", W.B. Sunders Co., USA,1975.
3. G.L. Karia and R.A. Christian, *Waste Water Treatment, Concepts and Design Approach,* Prentice Hall of India, 2005.
4. Benny Joseph, *Environmental Studies,* Tata McGraw Hill,2005.
5. V.K.Sharma, *Disaster Management, National Centre for Disaster Management,* IIPE, Delhi,1999.
6. *Environmental Science: towards a sustainable future* by Richard T. Wright. 2008 PHL Learning Private Ltd. New Delhi

With effect from the Academic year 2019-2020

PC 451 EC

Analog Electronic Circuits Laboratory

Credits:1

Instruction: 3p hr per week
CIE: 25 Marks

Duration of SEE: 3 hours
SEE: 50 Marks

Course Objectives:

- *Design and analyze BJT, FET amplifiers.*
- *Design and analyze multivibrators*
- *Analyze Oscillator circuits*
- *Understand Op-Amp applications*
- *Understand filter circuits*

Course Outcomes

- *Calculate gain and bandwidth of BJT, FET.*
- *Study multivibrator circuits.*
- *Study oscillator circuits.*
- *Demonstrate filter circuits*
- *Demonstrate power amplifier and Op-Amp Circuits*

List of Experiments

1. Two Stage RC Coupled CE BJT amplifier.
2. Two Stage RC Coupled CS FET amplifier.
3. Voltage Series Feedback Amplifier.
4. Voltage Shunt Feedback Amplifier.
5. Current series feedback Amplifier
6. RC Phase Shift Oscillator.
7. Hartley & Colpitt's Oscillators
8. Design of Class A and Class B Power amplifiers.
9. Constant-k low pass & high pass filters.
10. m-Derived low pass & high pass filters.
11. Series and Shunt voltage Regulators
12. RF Tuned Amplifier

SPICE:

13. Two Stage RC Coupled CS FET amplifier.
14. Voltage Series Feedback Amplifier
15. Current Shunt Feedback Amplifier

Suggested Reading:

1. Paul B. Zbar, Albert P. Malvino, *Micheal A. Miller, Basic Electronics, A text – Lab Manual*, 7th Edition, TMH 2001.

Note: A minimum of 10 experiments should be performed. It is mandatory to simulate any three experiments using SPICE.

With effect from the Academic year 2019-2020

PC 452 EC

Pulse and Integrated Circuits Laboratory

Credits: 1

Instruction: 2P per week
CIE : 25 Marks

Duration of SEE: 3 hours
SEE : 50 Marks

Course Objectives:

- *To implement high pass and low pass circuit and study it's performance.*
- *To implement clipping and clamping circuits and study it's performance.*
- *To design and test bi-stable, mono-stable multi-vibrators.*
- *To design and test filter circuits.*
- *To understand data conversion.*

Course Outcomes:

- *Design and analyze linear wave shaping circuits.*
- *Design and analyze clipping and clamping circuits.*
- *Design and analyze multivibrator circuits.*
- *Design Op-AMP applications.*
- *Effective use of 555 timer.*

List of Experiments

1. Verification of Low Pass circuit response to step, pulse and square inputs
2. Verification of High Pass RC Circuit response to step, pulse and square inputs
3. Design and verification of RC integrator and differentiator Circuits
4. Design and verification of Low pass and High pass Filters
5. Design and verification of Clipping Circuit (shunt and series)
6. Design and verification of Clamping Circuits (Positive and Negative, with and without bias)
7. Measurement of OPAMP Parameters
8. Inverting and Non-inverting OP-AMP Voltage follower
9. Integrator and Differentiator using OPAMP
10. Design and verification of Active filters
11. Astable and Mono stable multi vibrator using NE555 IC
12. Voltage regulators
13. Digital to Analog Converters
14. Analog to Digital Converters

Note: A minimum of 10 experiments should be performed.

Suggested Reading:

1. Robert Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory", 5th Edition, Prentice-Hall of India Private Limited, New Delhi, 1995.
2. David A. Bell, Laboratory Manual for "Electronic Devices and Circuits", 4th Edition, Prentice-Hall of India Private Limited, New Delhi, 2004.

Faculty of Engineering & Technology

Scheme of Instruction and Syllabus

For

B. Tech (CBCS) V and VI semester
(AICTE MODEL)

Of

Four Year Degree Course

In

ELECTRONICS AND COMMUNICATION ENGINEERING

(WITH EFFECT FROM THE ACADEMIC YEAR 2020-21)

Mahatma Gandhi University

Nalgonda - TS - 508 254

UCET, MGU AICTE *With effect from the Academic year 2020-21*

SCHEME OF INSTRUCTION

B.Tech. (ECE)

V- SEMESTER

S. No.	Course Code	Course Title	Scheme of Instruction			Contact hr/week	Scheme of Examination		Credits
			L	T	P		CIE	SEE	
Theory									
1	PC 501EC	Linear Control Systems	3	0	0	3	30	70	3
2	PC 502EC	Analog Communication	3	0	0	3	30	70	3
3	PC 503EC	Digital Communication	3	0	0	3	30	70	3
4	PC 504EC	Microprocessor and Microcontroller	3	0	0	3	30	70	3
5	PE#	Professional Elective –I	3	0	0	3	30	70	3
6	MC#	Mandatory course	3	0	0	3	30	70	0
Practicals									
7	PC 551EC	Analog Communication Laboratory	0	0	2	2	25	50	1
8	PC 552EC	Microprocessor and Microcontroller Laboratory	0	0	2	2	25	50	1
	Total		**18**	**0**	**4**	**22**	**230**	**520**	**17**

L : Lectures
T : Tutorials
P : Practicals
CIE : Continuous Internal Evaluation
SEE : Semester End Examination
PC : Professional Core
HS : Humanities and Social Sciences
PW : Project Work

NOTE: Mandatory course can be placed according to the AICTE Model and courses can be selected among hese.

Mandatory course
MC 501 HS: Technical communication and soft skills
MC 502 HS: Indian constitution
MC 503 HS: Essence of Indian traditional knowledge

Professional Elective – I

1 PE 501EC Digital Image Processing
2 PE 502EC Electronic Measurements and Instrumentation
3 PE 503EC Object Oriented Programming Language Systems
4 PE 504EC Digital System Design using Verilog HDL

UCET, MGU AICTE *With effect from the Academic year 2020-21*

SCHEME OF INSTRUCTION

B.Tech. (ECE)

VI– SEMESTER

S. No.	Course Code	Course Title	Scheme of Instruction			Contact hr/week	Scheme of Examination		Credits
			L	T	P		CIE	SEE	
Theory									
1	PC 601EC	Digital Signal Processing	3	0	0	3	30	70	3
2	PC 602 EC	Antenna Wave Propagation	3	0	0	3	30	70	3
3	PC 603EC	Data Communication and Computer Networks	3	0	0	3	30	70	3
4	PE#	Professional Elective –II	3	0	0	3	30	70	3
5	OE #	Open Elective-I	3	0	0	3	30	70	3
6	HS 601	Fundamentals Of Management	3	0	0	3	30	70	3
Practicals									
7	PC 651EC	Digital Signal Processing Laboratory	0	0	2	2	25	50	1
8	PC 652EC	Digital Communication Laboratory	0	0	2	2	25	50	1
9	PC 653EC	Summer Internship*	6-weeks				-	-	-
	Total		**18**	**0**	**4**	**22**	**230**	**520**	**20**

***Students have to undergo summer internship of 6 Weeks duration at the end of semester VI and valuation will be done in VII semester.**

L : Lectures
T : Tutorials
P : Practicals
CIE : Continuous Internal Evaluation
SEE : Semester End Examination
PC : Professional Core
PE : Professional Elective
OE : Open Elective

HS : Humanities and Social Sciences
PW : Project Work

Professional Elective –II
1. PE 601EC Operating Systems
2. PE 602EC Pattern Recognition
3. PE 603EC Information Theory and Coding
4. PE 604EC Scripting Languages

Open Elective I
1. OE 601EC Electronic Instrumentation
2. OE 602EC Verilog HDL
3. OE 603EC Principles of Electronic Communication

SMESTER - V

PC 501EC

LINEAR CONTROL SYSTEMS

Credits: 3

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*

Course Objectives:

1. *To develop mathematical modeling for different control systems.*
2. *To construct state space model for continuous and discrete data systems and analyze them.*
3. *To analyze control system in time domain and determine stability using Routh-Hurwitz criterion and Root-Locus technique.*
4. *To analyze control system in frequency domain and determine stability using Nyquist criterion and bode plots.*
5. *To design compensators for control systems.*

Course Outcomes: *Student will be*

1. *Able to develop mathematical models and derive transfer functions for various systems*
2. *Able to expose to an appropriate state space modeling of system and its analysis and the concept and testing of controllability and observability.*
3. *Able to analyze the systems in time domain and determine its stability.*
4. *Able to analyze the systems in frequency domain and determine relative stability.*
5. *Able to design compensators for a given specifications.*

UNIT – I

Introduction to control systems: Basic components, classification of control systems, effects of feedback, mathematical modeling of physical systems, transfer functions, DC and AC position control systems, block diagrams, signal flow graphs.

UNIT – II

State-variable analysis of continuous data systems: state, state variables, state equations, solution of state equations, state transition matrix and its properties, state diagram, relationship between state equations and transfer functions, concept and testing of controllability and observability.

UNIT – III

Time-domain analysis: Typical test signals, steady-state error, unit-step response and time-domain specifications and transient response of a prototype second-order system.

Stability analysis of continuous data systems: Bounded-Input, Bounded-output stability, Zero input and asymptotic stability, Routh-Hurwitz criterion.
Root-Locus technique: Properties and construction of the root loci.

UNIT – IV

Frequency-domain analysis: frequency response and frequency domain specifications, Nyquist stability criterion, Bode plots, relative stability – gain margin and phase margin.

UNIT – V

Design of control systems: Cascade and feedback compensation using Bode plots. Phase lag, phase lead and phase Lag-Lead compensators and their design.
Controllers: Introduction to PI, PD and PID controllers.

Suggested Readings:

1. Benjamin C. Kuo, "*Automatic Control Systems*", Prentice Hall of India, 2009, 7th Edition.
2. I.J.Nagrath and M Gopal, "*Control System Engineering*", New Age International Private Limited, New Delhi, 2008, 5th Edition
3. Katsuhiko Ogata, "*Modern Control Engineering*", Prentice-Hall of India Private Limited, New Delhi, 2003, 4th Edition.

PC 502EC

ANALOG COMMUNICATION

Credits: 3

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*

***Course Objectives:** This course aims to:*

1 *To understand the concept of modulation.*
2 *To study various types of analog modulation techniques.*
3 *To understand the analog modulation schemes.*
4 *To study the block diagram and characteristics of transmitters and receivers.*
5 *To study the types of noise and influence analog modulation.*

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

1 *Able to compare the performance of AM, FM and PM schemes with reference to bandwidth.*
2 *Able to understand generation of AM, FM, PM schemes.*
3 *Able to evaluate the performance of AM and FM transmitters and receivers.*
4 *Able to identify sources of noise, noise figure, signal to noise ratio for AM, FM, and PM.*
5 *Understand the concept of pulse modulation and to compare their performance.*

UNIT- I

Linear modulation schemes: need for modulation, double-side band suppressed-carrier (DSB-SC) modulation, conventional amplitude modulation (AM), single side band (SSB) modulation and vestigial-sideband (VSB) modulation. Generation and demodulation of the above, Frequency Division Multiplexing.

UNIT- II

Angle modulation schemes: frequency modulation(FM) and phase modulation(PM), concept of instantaneous frequency, NBFM, WBFM, FM spectrum in terms of Bessel function, direct and indirect(Armstrong's) methods of FM generation, discriminators, phase locked loop(PLL), FM receiver.

UNIT-III

Transmitters and receivers: classification of transmitters, AM and FM radio transmitters. Principles of tuned radio frequency (TRF) and super heterodyne receivers, choice of intermediate frequency (IF), image frequency, tracking alignment, automatic-gain control (AGC), receiver characteristics and measurements, communication receivers.

UNIT – IV

Noise performance of AM, FM and PM systems: Sources of noise, thermal noise, shot noise, noise in linear systems, equivalent noise band width, noise temperature, noise figure. Signal-to noise ratio (SNR) calculations for DSB-SC AM, SSB, FM and PM systems.

UNIT – V

Analog pulse modulation schemes: sampling of continuous-time signals, low pass and band pass sampling, practical aspects of sampling and reconstruction of signals. Pulse amplitude modulation (PAM), Time Division Multiplexing, pulse time modulation schemes-pulse width modulation (PWM) and pulse position modulation (PPM), generation and demodulation.

Suggested Readings:

1. Herbert Taub and Donald L.Schilling, *"Principles of Communication Systems"*, 2nd Edition, Tata McGraw-Hill publishing company Limited, New Delhi, 1986.
2. Simon Haykin, *"Communiaction Systems"*, 4th Edition, John WiLey&sons.inc, 2000.
3. George Kennedy, Bernard Davis, *"Electronic Communication Systems"*, 4th Edition, Tata McGraw-Hill publishing company Limited, New Delhi, 1993.

PC 503EC

DIGITAL COMMUNICATION

Credits: 3

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*

Course Objectives: *This course aims to:*

1. *To interpret the principles of information theory.*
2. *To understand wave form coding techniques.*
3. *To get familiarized with various error coding techniques.*
4. *To analyze various digital carrier modulation techniques.*
5. *To understand the concept of spread spectrum modulation.*

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

1. *Able to acquires knowledge about information theory and assesses entropy and efficiency of various channels.*
2. *Able to learn to design an optimum receiver and analyze the error performance of base band and band pass data transmission.*
3. *Able to understand to design block codes, convolution and cyclic codes.*
4. *Able to apply suitable digital carrier modulation techniques and coding techniques for various applications for improved spectral efficiency.*
5. *Able to analyze the performance of spread spectrum communication system.*

UNIT- I

Information Theory: Introduction, Information entropy, properties of entropy, information rate, types of information sources, channels, types of channels, joint entropy, conditional entropy, redundancy, mutual information, channel capacity.

UNIT- II

Digital Coding Techniques: Elements of digital communication system, sampling theorem, quantization noise, source coding techniques: PCM, DPCM, DM, noise in PCM, DM system. Performance comparison of above systems.

UNIT-III

Error Control Coding: Binary discrete channels, types of transmission errors, need for error control coding , Coding theory: Introduction, source coding/decoding, Huffman coding, , Shannonfano coding, linear block codes, binary cyclic codes, characteristics of BCH codes, convolution codes ,tree diagram, comparison of the above codes,

UNIT – IV

Digital carrier modulation techniques: optimum receiver, coherent and non-coherent ASK, FSK, PSK, DPSK, MSK, and QPSK schemes, M-ary signalling schemes, and synchronization methods.

UNIT – V

Spread spectrum modulation: introduction, generation and characteristics of PN sequences. Direct sequence spread spectrum system; frequency hopping spread spectrum system and their application, acquisition scheme for spread spectrum receivers, tracking ofFH and DS signals.

Suggested Readings:

1. K Sam Shanmugam, "*Digital and Analog Communication Systems*", John Wiley & sons, 1979.
2. John G.Proakis, "*Digital Communications*", 4th Edition, Tata McGraw- Hill publishing company Limited, New Delhi, 2003.
3. P Ramakrishna Rao, "*Digital Communication*", Tata McGraw- Hill Education Private Limited, New Delhi, 2011.

PC 504EC

MICROPROCESSOR AND MICROCONTROLLER

Credits: 3

Instruction: 3 periods per week
CIE: 30 marks

Duration of SEE: 3 hours
SEE: 70 marks

Course Objectives:

1. *To understand the microprocessor architecture with the help of 8086.*
2. *To study the block diagram and peripheral ICs of microprocessor.*
3. *To understand and differentiate between a microprocessor and a microcontroller.*
4. *To study the architecture and pin out of the 8051.*
5. *To understand the instructions and program the 8051.*

***Course Outcomes:** Student will be*

1. *Able to acquire an overview of what a processor and controller are and differentiate between them.*
2. *Able to understand the architecture of a microprocessor and microcontroller to enable to design applications using them.*
3. *Able to apply theoretical learning to practical real time problems for automation.*
4. *Able to understand the architecture of a microcontroller.*
5. *Able to analyze and design real world applications and interface peripheral devices to the microprocessor.*

UNIT – I

Introduction to 8086: The 8086 Microprocessor Family- Overview, 8086 architecture, segmented memory, Maximum and Minimum mode of operation, addressing modes, Memory read and write bus cycles, memory interfacing,

UNIT – II

Assembly Language Programming: Instructions for data transfer, arithmetic, logical, simple sequence program Jumps, Flags, and Conditional jumps, Loops and Constructs, Instruction Timing and Delay Loops ; String instructions, Procedures and Macros, Assembler Directives, Interrupts in 8086.

UNIT – III

Peripherals: Programmable Peripheral Interface 8255 – examples using DAC, ADC, stepper motor etc., DMA controllers , Programmable Interrupt Controller 8259, Programmable Interval Timer 8254, USART 8251.

UNIT – IV

Introduction to microcontroller: Difference between microcontroller and microprocessor, 8051microcontroller architecture. 8051 registers. Memory organizations-program memory and data memory, internal RAM and bit addressable memory, special functions registers.

UNIT - V

8051 assembly language programming: instruction set – arithmetic, logical, data transfer, branching and others, addressing modes, programming using different instructions, Timers/counters of 8051. Interfacing 8051 with peripherals – LCD, Stepper motor, ADC, DAC, PWM, and Relay.

Suggested Readings:

1. Douglas V.Hall, *"Microprocessors and Interfacing Programming and Hardware"*, 2nd Edition, Tata McGraw- Hill publishing company Limited, New Delhi, 1994.
2. Walter A.Triebel and Avatar singh, *"The 8088 and 8086 Microprocessors Programming, Interfacing,Software, Hardware and Applications"*, Prentice-Hall of India Private Limited, New Delhi, 1996.
3. Muhammad Ali Mazidi, Janice Gillispie Mazidi and Rolin D.McKinlay, *"The 8051 Microcontroller and Embedded Systems using Assembly and C"*, 2nd Edition, Pearson education, 2009.

PROFESSIONAL ELECTIVE –I

PE 501EC

DIGITAL IMAGE PROCESSING

Credits: 3

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*

Prerequisite: This course requires the knowledge of Digital Signal Processing

Course Objectives: *This course aims to:*

1. *Understand the image formation and its digital representation.*
2. *Learn digital image fundamentals. Be exposed to simple image processing techniques.*
3. *Learn representation of images in frequency domain and enhancement techniques.*
4. *Be familiar with image compression and segmentation techniques. Learn to represent image in form of features.*
5. *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. *Understand how images are formed, sampled and quantized.*
2. *Apply various transforms like Fourier, DCT, Haar, DWT and Hadamard Transform to different applications.*
3. *Apply image enhancement techniques for practical applications*
4. *Implement the image restoration techniques.*
5. *Implement image compression techniques by removing the redundancy.*

UNIT – I

Digital Image Fundamentals: Image sensing, acquisition, Image formation model, sampling and Quantization, Basic relationships between pixels; neighbors of a pixel, adjacency, connectivity, regions and boundaries. Image formation in the eye, its capabilities for brightness adaptation and discrimination. Categorization of images according to their source. Gamma ray imaging, x-ray imaging, imaging in the Ultra Violet band, visible and infrared bands, Microwave band and Radio band.

UNIT – II

Image Transforms: 2D Fourier transform, Properties of 2D Fourier transform, Walsh, Hadamard, Slant, Haar, Discrete cosine transform and Hotelling transform. Color Image Processing: Color Fundamentals, Color Models, Pseudo color Image Processing.

UNIT – III

Image Enhancement: Spatial domain techniques: Contrast stretching, histogram equalization and histogram specification method, Neighborhood averaging and adaptive Median filter. Frequency domain methods: Ideal Low pass, Butterworth and Gaussian Low pass filters. Ideal High pass, Butterworth and Gaussian High pass filters. Homomorphic filtering.

UNIT – IV

Image Restoration: Mathematical expression for degraded image, estimation of degradation functions: image observation, experimentation and by modeling. Inverse filter Wiener filter, Geometric transformation, periodic noise reduction method.

UNIT – V

Image Segmentation and Compression: Detection of discontinuities, point detection methods, line detection. Edge detection methods: Gradient operation, Laplacian, Prewitt, Sobel, Laplacian of a Gaussian and Canny edge detectors. Image compression: Functional block diagram of a general image compression system and description of each unit, various types of redundancies, coding redundancy, psycho visual redundancy spatial and temporal redundancy, Huffman coding, LZW coding.

Suggested Readings:

1. Rafael C. Gonzales, Richard E. Woods, "*Digital Image Processing*", Third Edition, Pearson Education, 2010.
2. Anil K Jain, "*Fundamentals of Digital Image Processing*", Prentice-Hall of India Private Limited, New Delhi, 1995.
3. Milan Sonka, Vaclav Havel and Roger Boyle, "*Digital Image Processing and Computer vision*", Cengage Learning India Pvt. Limited, 2008.
4. Willliam K Pratt, *"Digital Image Processing"*, John Willey, 2002.
5. Malay K. Pakhira, "*Digital Image Processing and Pattern Recognition*", First Edition, PHI Learning Pvt. Ltd., 2011.

PE 502EC

ELECTRONIC MEASUREMENTS AND INSTRUMENTATION

Credits: 3

Instruction: 3 periods per week
CIE: 30 marks

Duration of SEE: 3 hours
SEE: 70 marks

Course Objectives:

1. *To familiarize with various Static and Dynamic Characteristics of Instruments, SI units of measuring electrical quantities and Various Display devices.*
2. *To learn the working principles of various types of DVMs and Wave analyzers.*
3. *To understand the working of Simple CRO and design concepts of various types of CROs.*
4. *To understand the working and design concepts of various transducers for the measurement of quantities like temperature, displacement, force, pressure etc.*
5. *To understand the importance of DAS, its types and the concept of Virtual instrumentation.*

Course Outcomes:

1. *Analyze the various characteristics of instruments and familiar with the SI units of measurements. And understand the working principles of Display devices.*
2. *Analyze the design aspects of various DVMs and wave analyzers*
3. *Analyze and design concepts of CROs and different CROs for different applications*
4. *Analyze various models of Active and Passive Transducer circuits.*
5. *Analyze the DAS and virtual instruments.*

UNIT - I

Measurements, Units and Display Devices: Performance characteristics of Instruments, Static and Dynamic characteristics, Error in Measurement, Types of Errors, Statistical analysis of errors, Limiting errors, Systems of Units, SI units, Electric and Magnetic Units, Fundamental and derived units Display devices: Light emitting diodes, Liquid crystal display and other displays including $3\frac{1}{2}$-digit displays

UNIT – II

Digital Voltmeters and Signal analysers : Comparison of Digital and Analog meters, Analog to Digital conversion, Ramp-type Digital Voltmeter, Staircase Ramp Digital Voltmeter, Successive approximation Digital Voltmeter, Dual-slope Digital Voltmeter, General specifications of DVM Basic Wave analysers, Heterodyne Wave analysers, Harmonic Distortion analyser, Spectrum analysers.

UNIT –III

Oscilloscopes: Basic Principle, CRT features, Block diagram of Oscilloscope, Vertical amplifier, Continuous Sweep and Triggered Sweep CRO, Delay line in Triggered Sweep, Oscilloscope Controls, Waveform Display, Measurement of frequency and Phase using Lissajous method, Applications and Advantages of CRO

Types of CRO: Dual Beam CRO, Dual Trace CRO, Sampling CRO, Storage Oscilloscope, Digital Storage Oscilloscope

UNIT – IV

Transducers : Introduction, Electrical Transducer, Selecting a Transducer, Active and Passive Transducers, Resistive transducers, Strain gauges, Temperature measurements, Thermistors, Thermocouples, LVDT, Inductive transducers, Capacitive Transducers, Piezoelectric Transducers, Photo electric Transducer, Digital Transducers.

UNIT –V

Data Acquisition System and Virtual Instrumentation: Introduction, Data Acquisition system, Objective of a DAS, Signal Conditioning of the inputs, Single channel DAS, Multichannel DAS, Data loggers, Introduction to Virtual Instrumentation,
IEEE 488 bus

Suggested Reading:

1. Albert D.Helfrick and William D.Cooper, "*Modern Electronic Instrumentation and Measurement Techniques*", Prentice-Hall of India Private Limited, New Delhi, 1996.
2. H S Klasi, "*Electronic Instrumentation*". Tata McGraw-Hill Company Limited, New Delhi, 2004.
3. David A.Bell, "*Electronic Instrumentation and Measurements*", 2nd Edition, Prentice-Hall of India Private Limited, New Delhi, 1994.

PE 503EC

Object Oriented Programming Language Systems

Credits: 3

Instruction: 3 periods per week
CIE: 30 marks

Duration of SEE: 3 hours
SEE: 70 marks

Course Objectives:

1. *Introduces Object Oriented Programming concepts using the C++ language.*
2. *Introduces the principles of data abstraction, inheritance and polymorphism;*
3. *Introduces the principles of virtual functions and polymorphism*
4. *Introduces handling formatted I/O and unformatted I/O*
5. *Introduces exception handling*

Course Outcomes:

1. *Able to develop programs with reusability*
2. *Understand different types of constructors and initialization of objects*
3. *Handle exceptions in programming*
4. *Develop applications for a range of problems using object-oriented programming techniques*

UNIT - I

Basic Concepts of OOP, Benefits of OOP, Object Oriented Languages, Features of OOP. How OOP Differ from POP. Applications of OOP, A Simple C++ Program, Structure of C++ Program. Keywords, Identifiers and Constants, Basic Data Types, User Defined Data Types, Derived Data Types, Dynamic Initialization of Variables, Reference Variables, Operators in C++, Scope Resolution Operator, Member Dereferencing Operators, Memory Management Operators.

UNIT- II

Functions, Classes and Objects: Introduction of Classes, Specifying a Class, Defining a Member Functions, A C++ Program with Class Access Specifies, Inline functions, Nesting of Member Functions, Memory Allocation for Objects, Static Data Members, Static Member Functions, Arrays of Objects, Objects as Function Arguments, Default Arguments, Const Arguments, Function Overloading, Friend Functions

UNIT- III

Constructors, Destructors, Inheritance: Introduction, Constructors, Parameterized Constructors, Multiple Constructors in a Class, Constructors with Default Arguments, Dynamic initialization of Objects, Copy Constructors, Dynamic Constructors, Destructors. Introduction to inheritance, Defining Derived Classes, Single Inheritance, Multiple Inheritance, Multi-Level Inheritance, Hierarchical Inheritance, Hybrid Inheritance, Abstract Classes, Constructors in Derived Classes, Containership, Operator overloading, Rules for Operator overloading, overloading of binary and unary operators .

UNIT - IV

Pointers, Virtual Functions and Polymorphism: Introduction, Memory Management, new Operator and delete Operator, Pointers to Objects, this Pointer, Pointers to Derived Classes

Polymorphism, compile time polymorphism, Run time polymorphism, Virtual Functions, Pure Virtual Functions, Virtual Base Classes, Virtual Destructors.

UNIT - V

Templates and Exception handling: Introduction, Class Templates, Class Templates with Multiple Parameters, Function Templates, Function Templates with Multiple Parameters, Member Function Templates. Basics of Exception Handling, Types of exceptions, Exception Handing Mechanism, Throwing and Catching Mechanism, Rethrowing an Exception, Specifying Exceptions

Suggested Readings:

1. Walter Savitch, *"Problem Solving with C++"*, 6th Edition, Pearson Education Publishing, 2009.
2. SB Lippman, J Lajoie, *"C++ Primer"*, 3rd Edition, AW Publishing Company, 2007.
3. Paul Dietel, Harvey Dietel, *"C How to Program"*, 6th Edition, PHI, 2010.
4. Bjarne Stroustrup, *"The C++ Programming Language"*, 3rd Edition, Pearson Education.
5. Ashok N.Kamthane, *"Programming in C++"* 2nd Edition, Pearson Education Publishing.

PE 504EC

DIGITAL SYSTEM DESIGN USING VERILOG HDL

Credits: 3

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*

Course Objectives:

1. *To familiarize with various modeling styles: structural and dataflow using Verilog HDL.*
2. *To familiarize with behavioral modeling of digital systems using Verilog HDL*
3. *To familiarize with various ICs available (combinational units) and their usage and to design them using Verilog HDL.*
4. *To familiarize with various Register and counter ICs available in the market and develop their function using Verilog HDL.*
5. *To design and develop real time applications such as adders, multipliers, Divider, ALU and DSP filter.*

Course Outcomes: *Student will be*

1. *Able to implement and distinguish different Verilog HDL modeling styles.*
2. *Able to construct and analyze Verilog HDL models of combinational and sequential circuits.*
3. *Able to make a choice among various ICs available in the market (combinational and sequential)*
4. *Able to understand types of memories and their design using Verilog HDL*
5. *Able to design and develop Verilog HDL modeling and test bench for digital systems for the given specifications.*

UNIT – I

Structural modeling: Overview of Digital Design with Verilog HDL, modules and ports, gate-level modeling and design examples.

Dataflow modeling: dataflow modeling, operands and operators. Switch Level Modeling: CMOS switches and bidirectional switches and design examples. Introduction to test bench design.

UNIT – II

Behavioral Modeling: Structured Procedures, Procedural Assignments, Timing Controls, Conditional Statements, multi-way branching, Loops, Sequential and Parallel blocks, Generate blocks. Combinational, sequential logic modules and design examples.

UNIT-III

Digital Integrated Circuits: Classification of Integrated Circuits, Comparison of Various Logic Families Combinational Logic ICs – Specifications and Applications of TTL-74XX & Code Converters, Decoders, De-multiplexers, LED & LCD Decoders with Drivers, Encoders,

Priority Encoders, Multiplexers, De-multiplexers, Priority Generators/Checkers, Parallel Binary Adder/Subtractor and Magnitude Comparators.

UNIT-IV

Sequential Logic IC's and Memories: Familiarity with commonly available TTL 74XX, CMOS 40XX Series ICs – All Types of Flip-flops, Asynchronous and synchronous Counters, Decade Counters, Shift Registers. Memories - ROM Architecture, Types of ROMS & Applications, RAM Architecture and applications, Static & Dynamic RAMs.

UNIT –V

Real time implementations: Fixed-Point Arithmetic modules: Addition, Multiplication, Division, Arithmetic and Logic Unit (ALU), Timer, Universal Asynchronous Receiver and Transmitter (UART), DSP modules: FIR and IIR filters, CPU design: Data path and control units.

Suggested Readings:

1. Samir Palnitkar, *"Verilog HDL A Guide to Digital Design and Synthesis,"* 2nd Edition, Pearson Education, 2006.
2. R.P.Jain, *"Modern Digital Electronics"*, Tata McGraw Hill, 4th Edition, 2009.
3. Ming-Bo Lin, *"Digital System Designs and Practices: Using Verilog HDL and FPGA,"* Wiley India Edition, 2008.
4. J. Bhasker, *"A Verilog HDL Primer,"* 2nd Edition, BS Publications, 2001.

MC 501 HS

TECHNICAL COMMUNICATION AND SOFT SKILLS

Credits: 3

Instruction: 3 periods per week
SEE: 3 hours CIE: 30 marks

Duration of SEE: 70 marks

UNIT-I

Technical Writing, Grammar and Editing – Technical writing process, forms of discourse, Writing drafts and revising, Collaborative writing, creating indexes, technical writing style and language. Basics of grammar, study of advanced grammar, editing strategies to achieve appropriate technical style.

Unit – II

Technical Communications: Introduction to advanced technical communication, Usability, Hunan factors, Managing technical communication projects, time estimation, Single sourcing, Localization.

UNIT-III

Self-Development and Assessment – Self Assessment, Awareness, Perception and Attitudes, Values and belief, personal goal setting, career planning, Self-esteem Communication and Technical Writing – Public Speaking, Group Discussion.

Unit- IV

Presentation Skills - Oral presentation, Interviews, Graphic presentation, Presentation aids, Personality Development. Writing reports, project proposals, brochures, newsletters, technical articles, manuals, official notes, business letters, memos, progress reports, minutes of meetings, event report

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UNIT-V

Professional Ethics – Business ethics, Etiquettes in Social and Office settings, Email etiquettes, Telephone Etiquettes, Engineering ethics, Managing time, Role and responsibility of engineer, Work culture in jobs, personal memory, Rapid reading, Taking notes, Complex problem solving, Creativity.

Suggested Readings:

1. David F. Beer and David Mc Murrey, Guide to writing as an Engineer, John Willey. New York, 2004
2. Diane Hacker, pocket Style Manual, Bedford Publicatiion, New York, 2003. (ISBN 0312406843)
3. Shiv Khera, You Can Win, Macmillan Books, New York, 2003.
4. Raman Sharma, Technical Communications, Oxford Publication, London, 2004.
5. Dale Jungk, Applied Writing for Technicians, McGraw Hill, New York, 2004. (ISBN: 07828357-4)
6. Sharma, R. and Mohan, K. Business Correspondence and Report Writing, TMH New Delhi 2002.
7. Xebec. Presentation Book, TMH New Delhi, 2000. (ISBN 0402213)

UCET, MGU AICTE *With effect from the Academic year 2020-21*

MC 502 HS

INDIAN CONSTITUTION

Credits:----

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*

The Constitution of India is the supreme law of India. Parliament of India cannot make any law which violates the Fundamental Rights enumerated under the Part III of the Constitution. The Parliament of India has been empowered to amend the Constitution under Article 368, however, it cannot use this power to change the "basic structure" of the constitution, which has been ruled and explained by the Supreme Court of India in its historical judgments. The Constitution of India reflects the idea of "Constitutionalism" – a modern and progressive concept historically developed by the thinkers of "liberalism" – an ideology which has been recognized as one of the most popular political ideology and result of historical struggles against arbitrary use of sovereign power by state. The historic revolutions in France, England, America and particularly European Renaissance and Reformation movement have resulted into progressive legal reforms in the form of "constitutionalism" in many countries. The Constitution of India was made by borrowing models and principles from many countries including United Kingdom and America.

The Constitution of India is not only a legal document but it also reflects social, political and economic perspectives of the Indian Society. It reflects India's legacy of "diversity". It has been said that Indian constitution reflects ideals of its freedom movement; however, few critics have argued that it does not truly incorporate our own ancient legal heritage and cultural values. No law can be "static" and therefore the Constitution of India has also been amended more than one hundred times. These amendments reflect political, social and economic developments since the year 1950. The Indian judiciary and particularly the Supreme Court of India has played an historic role as the guardian of people. It has been protecting not only basic ideals of the Constitution but also strengthened the same through progressive interpretations of the text of the Constitution. The judicial activism of the Supreme Court of India and its historic contributions has been recognized throughout the world and it gradually made it "as one of the strongest court in the world".

Course content

1. Meaning of the constitution law and constitutionalism
2. Historical perspective of the Constitution of India
3. Salient features and characteristics of the Constitution of India
4. Scheme of the fundamental rights
5. The scheme of the Fundamental Duties and its legal status
6. The Directive Principles of State Policy – Its importance and implementation
7. Federal structure and distribution of legislative and financial powers between the Union and the States
8. Parliamentary Form of Government in India – The constitution powers and status of the President of India
9. Amendment of the Constitutional Powers and Procedure
10. The historical perspectives of the constitutional amendments in India
11. Emergency Provisions: National Emergency, President Rule, Financial Emergency
12. Local Self Government – Constitutional Scheme in India
13. Scheme of the Fundamental Right to Equality
14. Scheme of the Fundamental Right to certain Freedom under Article 19
15. Scope of the Right to Life and Personal Liberty under Article 21

UCET, MGU AICTE *With effect from the Academic year 2020-21*

MC 503 HS

ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE

Credits: Nil

Instruction: 2 periods per week *Duration of SEE: 3 hours*
CIE: 30 Marks *SEE: 70 Marks*

Course Objectives:

1. *The course aims at imparting basic principles of thought process, reasoning and inferencing. Sustainability is at the core of Indian Traditional Knowledge Systems connecting society and nature.*
2. *Holistic life style of Yogic-science and wisdom capsules in Sanskrit literature are also important in modern society with rapid technological advancements and societal disruptions.*
3. *The course focuses on introduction to Indian Knowledge System, Indian perspective of modern scientific world-view and basic principles of Yoga and holistic healthcare system.*

***Course Outcomes:** Towards the end of the course it is expected that the student would be matured enough to apply the industrial management concepts and techniques in real life situations.*

Course Outcomes: After learning the contents of this course, the student would be able to,Ability to understand, connect up and explain basics of Indian Traditional knowledge modern scientific perspective.

1. *To explain holistic life style of yoga science*
2. *Understand basic structure of Indian knowledge system*

Course Content

Basic Structure of Indian Knowledge System (i) वेद, (ii) उपवेद (आयुर्वेद, धनुर्वेद, गन्धर्वेद, स्थापत्य आदि) (iii) वेदांग (शिक्षा, कल्प, निरुत, व्याकरण, ज्योतिष छंद), (iv) उपाइग (धर्म शास्त्र, मीमांसा, पुराण, तर्कशास्त्र)

- Modern Science and Indian Knowledge System
- Yoga and Holistic Health care
- Case Studies.

Suggested Text/Reference Books

1. V. Sivaramakrishna (Ed.), Cultural Heritage of India-Course Material, Bharatiya Vidya Bhavan, Mumbai, 5th Edition, 2014
2. Swami Jitatmanand, Modern Physics and Vedant, Bharatiya Vidya Bhavan
3. Fritzof Capra, Tao of Physics
4. Fritzof Capra, The wave of Life
5. V N Jha (Eng. Trans,), Tarkasangraha of Annam Bhatta, Inernational Chinmay Foundation, Velliarnad, Amaku,am

6. Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkatta
7. GN Jha (Eng. Trans.) Ed. R N Jha, Yoga-darshanam with Vyasa Bhashya, Vidyanidhi Prakasham, Delhi, 2016
8. RN Jha, Science of Consciousness Psychotherapy and Yoga Practices, Vidyanidhi Prakasham, Delhi, 2016
9. P R Sharma (English translation), Shodashang Hridayam

PC 551EC

ANALOG COMMUNICATION LABORATORY

Credits: 1

Instruction: 2 periods per week
CIE: 25 marks

Duration of SEE: 3hours
SEE: 50 marks

Course Objectives:

1 To perform Analog modulation and demodulation techniques and measure modulation index.
2 To perform experiments on Radio Receivers to measure their performance parameters.
3 To perform Pulse analog modulation and demodulation techniques and understand.
4 To perform Pulse digital modulation and demodulation techniques and understand.
5 To perform carrier modulation techniques.

Course Outcomes: Student will be

1. Able to acquire knowledge of performing modulation and demodulation and analyze the effects of various parameters on the process.
2. Able to acquire knowledge of operation of various radio receiver sub systems.
3. Able to acquire in-depth understanding of pulse analog and pulse digital modulation techniques.
4. Able to acquire skill to perform carrier modulation schemes using MATLAB.

List of experiments

1. AM generation and Demodulation
2. FM generation and Demodulation
3. Spectrum Analyzer and Analysis of AM and FM Signals
4. Radio Receiver measurements
5. AGC Characteristics of Radio Receiver
6. Squelch Circuit and Frequency Multiplier Circuit
7. Pre-emphasis and De-emphasis Circuits
8. PAM generation and demodulation
9. PWM Generation and demodulation
10. PPM Generation and demodulation
11. Frequency Division Multiplexing
12. Mixer circuit.
13. Phase Locked Loop characteristics.

Note: At least 10 experiments need to be completed in a semester

Suggested Readings:

1. Simon Haykin, *"Communication Systems"*, 4th Edition, John Wiley &sons.inc, 2000.
2. George Kennedy, Bernard Davis, *"Electronic Communication Systems"*, 4th Edition, Tata McGraw-Hill publishing company Limited, New Delhi, 1993.
3. K.C. Raveendranathan *"Communication systems Modelling and simulation using Matlab and Simulink"* Universities Press 2011.

UCET, MGU AICTE *With effect from the Academic year 2020-21*

PC 552EC

MICROPROCESSOR AND MICROCONTROLLER LABORATORY

Credits: 1

Instruction: 2 periods per week
CIE: 25 marks

Duration of SEE: 3 hours
SEE: 50 marks

Course Objectives:

1. *To study the 8085 microprocessor and implement various basic programs on it.*
2. *To study the 8086 microprocessor and implement basic programs on it.*
3. *To write assembly language programs in 8086 for string manipulations.*
4. *To interface the 8086 to stepper motor, ADC, DAC etc.*
5. *To program the 8051 using Keil IDE.*

***Course Outcomes:** Student will be*

1. *Able to write assembly language programs for arithmetic operations using 8086.*
2. *Able to implement simple programs on 8086.*
3. *Able to perform string manipulation operations in 8086.*
4. *Able to interface the 8086 to peripherals like stepper motor, ADC, DAC etc.*
5. *Able to understand the Keil IDE and simulate 8051 programs on it.*

List of Experiments:

1. Addition, subtraction using 8085
2. Multiplication and division using 8085
3. Simple programs on 8086 kits
4. Searching and sorting using 8086 assembly language
5. String operations like concatenation and swapping using 8086
6. DAC interface to 8086
7. ADC interface to 8086
8. Stepper motor interface to 8086
9. Study of Keil software for 8051
10. Basic programs using 8051 instructions
11. Flashing LED program using 8051
12. Timer program to generate square wave on ports of 8051

Suggested Readings:

1. Ramesh S.Gaonkar, *"Microprocessor Architecture programming and Applications with the 8085"*, 5th Edition, Penram International publishing (India) private Limited, 1999.
2. Douglas V.Hall, *"Microprocessors and Interfacing programming and Hardware"*, 2nd Edition, Tata McGraw- Hill publishing company Limited, New Delhi, 1994.
3. Muhammad Ali Mazidi, Janice Gillispie Mazidi and Rolin D.McKinlay, *"The 8051 Microcontroller and Embedded Systems using Assembly and C"*, 2nd Edition, Pearson

UCET, MGU AICTE

With effect from the Academic year 2020-21

SEMESTER - VI

PC 601EC

DIGITAL SIGNAL PROCESSING

Instruction: 3 periods per week *Credits: 3*

CIE: 30 marks *Duration of SEE: 3 hours*

SEE: 70 marks

Course Objectives:

1 *To study the DFT and FFT algorithms.*
2 *To understand the concept of FIR and IIR filters.*
3 *To study the types of filters.*
4 *To understand Multi rate signal processing.*
5 *To study the architecture of TMS processor.*

Course Outcomes: *Student will be*

1 *Able to find DFT of a given signal through Fast Fourier Transform techniques.*
2 *Able to design FIR and IIR type digital filters.*
3 *Able to identify filter structures and evaluate the coefficient quantization effects.*
4 *Able to understand sample rate conversion techniques.*
5 *Able to compare the architectures of DSP and General Purpose Processors.*

UNIT-I

Introduction: Review of Discrete Time Fourier Transform, Concept of frequency in continuous and discrete time signals, DFT and its properties, linear convolution, circular convolution. Computational complexity of direct Computation of DFT, Fast Fourier Transform, DIT and DIF, FFT algorithms for RADIX-2 case, in-place computation, Bit reversal, Finite word length effects in FFT algorithms, Use of FFT in Linear Filtering.

UNIT-II

FIR Filters: FIR digital filter design techniques. Properties of FIR digital filters, design of FIR filters using windows and frequency sampling techniques, linear phase characteristics. Realization diagrams for IIR and FIR filters, finite word length effects.

UNIT-III

IIR Filters: Analog filter design – Butterworth and Chebyshev approximations, IIR digital filter design techniques, impulse invariant technique. Bilinear transform technique. Comparison of FIR and IIR filters, frequency transformations.

UNIT- IV

Multirate signal processing: Introduction, decimation by a factor D, interpolation by a factor I, sampling rate conversion by a rational factor I/D, design of practical sampling rate converter, S/W implementation of sampling rate converter, application of Multirate signal processing.

UNIT-V

DSP Processors: Introduction to Fixed point Digital Signal Processors, TMS 320C54XX processor- architecture, addressing modes, instruction set, Assembly programming, [illegible] Applications of DSP processors.

Suggested Readings:

1. John G.Proakis and Dimitris G. Manolakis, *"Digital Signal Processing principles, Algorithms and Applications"*, 3rd Edition, Prentice-Hall of India Private Limited, New Delhi, 1997.
2. Alan V. Oppenheim and Ronald W. Schafer, *"Discrete Time Signal Processing"*, 3rd edition, Prentice Hall, Upper Saddle River, NJ,2010
3. Sanjit K. Mitra, *"Digital Signal Processing: A Computer-Based Approach"*, 4/e, McGraw-Hill, New York,2011
4. Avatar sing and S.Srinivasan, *"Digital Signal Processing implementation using DSP Microprocessors with Examples from TMS320C54XX"*, Thomson Books Icole, 2004.

UCET, MGU AICTE

With effect from the Academic year 2020-21

PC 602 EC

ANTENNA WAVE PROPAGATION

Instruction: 3 periods per week *Credits: 3*

CIE: 30 marks *Duration of SEE: 3 hours*

SEE: 70 marks

Course Objectives:

1. *To understand the various antenna parameters give insight of the radiation phenomena*
2. *To have thorough understanding of radiation characteristics of different types of antennas.*
3. *To study the characteristics of array antennas having directional radiation characteristics.*
4. *To give insight on aperture antennas and modern antennas.*
5. *To understand the concepts of wave propagation and create awareness about the different types of propagation of radio waves at different frequencies.*

Course Outcomes:

1. *The student acquires knowledge about the basic antenna parameters and radiation concepts.*
2. *The student learns to analyze wire antennas in detail.*
3. *The student attains engineering fundamentals to analyze and design antenna arrays.*
4. *The student can classify, analyze and design aperture and modern antennas.*
5. *The student gains ability to identify and explain different modes of propagation in different regions of atmosphere.*

UNIT - I

Fundamentals of Antenna theory: Principle of radiation, Basic Antenna Parameters – Patterns, Beam Area, Radiation Intensity, Beam Efficiency, Directivity, Gain, Antenna Apertures, Effective Height, Illustrative Problems. Retarded Potentials – Helmholtz Theorem Thin Linear Wire Antennas – Radiation from Small Electric Dipole, Quarter Wave Monopole and Half Wave Dipole – Current Distributions, near field and far field Components, Radiated Power, Radiation Resistance, Beam Width, Directivity, Effective Area and Effective Height. Loop Antennas – Introduction, Small Loop, Comparison of Far Fields of Small Loop and Short Dipole.

UNIT - II

Antenna Arrays: Basic two element array, N element uniform linear array, Pattern multiplication, Broadside and End fire array, Planar array, Concept of Phased arrays, Adaptive array, Basic principle of antenna Synthesis- Binomial array, Tschebysev array.

UNIT - III

Practical Antennas: Yagi-uda antenna, V- Antenna, Rhomble antenna, Travelling wave antennas, Microstrip antennas – Introduction, Features, Advantages and Limitations, Rectangular Patch Antennas – Geometry, Design equations and Characteristics.

UNIT - IV

Aperture and Modern Antennas: - Reflector Antennas – Introduction, Flar Sheet and Corner Reflectors, Paraboloidal Reflectors – Geometry, Pattern Characteristics, Feed Methods, and Reflector Types – Related Features, Illustrative Problems. Horn Antennas – Types, Fermat's Principle, Radiation from sectorial and pyramidal horns, Design Considerations of Pyramidal Horns, Reconfigurable antenna, Active antenna, Dielectric antennas, Electronic band gap structure and applications

UNIT - V

Wave propagation: Ground wave propagation. Space and surface waves, Tropospheric refraction and reflection. Sky wave propagation – Virtual height, critical frequency, Maximum usable frequency – Skip distance, Fading, Multi hop propagation

Suggested Reading:

1. Constantine A. Balanis, *"Modern Antenna Handbook"*, a John Wiley & Sons, Inc., Publication, 2008.
2. John D.Kraus, Ronald J.Marhefka and Ahmed S.Khan, *"Antennas for All Applications"* 3rd Edition, Tata McGraw- Hill publishing company Limited, New Delhi, 2006.
3. K.D.Prasad, *"Antennas and Wave Propagation"*, Khanna or Satya Publications.

PC 603EC

DATA COMMUNICATION AND COMPUTER NETWORKS

Credits: 3

Instruction: 3 periods per week
CIE: 30 marks

Duration of SEE: 3 hours
SEE: 70 marks

Course Objectives:

1. *To provide a conceptual foundation for the study of data communications using the open Systems interconnect (OSI) model for layered architecture.*
2. *To study the principles of network protocols and internetworking*
3. *To understand the Network security and Internet applications.*
4. *To understand the concepts of switched communication networks.*
5. *To understand the performance of data link layer protocols for error and flow control.*
6. *To understand various routing protocols and network security.*

Course Outcomes:

1. *Understand the working of various network topologies and circuit and packet switching*
2. *Comprehend the role of data link layers and significance of MAC protocols*
3. *Understand the networking protocols and Internet protocols*
4. *Understand the transport layer working with TCP, UDP and ATM protocols*
5. *Comprehend the functionality of application layer and importance of network security.*

UNIT - I

Data communication: A Communication Model, The Need for Protocol Architecture and Standardization, Network Types: LAN, WAN, MAN, Network Topologies: Bus, Star, Ring, Hybrid. Line configurations. Reference Models: OSI, TCP/IP.

Circuit switching: Circuit Switching Principles and concepts.

Packet switching: Virtual circuit and Datagram subnets, X.25.

UNIT - II

Data Link Layer: Need for Data Link Control, Design issues, Framing, Error Detection and Correction, Flow control Protocols: Stop and Wait, Sliding Window, ARQ Protocols, HDLC.

MAC Sub Layer: Multiple Access Protocols: ALOHA, CSMA, Wireless LAN, IEEE 802.2, 802.3, 802.4, 802.11, 802.15, 802.16 standards. Bridges and Routers.

UNIT - III

Network Layer: Network layer Services, Routing algorithms: Shortest Path Routing, Flooding, Hierarchical routing, Broadcast, Multicast, Distance Vector Routing, and Congestion Control Algorithms.

Internet Working: The Network Layer in Internet: IPV4, IPV6, Comparison of IPV4 and IPV6, IP Addressing, ATM Networks

UNIT - IV

Transport Layer: Transport Services, Elements of Transport Layer, Connection management, TCP and UDP protocols, ATM AAL Layer Protocol.

UNIT - V

Application Layer: Domain Name System, SNMP, Electronic Mail, World Wide Web. **Network Security:** Cryptography Symmetric Key and Public Key algorithms, Digital Signatures, Authentication Protocols.

Suggested Reading:

1. Andrew S Tanenbaum, *"Computer Networks,"* 5/e, Pearson Education, 2011.
2. Behrouz A. Forouzan, *"Data Communication and Networking,"*3/e, TMH, 2008.
3. William Stallings, *"Data and Computer Communications,"* 8/e, PHI, 2004.
4. Douglas EComer, *"Computer Networks and Internet"*, Pearson Education Asia, 2000.
5. PrakashC. Gupta, *"Data Communications and Computer Networks"*, PHI learning, 2013

UCET, MGU AICTE

With effect from the Academic year 2020-21

PE 601EC

PROFESSIONAL ELECTIVE –II

OPERATING SYSTEMS

Credits: 3

Instruction: 3 periods per week
CIE: 30 marks

Duration of SEE: 3 hours
SEE: 70 marks

Course Objectives:

1. *To introduce the concepts of OS structure and process synchronization*
2. *To study different memory management strategies*
3. *To familiarize the implementation of file system*
4. *To understand the principles of system security and protection*
5. *To discuss the design principles and structure of Windows 7 and Linux*

Course Outcomes: Student will be able to

1. *Evaluate different process scheduling algorithms*
2. *Describe the steps in address translation and different page replacement strategies*
3. *Compare different file allocation methods and decide appropriate allocation strategy for given type of file*
4. *Understand the concepts of system protection and security process*
5. *Explain the mechanisms available in an OS to control access to resource*

UNIT-I

Introduction to Operating Systems: OS structure and strategies, Process concepts, Multithreaded Programming, Process scheduling, Process synchronization, Deadlocks.

UNIT-II

Memory management strategies with example architectures: Swapping, Contiguous allocation,
Paging, Segmentation, Segmentation with paging, Virtual memory management: Demand paging, Page replacement, Thrashing.

UNIT-III

File system interface: File concepts, Access methods and protection. File system implementation: File system structure, Allocation methods, Directory implementation of file systems, Mass storage structures, I/O systems

UNIT-IV

System Protection: Principles and Domain, Access Matrix and implementation, Access control and access rights, Capability based systems, and Language based Protection,
System Security: Problem, Program threats, cryptography, user authentication, implementing security defences, Firewalling, Computer security Classification

UNIT-V

Case Studies: The Linux System–Design principles, Kernel modules, Process management, Scheduling, Memory management, File systems, Input and Output, Inter process

communication. Windows 7 –Design principles, System components, Terminal services and fast user switching File systems, Networking, Programmer interface.

Suggested Reading:

1. Abraham Silberschatz, Peter B Galvin, *"Operating System Concepts"*, 9th edition, Wiley, 2016
2. William Stallings, *"Operating Systems-Internals and Design Principles"*, 8th edition, Pearson, 2014
3. Andrew S Tanenbaum, *"Modern Operating Systems"*, 4th edition, Pearson, 2016.

PE 602EC

PATTERN RECOGNITION

Credits: 3

Instruction: 3 periods per week
CIE: 30 marks

Duration of SEE: 3 hours
SEE: 70 marks

Course Objectives:

1. *To provide the students both supervised and unsupervised pattern classification methods*
2. *To provide different parameter estimation techniques required in data classification task.*
3. *To provide methods how to estimate the shape of the given data distribution.*
4. *To provide the students both data reduction and unsupervised classification methods and statistical based methods*
5. *To provide different learning algorithms and application of a deep neural network.*

Course Outcomes: *Student will be*

1. *Able to learn supervised classification techniques based on Bayesian decision theory.*
2. *Able to learn parameter estimation and density estimation methods required for data classification*
3. *Students able to learn the concept of data reduction and support vector and nearest neighbor classifiers.*
4. *Able to learn data clustering methods employed in partitioning the data.*
5. *Able to learn neural networks and deep convolutional networks and its application for numerals and image data classification*

UNIT – I

Introduction to Pattern Recognition: Pattern recognition system, Bayesian decision theory, two category classifier, minimum error rate classification, discriminant functions and decision surfaces, two category cases. Discriminant functions for normal density function.

UNIT – II

Maximum likelihood and Bayesian parameter estimation Techniques: General principles, parameter estimation from a multivariate distribution. Component analysis and discriminants: Principle component analysis and Fisher linear Discriminant.

UNIT – III

Non-parametric Techniques: Introduction, density estimation, Parzen window. Nearest Neighbor rule, convergence and error rate for the Nearest Neighbor rule, Metrics and nearest Neighbor classification: Properties of metrics and tangent distance.

UNIT – IV

Linear discriminant functions and Decision surfaces: Two category and multi-category cases, Generalized discriminant functions .Data description and clustering: similarity

measures, criterion functions for clustering, k means and fuzzy k means clustering techniques and Support vector machine.

UNIT – V

Neural networks and deep learning: Model of an artificial neuron, different learning rules, perceptron and its training algorithm, multilayer neural network, back propagation algorithm, deep convolutional neural networks, architecture, training algorithm and its application to digit data set classification.

Suggested Readings:

1. Richard O.Duda, Peter E Heart, David G.Stork, "*Pattern Classification*", John Wiley and Sons 2002.
2. Rafael C.Gonzalez and Richard E. Woods, "*Digital Image processing*", Pearson, NY 2018.
3. B. Yegnanarayana, "*Artificial Neural Networks*", Prentice Hall, New Delhi 2007.

UCEK, MGU AICTE With effect from the Academic year 2020-21

PE 603EC

INFORMATION THEORY AND CODING

Credits: 3

Instruction: 3 periods per week
CIE: 30 marks

Duration of SEE: 3 hours
SEE: 70 marks

Course Objectives:

1. *To acquire the knowledge in measurement of information and errors.*
2. *Understand the importance of various codes for communication systems*
3. *To design encoder and decoder of various codes.*
4. *To know the applicability of source and channel codes*
5. *To learn about emerging applications of error-control coding.*

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

1. *Learn measurement of information and errors.*
2. *Design encoders and decoders for linear block codes*
3. *Apply cyclic codes for error correction and detection.*
4. *Design encoders and decoders for convolution codes*
5. *Understand encoders and decoders for BCH codes*

UNIT - I

Coding for Reliable Digital Transmission and storage: Mathematical model of Information, A Logarithmic Measure of Information, Average and Mutual Information and Entropy, Types of Errors, Error Control Strategies. Channel Coding Channel capacity, binary symmetric channel, binary erasure channel, Shannon's channel coding theorem, Huffman coding

UNIT - II

Linear Block Codes: Introduction to Linear Block Codes, Syndrome and Error Detection, Minimum Distance of a Block code, Error-Detecting and Error-correcting Capabilities of a Block code, Standard array and Syndrome Decoding, Probability of an undetected error for Linear Codes over a BSC, Hamming Codes. Applications of Block codes for Error control in data storage system

UNIT - III

Cyclic Codes: Description, Generator and Parity-check Matrices, Encoding, Syndrome Computation and Error Detection, Decoding, Cyclic Hamming Codes, shortened cyclic codes, Error-trapping decoding for cyclic codes, Majority logic decoding for cyclic codes.

UNIT - IV

Convolutional Codes: Encoding of Convolutional Codes- Structural and Distance Properties, state, tree, trellis, [illegible] likelihood decoding, Sequential decoding, Majority-

Basic decoding of Convolution codes. Application of Viterbi Decoding and Sequential Decoding, Applications of Convolutional codes in ARQ system.

UNIT - V

BCH Codes: Minimum distance and BCH bounds, Decoding procedure for BCH codes, Syndrome computation and iterative algorithms, Error locations polynomials for single and double error correction.

Suggested Readings:

1. K. Sam Shanmugam, *"Digital and analog communication systems"*, John Wiley India Pvt. Ltd, 1996.
2. Simon Haykin, *"Digital communication"*, John Wiley India Pvt. Ltd, 2008.
3. Muralidhar Kulkarni, K.S. Shivaprakasha, *"Information Theory and Coding"*, Wiley India Pvt. Ltd, 2015, ISBN: 978-81-265-5305-1.
4. Shu Lin, Daniel J. Costello, Jr, *"Error Control Coding- Fundamentals and Applications"*, Prentice Hall, Inc 2014.
5. Man Young Rhee, *"Error Correcting Coding Theory"* McGraw – Hill Publishing 1989

SCRIPTING LANGUAGES

Credits: 3

Duration of SEE: 3 hours
SEE: 70 marks

3 periods per week

Objectives:

1. *To understand the UNIX and Shell environments.*
2. *To study the Linux kernel and commands.*
3. *To understand the ability of PERL scripting language.*
4. *To study the Python scripting language.*

Outcomes: Student will be

1. *Able to use UNIX and Linux based systems to perform various tasks.*
2. *Able to use shell scripting to run programs of any scripting language.*
3. *Able to compile large programming sets in the Perl and Python environment.*
4. *Able to effectively apply knowledge of Perl and Python to new situations and learn from the experience.*
5. *Able to Use Python scripting language for Web application development.*

NIT - I

Introduction to Linux, File System of the Linux, General usage of Linux kernel & basic commands, Permissions for file, directory and users, searching a file & directory, zipping and scripting concepts, Overview of scripting languages.

NIT - II

Shell: The Shell as a Process, Creating a Command File, VI Editor, UNIX Power Tools, Redirection and Pipelines, Variables, Conditional Constructs, Looping Constructs, Shell Functions, Parameters, Pattern Matching. Exporting, Signals And Traps, Built-In Commands, Source-Again Shell, Error Debugging, Advanced Shell Scripting Commands.

NIT - III

PERL Basics-I: PERL basics, file handles, operators, control structures, regular expressions, built in data types, operators, statements and declarations- simple, compound, loop statements, local and scoped declarations, Pattern matching - regular expression, pattern matching operators, character classes, positions, capturing and clustering.

NIT - IV

PERL Basics-II: Lists and Hashes, Subroutines- syntax, semantics, proto types, format variables, references, data structures- arrays of arrays, hashes of arrays, hashes of functions. Inter process communication. - signals, files, pipes, sockets. PERL debugger.

UNIT – V

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

Suggested Readings:

1. David Barron, *"The World of Scripting Languages"*, Wiley Publications.
2. Larry Wall, Tom Christiansen, John Orwant, *"Programming PERL"*, Oreilly publications, 3rd Ed.
3. Steve Holden and David Beazley, *"Python Web Programming"*, New Riders Publications.

With effect from the Academic year 2020-21

OPEN ELECTIVE-I

OE 601EC

ELECTRONIC INSTRUMENTATION

Credits: 3

Duration of SEE: 3 hours
SEE: 70 marks

Instruction: 3 periods per week
CIE: 30 marks

Course Objectives:

1. *To familiarize with various measurement parameters and Standards of measurement.*
2. *To learn the working principles of various types of Microphones and Hygrometers.*
3. *To understand the operation and applications of CRO.*
4. *To understand about the operation of various transducers.*
5. *To understand the importance of biomedical instrumentation and Virtual instrumentation.*

Course Outcomes:

1. *Analyze the various characteristics of measurement parameters and Standards of measurement.*
2. *Evaluate the operation and application of microphones*
3. *Use the CROs for various applications and explore its features.*
4. *Explore various types of Transducers and their characteristics.*
5. *Analyze the operation of various biomedical instruments and the features of Virtual Instrumentation.*

UNIT – I

Measurement parameters: History of instrumentation. Error in Measurement, Types of Errors, Statistical analysis of errors, Limiting errors, Standards of measurement, IEEE and ISO standards.

UNIT – II

Microphones and Hygrometers: Microphones: Microphones and their types, Humidity measurement, resistive, capacitive, aluminium-oxide and crystal Hygrometer types – Operation and applications.

UNIT – III

CRO: Basic Principle of CRT, its features, Block diagram and operation of CRO, Oscilloscope Controls, Waveform display, Measurement of frequency and Phase using Lissajous method, Applications and Advantages of CRO.

UNIT –IV

Transducers: Introduction, Electrical Transducer, Factors for Selecting a Transducer, Active and Passive Transducers, Operation and applications of Resistive transducers, Strain gauges and Thermistors

UNIT –V

Biomedical and Virtual Instrumentation: Biomedical instrumentation, Bio-potential electrodes, Principles of operation and applications of ECG, EEG, EMG, X-ray machines, CT scanners and Introduction to virtual instrumentation.

Suggested Reading:

1. Albert D.Helfrick and William D.Cooper, *"Modern Electronic Instrumentation and Measurement Techniques"*, Prentice-Hall of India Private Limited, New Delhi, 1996.
2. H S Klasi, *"Electronic Instrumentation"*, *Tata* McGraw-Hill Company Limited, New Delhi, 2004.
3. David A.Bell, *"Electronic Instrumentation and Measurements"*, 2nd Edition, Prentice-Hall of India Private Limited, New Delhi, 1994.
4. R.S.Khandpur, *"Handbook of biomedical Instrumentation"*, Tata McGraw- Hill publishing company Limited, New Delhi, 2000.

OE 602EC

VERILOG HDL

Credits: 3

Instruction: 3 periods per week
CIE: 30 Marks

Duration of SEE: 3 hours
SEE: 70 Marks

Course Objectives:

1. *To familiarize with various modeling styles: structural, dataflow and behavioral of Verilog HDL.*
2. *To develop combinational and sequential circuits using various modeling styles of Verilog HDL.*
3. *To design and develop Verilog HDL models of data path and control units of Central Processing Unit (CPU).*
4. *To learn Synthesis and FPGA design flow.*
5. *To design and develop real time applications: Booth's multiplier, Divider, hardwired control for basic CPU and FIR filter.*

Course Outcomes: *Student will be*

1. *Able to implement and distinguish different Verilog HDL modeling styles.*
2. *Able to construct and analyze Verilog HDL models of combinational and sequential circuits.*
3. *Able to design and develop Verilog HDL modeling and test bench for digital systems for the given specifications.*
4. *Able to outline FPGA design flow and timing analysis.*
5. *Able to describe the concepts of real time implementations*

UNIT – I

Structural modeling: Overview of Digital Design with Verilog HDL, Basic concepts, modules and ports, gate-level modeling, hazards and design examples.

UNIT – II

Dataflow and Switch level modeling: dataflow modeling, operands and operators. Switch Level Modeling: CMOS switches and bidirectional switches and design examples.

UNIT - III

Behavioral Modeling: Structured Procedures, Procedural Assignments, Timing Controls, Conditional Statements, multi-way branching, Loops, Sequential and Parallel blocks, Generate blocks. Combinational, sequential logic modules and design examples.

UNIT - IV

Synthesis and Verification: Verilog HDL synthesis, Application Specific IC (ASIC) and Field Programmable Gate Array (FPGA) design flow. Verification: Timing analysis and Test bench design. Design examples.

UNIT - V

Real time implementations: Fixed-Point Arithmetic modules: Addition, Multiplication, Division, Arithmetic and Logic Unit (ALU), Timer, Universal Asynchronous Receiver and Transmitter (UART), DSP modules: FIR and IIR filters, CPU design: Data path and control units.

Suggested Readings:

1. Samir Palnitkar, *"Verilog HDL A Guide to Digital Design and Synthesis,"* 2nd Edition, Pearson Education, 2006.
2. Ming-Bo Lin, *"Digital System Designs and Practices: Using Verilog HDL and FPGA,"* Wiley India Edition, 2008.
3. J. Bhasker, *"A Verilog HDL Primer,"* 2nd Edition, BS Publications, 2001.

OE 603EC
PRINCIPLES OF ELECTRONIC COMMUNICATION SYSTEMS

Credits: 3

Instruction: 3 periods per week
CIE: 30 Marks

Duration of SEE: 3 hours
SEE: 70 Marks

Course Objectives:

1. *Provide an introduction to fundamental concepts in the understanding of communications systems.*
2. *Provide an introduction to network model and some of the network layers including physical layer, data link layer, network layer and transport layer.*
3. *Provide an introduction to the evolution of wireless systems and current wireless technologies.*

Course Outcomes: *Student will be able to*

1. *Understand the working of analog and digital communication systems*
2. *Understand the OSI network model and the working of data transmission*
3. *Understand the concepts of modulation and demodulations*
4. *Understand the evolution of communication technologies from traditional telephony systems to modern wireless communication systems.*
5. *Understand the principles of optical communications systems*

UNIT- I

Introduction to communication systems: Electromagnetic Frequency Spectrum, Signal and its representation, Elements of Electronic Communications System, Types of Communication Channels, Signal Transmission Concepts-Baseband transmission and Broadband transmission, Communication parameters-Transmitted power, Channel bandwidth and Noise, Need for modulation Signal Radiation and Propagation-Principle of electromagnetic radiation, Types of Antennas, Antenna Parameters and Mechanisms of Propagation.

UNIT- II

Analog and Digital Communications: Amplitude modulation and demodulation, FM modulation and demodulation, Digital converters, Digital modulation schemes – ASK, FSK, PSK, QPSK, Digital demodulation.

UNIT- III

Data Communication and Networking: Network Models, OSI Model, Data Link Layer – Media Access control, Ethernet, Network Layer – Internet Protocol (IPv4/IPv6), Transport Layer – TCP, UDP.

UNIT- IV

Telecommunication Systems: Telephones, Telephone system, Paging systems, Internet Telephony. Optical Communications: Optical Principles, Optical Communication Systems, Fiber –Optic Cables, Optical Transmitters & Receivers, Wavelength Division Multiplexing.

UNIT- V

Wireless Communications: Evolution of Wireless Systems: AMPS, GSM, CDMA, WCDMA, And OFDM. Current Wireless Technologies: Wireless LAN, Bluetooth, PAN and ZigBee, Infrared wireless, RFID communication, UWB, Wireless mesh networks, Vehicular adhoc networks.

Suggested Readings:

1. Louis E. Frenzel, "*Principles of Electronic Communication Systems*", 3e, McGraw Hill publications, 2008.
2. Behrouz A. Forouzan, "*Data Communications and Networking*", 5e TMH, 2012.
3. Kennady, Davis, "*Electronic Communications systems*", 4e, TMH, 1999.

With effect from the Academic year 2020-21

HS 601
MB

FUNDAMENTALS OF MANAGEMENT

Credits: 3

Duration of SEE: 3 hours
SEE: 70 Marks

Instruction: 3 periods per week
CIE: 30 Marks

Course Objectives:

This course ensures that the students understand how:

1. Managers manage business organizations in the dynamic global environment
2. Organizations develop and maintain competitive advantage
3. Business decisions are made using various tools and techniques to remain competitive
4. Managers use problem-solving strategies and critical thinking skills in real life situations
5. Different areas of the business (i.e., Manufacturing/Service, Marketing, Finance and Human Resource Management) support the vision and mission.
6. Managers implement successful planning.

Course Outcomes: Towards the end of the course it is expected that the student would be matured enough to apply the industrial management concepts and techniques in real life situations.

After learning the contents of this course, the student would be able to,

1. What are the circumstances that lead to management evolution and how it will affect future managers
2. Analyze and evaluate the influence of historical forces on the current practice of management
3. Identify and evaluate social responsibility and Level 3(Applying) Identify ethical issues involved in business situations and logically articulate own position on such issues.
4. Explain how organizations adapt to an uncertain environment and identify techniques managers use to influence and control the internal environment.
5. Evaluate leadership styles to anticipate the consequences of each leadership style
6. Develop the process of management's four functions: planning, organizing, leading, and controlling.

UNIT - I

Introduction to Management: Definition, Nature and Scope, Functions, Managerial Roles, Levels of Management, Managerial Skills, Challenges of Management; Evolution of Management- Classical Approach- Scientific and Administrative Management; The Behavioral approach; The Quantitative approach; The Systems Approach; Contingency Approach, IT Approach.

UNIT – II

Planning and Decision Making: General Framework for Planning - Planning Process, Types of Plans, Management by Objectives; Development of Business Strategy. Decision making and Problem Solving - Programmed and Non Programmed Decisions, Steps in Problem Solving and Decision Making; Bounded Rationality and Influences on

Decision Making; Group Problem Solving and Decision Making, Creativity and Innovation in Managerial Work.

UNIT – III

Organization and HRM: Principles of Organization: Organizational Design & Organizational Structures; Departmentalization, Delegation; Empowerment, Centralization, Decentralization, Recentralization; Organizational Culture; Organizational Climate and Organizational Change.Human Resource Management & Business Strategy: Talent Management, Talent Management Models and Strategic Human Resource Planning; Recruitment and Selection; Training and Development; Performance Appraisal.

UNIT – IV

Leading and Motivation: Leadership, Power and Authority, Leadership Styles; Behavioral Leadership, Situational Leadership, Leadership Skills, Leader as Mentor and Coach, Leadership during adversity and Crisis; Handling Employee and Customer Complaints, Team Motivation - Types of Motivation; Relationship between Motivation, Performance and Engagement, Content Motivational Theories - Needs Hierarchy Theory, Two Factor Theory, Theory X and Theory Y.

UNIT – V

Controlling: Control, Types and Strategies for Control, Steps in Control Process, Budgetary and Non- Budgetary Controls, Characteristics of Effective Controls, Establishing control systems, Control frequency, and Methods.

SUGGESTED TEXT BOOKS:

1 Management Fundamentals, Robert N Lussier, 5e, Cengage Learning, 2013.
2 Fundamentals of Management, Stephen P. Robbins, Pearson Education, 2009.

REFERENCES:

1) Essentials of Management, Koontz Kleihrich, Tata McGraw Hill.
2) Management Essentials, Andrew DuBrin, 9e, Cengage Learning, 2012

UCET, MGU AICTE *With effect from the Academic year 2020-21*

PC 651EC DIGITAL SIGNAL PROCESSING LABORATORY

Credits: 1

Instruction: 2 periods per week
CIE: 25 Marks

Duration of SEE: 3 hours
SEE: 50 Marks

Course Objectives:

1. *To understand the concept of basic signals and to generate them using MATLAB.*
2. *To understand the concept of N-point FFT algorithm.*
3. *To understand the concept of analog and digital filters and simulation using MATLAB.*
4. *To study the architecture of TMS320 C54x.*
5. *To understand the concept of Linear Convolution and simulate it using CCSTUDIO/Visual DSP ++.*

Course Outcomes: *Student will be*

1. *Able to develop various DSP Algorithms using MATLAB Software package.*
2. *Able to analyze and Observe Magnitude and phase characteristics (Frequency response Characteristics) of digital FIR filter using window techniques.*
3. *Able to analyze and Observe Magnitude and phase characteristics (Frequency response Characteristics) of digital IIR-Butterworth, Chebyshev filters.*
4. *Able to design and Implement DSP algorithms in software using a computer language such as C with TMS320C54x fixed point Processor.*

List of Experiments

1. (a)Generation of basic signals based on recursive difference equations.
   (b) Operations on Basic sequences
2. (a) Linear and Circular Convolutions in time domain and frequency domain
   (b) Determination of autocorrelation and Power Spectrum of a given signal(s)
3. (a) Fast Fourier Transform – DIT and DIF algorithm
   (b) Spectrum analysis using DFT
4. (a) Generation of windows – Rectangular, Hamming and Hanning window
   (b) Design of LPF, HPF, BPF and BSF using windowing technique
   (a) Design of Butterworth Filter using Impulse Invariant and Bilinear transformation
   (c) Design of Chebyshev Filter using Impulse Invariant and Bilinear transformation
5. (a) Implementation of Decimation and Interpolation Process.
   (b) Implementation of I/D sampling rate converters.
6. (a) Study of TMS320C54X DSP processor
   (b) Arithmetic operation using TMS320C54XX
   MAC operation using various addressing modes
7. (a) Linear Convolution
   (b) Circular Convolution
   (a) FFT Implementation
   (c) Waveform Generation – Sine wave and Square wave
8. Implementation of FIR filter on DSP processor
9. Implementation of IIR filter on DSP processor

UCET, MGU AICTE *With effect from the Academic year 2020-21*

PC 652 EC

DIGITAL COMMUNICATION LABORATORY

Credits: 1

Instruction: 2 periods per week
CIE: 25 marks

Duration of SEE: 3hours
SEE: 50 marks

Course Objectives:

1. *To perform Analog modulation and demodulation techniques and measure modulation index.*
2. *To perform experiments on Radio Receivers to measure their performance parameters.*
3. *To perform Pulse digital modulation and demodulation techniques and understand.*
4. *To perform carrier modulation techniques.*

Course Outcomes: *Student will be*

1. *Able to acquire knowledge of performing modulation and demodulation and analyze the effects of various parameters on the process.*
2. *Able to acquire in-depth understanding of pulse digital modulation techniques.*
3. *Able to acquire skill to perform carrier modulation schemes using MATLAB.*

1. PCM Generation And Detection
2. Differential and adaptive delta modulation.
3. Delta Modulation
4. Frequency Shift Keying: Generation And Detection
5. Phase Shift Keying: Generation And Detection
6. Amplitude Shift Keying: Generation And Detection
7. Concept of aliasing using MATLAB
8. Sampling and quantization using MAT LAB
9. ASK modulation and Demodulation using MATLAB
10. FSK modulation and Demodulation using MATLAB
11. PSK modulation and Demodulation using MATLAB
12. QPSK modulation and Demodulation using MATLAB

SCHEME OF INSTRUCTION

B. Tech (ELECTRONICS & COMMUNICATION ENGINEERING)

CBCS-AICTE MODEL CURRICULUM

Proposed from the Academic year 2021-22

VII- SEMESTER

S.No.	Course Code	Course Title	Scheme of Instruction			Contact hr/week	Scheme of Examination		Credits
			L	T	P		CIE	SEE	
Theory									
1	PC 701 EC	Microwave Techniques	3	1	0	4	30	70	3
2	PC702 EC	VLSI Design	3	1	0	4	30	70	3
3	PC 703 EC	Mobile communication and Networks	3	0	0	3	30	70	3
4	PE #	Professional Elective-III	3	0	0	3	30	70	3
5	PE#	Professional Elective-IV	3	0	0	3	30	70	3
6	OE#	Open Elective-II	3	0	0	3	30	70	3
Practical									
7	PC 751 EC	Microwave Laboratory	0	0	2	2	25	50	1
8	PC 752 EC	Electronic Design And Automation Laboratory	0	0	2	2	25	50	1
9	PW 761 EC	Project Stage-1	0	0	4	4	50	0	2
10	PW 762 EC	Self-Study Project	0	0	0	4	50	0	2
Departmental Requirements									
11	PW 653 EC	Summer Internship	-	-	-	-	50	-	2
Total			**18**	**2**	**8**	**32**	**380**	**520**	**26**

- Students have to undergo summer internship of 6 weeks duration at the end of semester VI and evaluation will be done in present semester.

L : Lectures
T : Tutorials
P : Practical
BS : Basic Sciences
HS : Humanities and Social Sciences
CIE : Continuous Internal Evaluation
SEE : Semester End Examination
ES : Engineering Sciences
PC : Professional Core
MC : Management Course

Professional Elective-III

1. PE 704 EC Embedded System Design
2. PE 705 EC Adaptive Filter Theory and Applications
3. PE 706 EC Neural Networks and Fuzzy Logic

Professional Elective-IV

1. PE 707 EC Soc Design
2. PE 708 EC Radar Systems
3. PE 709 EC Machine learning and AI
4. PE 710 EC Fault Detection in Digital Systems

OPEN ELECTIVE-II

1. OE 701 BM Micro Electro-Mechanical Systems
2. OE 702 CE Green Building Technology
3. OE 703 CS Information Security
4. OE 704 CS Data Base Management Systems
5. OE 705 EC Embedded Systems
6. OE706 EC Digital Image & Video Processing
7. OE 707 EC Satellite Communication and Applications
8. OE 708 EE Optimization Techniques
9. OE 709 EE Non-Conventional Energy Sources
10. OE 710 ME Industrial Robotics
11. OE 711 ME Nano Technology
12. OE 712 EC CMOS Mixed Signal Circuit Design
13. OE 713 MC Professional Practice, Law And Ethics
14. OE 714 MC Entrepreneurship
15. OE 715 MC Industrial Administration & Financial Management

PC 701 EC

MICROWAVE TECHNIQUES

(Professional Core)

Instruction: (3L+1T) hours per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives:

- *To learn field calculations between parallel planes and rectangular wave guide.*
- *To study and understand various microwave devices and circuits.*
- *To study the construction and to understand principal of amplification/Oscillation at microwave frequency.*

Course Outcomes: *Student will be*

- *Able to understand electromagnetic wave propagation in parallel plane waveguides.*
- *Able to understand electromagnetic wave propagation in rectangular waveguides and resonators.*
- *Able to understand the formulation of Scattering Matrix and define them for various microwave components.*
- *Able to learn principle of operation and applications of specialized microwave vacuum tubes.*
- *Able to distinguish between transfer electron devices from ordinary low frequency semiconductor devices and learn basic modes of operation of Gunn Diode and its applications.*

UNIT – I

Waves between parallel planes, TE, TM, TEM Waves characteristics, Velocity of propagation, Group and Phase velocity, Wave Impedance, Attenuation in parallel plate waveguides.

UNIT – II

TE & TM Waves in rectangular wave guides, Wave impedance, Attenuation and Q of Waveguides, Waveguide resonators, Power handling capability, Transmission line analogy, Waveguide Design/Bandwidth.

UNIT – III

Microwave circuit concepts, Normalized voltage and current, scattering parameters, properties of S- Matrix, Unitary property. S-Matrix for directional coupler, Magic tee, Construction, principle and applications of Attenuator, Phase Shifter, Circulator, Isolator, S-Matrix of Circulator.

UNIT – IV

High Frequency limitations of conventional tubes, Two cavity Klystron, Bunching by velocity modulation, Small signal theory of bunching, Effect of grid interception and de-bunching. Tran's

admittance, Reflex Klystron, Mathematical theory of bunching, Admittance spiral and condition of oscillation. Principle of operation, construction and characteristics of TWT Amplifier, Backward wave oscillator (qualitative treatment only).

UNIT – V

Principle of operation, construction and characteristics of multi-cavity magnetron, Microwave Solid-state devices: Introduction, Classification and Applications. TEDs —Introduction, Gunn Diode — Principle, RWH Theory, Characteristics, Basic Modes of Operation, Oscillation Modes, Introduction to Avalanche Transit-Time Devices.

Suggested Readings:

1. Samuel Y. Liao, "*Microwave Devices and Circuits"*, 3rd Edition, PHI, 1994.
2. Pozar D.M., "*Microwave Engineering*", 3rd edition, John Wiley & Sons, 2005.
3. Skalnik, Krauss, Reich, "*Microwave principles"*, East West Press, 1976.

PC 702 EC

VLSI DESIGN

(Professional Core)

Instruction: (3L + 1T) hrs per week *Duration of SEE: 3 hours*
CIE: 30 Marks *SEE: 70 Marks*
Credits: 3

Course Objectives:

- *Study of the structure and operation of MOS transistor, CMOS Inverter Design, Bipolar Inverter*
- *Demonstrate Lambda based design rules, designing layouts and strategies for building Low power gates*
- *Design of Combinational logic gates in CMOS and design of Sequential Logic circuits*
- *Design of resistive Interconnect, inductive Interconnect and Interconnect coupling capacitance Design single stage CMOS amplifiers using current mirrors.*

Course Outcomes: *Students will be able to*

- *Have an understanding of the Fabrication processes and the comparison between different state-of-the-art CMOS technologies.*
- *Acquire the knowledge in understanding CMOS Inverter characteristics. Illustrate circuit diagrams, stick diagrams and layouts.*
- *Design and analyze various Combinational Logic circuits in different models.*
- *Design and analyze various Arithmetic Blocks and Memory structures*
- *Synthesize a digital system to meet design specifications of the system.*

UNIT-I

Introduction to MOS Technology, Basic MOS Transistor action: Enhancement and Depletion Modes. Basic electrical properties of MOS, Threshold voltage and Body Effect Design of MOS inverters with different loads, Basic Logic Gates with CMOS: INVERTER, NAND, NOR, AOI and OAI gates. Transmission gate logic circuits, Bi CMOS inverter

UNIT-II

MOS and CMOS circuit Design Process: MOS Layers, Stick diagrams, Lambda based Design rules and Layout diagrams. Basic Circuit Concepts: Sheet Resistance, Area Capacitance and Delay calculation.

UNIT-III

Combinational Logic: Manchester, Carry select and Carry Skip adders, Crossbar and barrel shifters, Multiplexer. Sequential Logic: Design of Dynamic Register Element, 3T, 1T Dynamic RAM Cell, 6T Static RAM Cell. D flip flop using Transmission gates. NOR and NAND based ROM Memory Design.

UNIT-IV

Interconnect Design: Introduction, Interconnect RC Delays, Buffer Insertion for very long wires, Interconnect coupling capacitance: Components of Coupling capacitance, Coupling effects on Delay, Crosstalk, Interconnect Inductance.

UNIT-V

Analog VLSI Design: Small Signal Model of MOSFETs, Simple CMOS current mirror, common source amplifier, source follower, common gate amplifier, cascode amplifiers. Source-degenerated current mirror, cascode current mirror, Wilson current mirror

Suggested Readings:

1. JAN.M. Rabaey, A. Chandrakasan and B. Nikholic, *Digital Integrated Circuits – A Design Perspective*, 2nd Edition, PHI, 2007.
2. David A Hodges, H. Jackson and R. A. Saleh, *Analysis and Design of Digital Integrated Circuits in Deep Submicron Technology*, 3rd Edition, Tata McGraw Hill, 2007.
3. John. P. Uymera, *Introduction to VLSI Circuits and system*, student edition, John Wiley and Sons, 2003.
4. Wayne Wolf, Modern VLSI Design, 4th edition, Pearson Education, 2009.
5. Kamran Eshraghian, Douglas A. Pucknell, and Sholeh Eshraghian, "Essentials of VLSI circuits and systems", PHI, 2011.
6. David Johns, Ken Martin, Analog Integrated Circuit Design, John Wiley & sons. 2004

PC 703 EC

MOBILE COMMUNICATION

(Open Elective - III)

Instruction: (3L) hours per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives:

- *Understand basics of Cellular systems, their generations and Characteristics of Mobile Communications.*
- *Understand the Frequency reuse mechanism for Mobile operations and Co-Channel interference concepts*
- *Understand the Mobile signal Coverage in different terrains and Lee models*
- *Understand the working of Antennas at Cell-site and at Mobile units.*
- *Understand the various Handoff mechanisms and Concept of Dropped calls*

Course Outcomes: S*tudent will be*

- *Able to analyze the various operational features of Mobile Communication Systems*
- *Able to deal with the Mobile communication system designs of Frequency re-use and Interference Factors*
- *Able to carry out the Design aspects of Mobile signal coverage over different terrains*
- *Able to analyze the different Cell-site and Mobile antennas for different applications*
- *Able to characterize the Handoffs mechanisms.*

UNIT – I

Introduction to Cellular Mobile Communications:

History of Mobile cellular: AMPS system (First-generation systems), Second-generation System, 3G Systems, 4G Systems, 5G Systems, Other Cellular-like Systems, Spectrum allocation, Spectrum Efficiency Considerations.

Basic Cellular systems, Circuit-Switched and Packet-Switched Systems, Performance criteria, Voice quality, Data quality, Picture quality, Service quality and special features.

Uniqueness of Mobile Radio Environment, Description of Mobile Radio Transmission Medium, Model of Transmission Medium, Mobile Fading characteristics, The Radius of Active Scatter region, Delay spread and Coherence Bandwidth, Noise level in Cellular Frequency band

UNIT – II

Frequency Reuse Concept and Cellular system Components:

Concept of Frequency reuse channels, Frequency reuse schemes, Frequency reuse distance, Number of Customers in the System, Co-Channel Interference Reduction Factor, Desired C/I from a Normal case in an Omni-directional antenna System, Handoff mechanism, Cell splitting, Consideration of the Components of Cellular Systems, Antennas, Switching equipment and Data Links.

UNIT – III

Cell Coverage:

General Introduction, Ground Incident angle and Ground Elevation angle, Ground Reflection angle and Reflection point, Obtaining the Mobile Point-to-Point Model (Lee Model), A standard condition, Obtain Area-to-Area Prediction model, The Phase difference between a direct path and ground-reflected path, A general formula for Mobile Radio Propagation

Propagation over water or Flat open area, Between Fixed stations, Land-to-Mobile transmission over water, Foliage Loss, Propagation in Near-In distance, Long distance propagation, Obtain Path loss from a Point-to-Point Prediction Model in Non-obstuctive condition and obstructive condition, Form of a Point-to-Point Model, General Formula and its Merit

UNIT – IV

Cell-Site and Mobile Antennas:

Antennas at Cell-site, Omnidirectional antennas, Directional antennas, Location antennas, Set-up Channel antennas, Space Diversity Antennas at cell site, Umbrella-Pattern Antennas, Interference reduction antennas, Unique Situations of Cell-Site antennas, Smart antennas, types and applications

Mobile Antennas, Roof-mounted antenna, Glass-Mounted antenna, High-gain antenna, horizontally and vertically oriented Space-Diversity Antennas.

UNIT – V

Handoff and Dropped Calls:

Value of Implementing Handoffs, Types of Handoff, Initiation of Hard Handoff, Delaying a Handoff, Forced Handoffs. Queuing of handoffs, Power difference Handoffs, MAHO and Soft Handoff, Cell-site Handoff only, Intersystem Handoff

Introduction to Dropped Call Rate and Formula of Dropped Call Rate

Suggested Readings:

1. William C.Y.Lee*, "Wireless and Cellular Telecommunications*", 3rd International edition, McGraw Hill, 2006
2. Theodere S. Rappaport, *"Wireless Communications, Principles and Practice*", 2nd edition, Prentice Hall, 2003.
3. Gordon L. Stuber. "*Principles of Mobile Communications",* 3rd edition, Springer Publications, 2011.

PROGRAM ELECTIVE –III

PE 704 EC

EMBEDDED SYSTEM DESIGN

(Professional Elective –III)

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 Marks *SEE: 70 Marks*
Credits: 3

Course Objectives:

- *To gain knowledge to design embedded systems.*
- *To understand the processor selection criteria for Embedded System Design.*
- *To gain the knowledge of ARM Cortex on Zynq for embedded systems.*
- *To gain the knowledge of tool chain for embedded systems.*
- *To understand the importance of RTOS in building real time systems*

Course Outcomes: *Student will be able to*

- *Design an embedded system.*
- *Distinguish between RISC and CISC*
- *Use the ARM Cortex for design of embedded system*
- *Use Embedded Software Development Tools for Designing Embedded System applications*
- *Apply their understanding in building real time systems.*

UNIT-I

Introduction To Embedded Systems: The Embedded Design Life Cycle - Product Specification, Hardware/Software Partitioning, Iteration And Implementation, Detailed Hardware (selection fo processor) and Software Design, Hardware/Software Integration, Product Testing And Release, Maintenance and Up gradation.

UNIT-II

ARM Embedded Systems: The RISC design philosophy, The ARM design philosophy, ARM processor fundamentals, registers, current program status register, pipeline, exceptions, interrupts, and vector table, core extensions, architecture revisions, ARM processor families.

UNIT-III

Embedded processing with ARM CORTEX on Zynq: Fundamentals of FPGA, types of FPGA, case study of Xilinx FPGA, Processing System, programmable logic, programmable logic interfaces, security, Zynq 7000 family members, Zynq versus standard FPGA, Zynq versus standard processor.

UNIT-IV

Embedded Software Development Tools: Host and Target Machines, Cross Compilers, Cross Assemblers, Tool Chains, Linkers/Locators for Embedded Software, Address Resolution, Locator

Maps. Getting Embedded Software Into Target System: PROM programmer, ROemulator, In Circuit- Emulators, Monitors, Testing on Your Host Machine - Instruction Set Simulators, Logic Analysers.

UNIT-V

Introduction to Real Time Operating Systems: Tasks and task states, tasks and Data, Semaphores and shared data. Operating system services: Message queues, mailboxes and pipes, timer functions, events, memory management, Interrupt routines in an RTOS environment.

Suggested Readings:

1. Arnold S Berger, "*Embedded Systems Design*", South Asian edition, CMP Books, 2005.
2. Andrew Sloss, Dominic Symes, Chris Wright, *"ARM System Developer's Guide: Designing and Optimizing System Software"*, Elsevier, 2004.
3. Louise H Crockett, Ross.A.Elliot et *al " The Zynq Book*" , Edition 1, Strathclyde academic media, July 2014.
4. David E Simon, *"An Embedded software primer"*, Pearson, 2012

PE 705 EC

ADAPTIVE FILTER THEORY AND APPLICATIONS

(Professional Elective –III)

Instruction: 3L hours per week *Duration of SEE: 3 hours*
CIE: 30 Marks *SEE: 70 Marks*
Credits: 3

Course Objectives:

- *To understand the adaptive filter.*
- *To study LMS and convergence of LMS.*
- *To understand the applications of adaptive filter.*
- *To study the kalman filter and vector kalman filter.*
- *To Understand the concept of vector kalman filter*

Course Outcomes: *Student will be*

- *Able to understand adaptive filter.*
- *Able to understand LMS algorithm and practical application of LMS algorithm.*
- *Able to understand applications of adaptive filter.*
- *Able to understand kalman filter*
- *Able to understand vector kalman filter for practical applications.*

UNIT - I

Approaches to the development of adaptive filter theory. Introduction to filtering, smoothing and prediction. Wiener filters theory, introduction; Error performance surface; Normal equation; Principle of orthogonality; Minimum mean squared error; example.

UNIT - II

Gradient algorithms; Learning curves; LMS gradient algorithm; LMS stochastic gradientalgorithms; convergence of LMS algorithms.

UNIT - III

Applications of adaptive filter to adaptive noise cancelling, Echo cancellation in telephone circuits and adaptive beam forming.

UNIT - IV

Kalman Filter theory; Introduction; recursive minimum mean square estimation for scalar random variables; statement of the kalman filtering problem: the innovations process; Estimation of state using the innovations process; Filtering examples.

UNIT V

Vector Kalman filter formulation. Examples. Application of kalman filter to target tracking.

Suggested Reading:

1. Sophoclas, J. Orphanidies, *"Optimum signal processing an introduction*", McMillan, 1985.
2. Simon Haykins, *"Adaptive signal processing*", PHI, 1986.
3. Bernard Widrow, *"Adaptive signal processing*", PHI, 1986.
4. Bozic. SM., "*Digital and Kalman Filtering".*

PE 706 EC

NEURAL NETWORKS AND FUZZY LOGIC

(Professional Elective –III)

Instruction: 3L hours per week *Duration of SEE: 3 hours*
CIE: 30 Marks *SEE: 70 Marks*
Credits: 3

Course Objectives:

- *To understand the basics of Neural Networks and essentials of Artificial Neural Networks*
- *To train different Feedback Neural Networks Single Layer and Multilayer Feed Forward Networks.*
- *To understand the concepts of Associate Memories and introduces Fuzzy sets and Fuzzy Logic system components.*
- *Provide an understanding of the basic mathematical elements of the theory of fuzzy sets.*
- *Provide an emphasis on the differences and similarities between fuzzy sets and classical sets theories.*

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

- *Understand principles of neural networks.*
- *Apply basic principles of ANN in solutions that require problem solving, inference perception, knowledge representation, and learning.*
- *Demonstrate an ability to share in discussions of NN, its current scope and limitations, and societal implications*
- *Understand appropriate learning rules for each of the architectures and learn several neural network paradigms and its applications*
- *Understand basic knowledge of fuzzy sets and fuzzy logic and different applications of these models to solve engineering and other problems.*

UNIT –I

Introduction to Neural Networks: Introduction, Biological Neuron, Biological and Artificial Neuron Models, Characteristics of ANN, McCulloch-Pitts Model, Essentials of Artificial Neural Networks: Types of Neuron Activation Function, ANN Architectures, Classification Taxonomy of ANN – Connectivity, Neural Dynamics (Activation and Synaptic), Learning Strategy (Supervised, Unsupervised, Reinforcement), Learning Rules, Applications of ANN.

UNIT- II

Feed Forward Neural Networks: Single Layer: Introduction, Perceptron Models: Discrete, Continuous and Multi-Category, Training Algorithms: Discrete and Continuous Perceptron Networks, Perceptron Convergence theorem, Limitations of the Perceptron Model, Applications.

Multilayer: Generalized Delta Rule, Derivation of Back propagation (BP) Training, Summary of Back propagation Algorithm, Kolmogorov Theorem

UNIT–III

Associative Memories: Paradigms of Associative Memory, Pattern Mathematics, Hebbian Learning, General Concepts of Associative Memory, Bidirectional Associative Memory (BAM) Architecture, BAM Training Algorithms: Storage and Recall Algorithm, BAM Energy Function, Proof of BAM Stability Theorem Architecture of Hopfield Network: Discrete and Continuous versions

UNIT- IV

Classical & Fuzzy Sets: Introduction to classical sets - properties, Operations and relations; Fuzzy sets, Membership, Uncertainty, Operations, properties, fuzzy relations, cardinalities, membership functions.

UNIT - V

Logic System Components: Fuzzification, Membership value assignment, development of rule base and decision making system, Defuzzification to crisp sets, Defuzzification methods. Fuzzy logic applications

Suggested Readings:

1. James A Freeman and Davis Skapura, *"Neural Networks"*, Pearson Education, 2002.
2. B. Yeganaranarana, "*Artificial Neural Networks*", Prentice Hall, New Delhi, 2007.
3. Bart Kosko, *"Neural Networks and Fuzzy Logic System*", PHI Publications.

PE 707 EC

SYSTEM ON CHIP DESIGN

(Professional Elective - IV)

Instruction: 3L hours per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives:

1. *To Understand the System Architecture and Processor Architecture, approach for a SOC Design and the concept of pipelining.*
2. *To Learn about SOC external memory, Scratchpads and Cache memory and Multilevel Caches.*
3. *To familiarize with on-chip memory concepts for SoC and to adopt the architectural support for operating systems.*

Course Outcomes*: Students will be able to**:*

1. *Analyze the system and processor architecture approach for SoC design*
2. *Explore the concept of pipelining.*
3. *Understand the concept of memory interface and bus architecture for SoC design.*
4. *Analyze the performance metrics of on-chip memory.*
5. *Understand the architectural support for operating systems.*

UNIT – I

Introduction to System on Chip*:* System Architecture components of the system, hardware and Software, processor architecture, memory and addressing, system level interconnection, an Approach for SOC design, system architecture and complexity.

Processor design: Processor architecture and organization, processor design trade-offs, the Reduced instruction set computer, the acron risc machine, architectural inheritance, the arm Programmers model, arm development tools.

UNIT – II

Organization of an SoC: 3-stage pipeline arm organization, 5-stage pipeline arm organization, the arm coprocessor interface coprocessor instructions, data operations, data transfers, the thumb bit in the cpsr, the thumb programmer's model

UNIT – III

Architectural support for system development*:* The arm memory interface, the advanced micro controller bus architecture (amba), the arm reference peripheral specification, hardware system prototyping tools, the armulator, the jtag boundary scan test architecture embedded trace, signal processing support.

UNIT – IV

Memory hierarchy: Memory size and speed: memory cost, on chip memory, caches: processor & Memory speeds, unified & Harvard caches, cache performance metrics, the direct mapped Cache the set-associative cache, the fully associative cache, write strategies cache design-an example.

UNIT – V

Architectural support for operating systems: An introduction to operating system, the arm System control coprocessor, cp15 protection unit register, arm protection unit, cp15 mmu Registers, arm mmu architecture, synchronization, context switching, input/ouput.

Suggested readings:

1. Steve furber, *"arm system-on-chip architecture"*, second edition, pearson publications
2. Andrew n.sloss, domnic symes,chris wright, *"arm system developers guide"*, publications Elsevier.

PE 708 EC

RADAR SYSTEMS

(Professional Elective - IV)

Instruction: 3L hours per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives:

- *To familiarize with basic concepts of radar systems.*
- *To understand different Radar Systems.*
- *To know about Radar antennas.*
- *To know the propagation effects on a radar signal.*
- *To understand tracking radar principles.*

Course Outcomes: S*tudent will be*

- *Able to understand the components of a radar system.*
- *Able to demonstrate the function of FMCW radar.*
- *Able to analyze the concept of MTI radar systems.*
- *Able to incorporate the effects of environment condition in a radar system.*
- *Able to apply appropriate mathematical and computer models relevant to radar systems to calculate system performance.*

UNIT- I

Radar Systems: Radar Block diagram and operation, Applications of Radar. Radar frequencies, Radar Range Equation, Radar Cross Section of target, Prediction of range performance, Minimum detectable signal, Receiver noise figure, Effective noise temperature, Signal to noise ratio, System losses, False alarm time and probability of false alarm, Integration of radar pulses, Pulse-repetition frequency and range ambiguities. Swerling's Models.

UNIT- II

CW and FMCW Radars: Doppler effects, CW Radar, FMCW Radar, Multiple frequency CW radar, Low noise front-ends, A-scope, B-scope, PPI Displays, and Duplexers.

UNIT- III

MTI and Pulse Doppler Radar: MTI radar, Delay line canceller, Multiple and staggered prf, Blind speeds, Limitations to MTI performance, MTI using range gated Doppler filters, Pulse Doppler radar, Non coherent radar. CFAR techniques in Radar Detection

UNIT- IV

Tracking Radar: Sequential Lobing, Conical scan, Monopulse - Amplitude comparison and Phase comparison methods, tracking in range and in Doppler, Acquisition, and Comparison of Trackers.

UNIT- V

Search Radar: Track while scan radars, Search radar range equation, Search scans, Effect of surface reflection, Line of Sight (LOS), Propagation effects: Propagation over a plane earth, the round earth, Refraction, Anomalous propagation, Diffraction, Attenuation by atmospheric gases, Environmental noise.

Suggested Readings:

1. Skolnik, Merrill I, *"Introduction to Radar Systems",* MGH, third edn. 2001.
2. Barton. David K, *"Modern Radar System Analysis*", Artech House, 1988.
3. Peebles PZ, *"Radar Principles*", John – Willey, 2004.

PE 709 EC

MACHINE LEARNING & ARTIFICIAL INTELLIGENCE

(Professional Elective - IV)

Instruction: 3L hours per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives:

- *Study the concepts of Artificial Intelligence.*
- *Learn the methods of solving problems using Artificial Intelligence.*
- *Introduce the concepts of Expert Systems and machine learning.*

Course Outcomes: At the end of the course, the student should be able:

- *To identify problems those are amenable to solution by AI methods.*
- *To identify appropriate AI methods to solve a given problem & implement basic AI algorithms*
- *To formalize a given problem in the language/framework of different AI methods.*
- *To study the basics of Machine learning. Usage of Python packages for Machine Learning*
- *To evaluate the performance* of various Machine Learning algorithms on a dataset

UNIT - I
INTRODUCTION TO Al AND PRODUCTION SYSTEMS

Introduction to AI-Problem formulation, Problem Definition -Production systems, Control strategies' Search strategies. Problem characteristics, Production system characteristics - Specialized productions system- Problem solving methods – Problem graphs, Matching, Indexing and Heuristic functions -Hill Climbing-Depth first and Breath first, Constraints satisfaction – Related algorithms, Measure of performance and analysis of search algorithms.

UNIT - II
REPRESENTATION OF KNOWLEDGE

Game playing – Knowledge representation, Knowledge representation using Predicate logic, Introduction to predicate calculus, Resolution, Use of predicate calculus, Knowledge representation using other logic-Structured representation of knowledge.

UNIT - III
ADABOOST

Concept of ensemble of classifiers; basic algorithm; case study- Face detection Artificial Immune Systems Fuzzy belief networks, Evolving belief networks Bayesian belief networks Evolutionary and swarm-based neural networks.

UNIT - IV

MACHINE LEARNING

Classification, Machine learning: clustering, Machine learning: classification. Logistic regression Bayesian logistic regression Non-linear logistic regression Dual logistic regression Kernel logistic regression, Incremental fitting and boosting.

UNIT - V

REINFORCEMENT LEARNING

Classification trees- Multi-class logistic regression Random trees, Random forests, Applications. Introduction to Deep Learning.

Suggested readings:

1. Kevin Night and Elaine Rich, Nair B., *"Artificial Intelligence (SIE)"*, Mc Graw Hill-2008. (Units-I,II,VI & V)
2. Dan W. Patterson, *"Introduction to AI and ES",* Pearson Education, 2007. (Unit-III).
3. Peter Jackson, *"Introduction to Expert Systems"*, 3rd Edition, Pearson Education, 2007.
4. Stuart Russel and Peter Norvig *"AI – A Modern Approach"*, 2nd Edition, Pearson Education 2007.
5. Deepak Khemani *"Artificial Intelligence",* Tata Mc Graw Hill Education 2013.
6. http://nptel.ac.in

PE 710 EC

FAULT DETECTION IN DIGITAL SYSTEMS

(Professional Elective - IV)

Instruction: 3L hours per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives:

- *To represent physical faults by logical faults and understand fault modeling methods.*
- *To understand methods for economical fault detection test experiments.*
- *To be able to generate tests for fault detection in sequential circuits.*
- *To understand the usage of coding techniques to generate test patterns for self-checking circuits.*
- *To address the problem of test generation for SSFs using TG algorithms.*

Course Outcomes: S*tudent will be*

- *Able to understand various design and modeling concepts thoroughly.*
- *Able to device test inputs using various methods and compare the complexity of the techniques qualitatively.*
- *Able to design detection test sets for sequential circuits.*
- *Able to understand the usage of self-checking codes for fault detection.*
- *Able to understand various algorithms and compare their implementation costs qualitatively.*

UNIT – I

Introduction: Modeling and testing digital circuits at different levels of abstraction, Types of testing, Errors and Faults, Fault classification and modeling, Hazards, Test generation and evaluation.

UNIT – II

Fault detection in Combinational Circuits: Detection of single stuck faults using Fault Table method, path sensitization and Boolean difference method, fault detection in two level and multilevel circuits, Bridging fault model, detection of non-feedback and feedback bridging faults, bridging fault simulation and test generation.

UNIT – III

Fault Detection in Sequential Circuits: State identification with homing and distinguishing experiments, Design of fault detection experiments for diagnosable machines.

UNIT – IV

Self-Checking Design: Basic concepts, application of Error-detecting and Error-correcting codes, multiple bit errors, checking circuits and self-checking, self-checking checkers, parity-check

functions, totally self-checking m/n code checkers, totally self-checking equality checkers, self-checking Berger code checkers.

UNIT – V

Test Generation algorithms for SSFs: Combinational Circuits-Fault oriented ATG- algorithms and selection criteria, fault independent ATG, ATG for sequential circuits using iterative array model.

Suggested Readings:

1. Samuel C Lee, "*Digital Circuits and Logic Design*". PHI Pvt. Ltd. 2000
2. Zvi Kohavi, "Switching *and Finite Automata Theory*", TMH.2nd edition
3. M. Abramovici, M. Breuer, A. Friedman, "Digital *System Testing and testable design*", Jaico Publications

OE 701 BM

MICRO ELECTRO-MECHANICAL SYSTEMS

(OPEN ELECTIVE-II)

Instruction: 3 Periods per week *Duration of SEE: 3 hours*
CIE: 30 Marks *SEE: 70 Marks*
Credits: 3

Course Objectives:

- *To introduce to basics of Micro-electro-mechanical systems*
- *To understand properties of materials involved in MEMS*
- *To pertain fabrication methods involved in MEMS manufacturing*
- *To apply the concepts for various applications*

Course Outcomes: *Upon completion of the course, the student will be able to*

- *Elucidate basic concepts involved in MEMS technologies*
- *Realize the properties of various materials involved in MEMS technologies*
- *Apply the concepts and technologies involved in designing of MEMS*
- *Relate different manufacturing processes involved in fabrication of MEMS*
- *Recognize micro sensors, micro actuators and their applications in various fields.*

UNIT I

Introduction to MEMS: What is MEMS, Historical Background, classification, Micro-engineering, importance of micro-engineering. Technological advancements in MEMS, advantages and disadvantages of MEMS.

UNIT II

MEMS materials: Materials used in MEMS. Material properties: electrical, mechanical, thermal, chemical, biological, optical and processing. Reliability issues of materials

UNIT III

Designing of MEMS: Design and analysis process for MEMS. Initial design process, structured design process. Commonly used design flow, structured design flow. Design flow for MEMS cad design. Design and verification flow for integrated MEMS.

UNIT IV

MEMS fabrication Techniques: Photolithography, materials for micromachining, bulk micromachining Surface micromachining, High aspect-ration-micromachining, assembly and system integration.

UNIT V

MEMS structures and devices: Mechanical sensors, mechanical actuators, micro-fluidic devices, optical/photonic micro-systems, biological transducers.

Suggested Readings:

1. Adams TM, Layton RA. Introductory MEMS: Fabrication and applications, 2010.
2. Tobergte DR, Curtis S. "An Introduction to Micro-electro-mechanical Systems Engineering" Second Edition. vol. 53. 2013.
3. Kreith F, Kreider JF. :The MEMS Handbook" CRC Press 2002.
4. Reza Ghodssi · Pinyen Lin. "MEMS Materials and Processes Handbook" Springer 2013
5. Gad-el-Hak M. "MEMS applications" 2nd edition, CRC press 2006.

OE 702 CE

GREEN BUILDING TECHNOLOGY

(Open Elective - II)

Instruction: 3L hours per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives:

- *Exposure to the green building technologies and their significance.*
- *Understand the judicial use of energy and its management.*
- *Educate about the Sun-earth relationship and its effect on climate.*
- *Enhance awareness of end-use energy requirements in the society.*
- *Develop suitable technologies for energy management.*

Course Outcomes: S*tudent will be*

- *Understand the fundamentals of energy use and energy processes in building.*
- *Identify the energy requirement and its management.*
- *Know the Sun-earth relationship vis-a-vis its effect on climate.*
- *Be acquainted with the end-use energy requirements.*
- *Be familiar with the audit procedures of energy.*

UNIT- I

Overview of the significance of energy use and energy processes in building: Indoor activities and environmental control - Internal and external factors on energy use and the attributes of the factors - Characteristics of energy use and its management - Macro aspect of energy use in dwellings and its implications.

UNIT- II

Indoor environmental requirement and management: Thermal comfort - Ventilation and airquality – Air-conditioning requirement - Visual perception - Illumination requirement - Auditory requirement.

UNIT- III

Climate, solar radiation and their influences: Sun-earth relationship and the energy balance onthe earth's surface - Climate, wind, solar radiation, and temperature - Sun shading and solar radiation on surfaces - Energy impact on the shape and orientation of buildings.

UNIT- IV

End-use, energy utilization and requirements: Lighting and day lighting - End-use energy requirements - Status of energy use in buildings Estimation of energy use in a building - Heat gain and thermal performance of building envelope - Steady and non-steady heat transfer through the glazed window and the wall - Standards for thermal performance of building envelope - Evaluation of the overall thermal transfer

UNIT- V

Energy management options: Energy audit and energy targeting - Technological options for energy management.

Suggested Readings:

1. Michael Bauer, Peter Mösle and Michael Schwarz, *"Green Building – Guidebook forSustainable Architecture"*, Springer, Heidelberg, Germany, 2010.
2. Norbert Lechner, *"Heating, Cooling, Lighting - Sustainable Design Methods forArchitects",* Wiley, New York, 2015.
3. Mike Montoya, *"Green Building Fundamentals*", Pearson, USA, 2010.
4. Charles J. Kibert, *"Sustainable Construction - Green Building Design and Delivery*",John Wiley & Sons, New York, 2008.
5. Regina Leffers, *"Sustainable Construction and Design*", Pearson / Prentice Hall, USA,2009.
6. James Kachadorian, *"The Passive Solar House: Using Solar Design to Heat and CoolYour Home",* Chelsea Green Publishing Co., USA, 1997.

OE 703 CS

INFROMATION SECURITY

(Open Elective - II)

Instruction: 3L hours per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives:

- *To learn legal and technical issues in building secure information systems*
- *To provide an understanding of network security*
- *To expose the students to security standards and practices*

Course Outcomes: S*tudent will be*

- *Describe the steps in Security Systems development life cycle(SecSDLC)*
- *Understand the common threats and attack to information systems*
- *Understand the legal and ethical issues of information technology*
- *Identify security needs using risk management and choose the appropriate risk control strategy based on business needs*
- *Use the basic knowledge of security frameworks in preparing security blue print for the organization*
- *Usage of reactive solutions, network perimeter solution tools such as firewalls, host solutions such as antivirus software and Intrusion Detection techniques and knowledge of ethical hacking tools*
- *Use ethical hacking tools to study attack patterns and cryptography and secure communication protocols*
- *Understand the technical and non-technical aspects of security project implementation andaccreditation*

UNIT – I

Introduction: History, Critical Characteristics of Information, NSTISSC Security Model, Components of an Information System, Securing the Components, Balancing Security and Access,the SDLC, the Security SDLC.

Need for Security: Business Needs, Threats, Attacks, and Secure Software Development

UNIT – II

Legal, Ethical and Professional Issues: Law and ethics in Information Security, Relevant U.S. Laws, International Laws and Legal Bodies, Ethics and Information Security.

Risk Management: Overview, Risk Identification, Risk Assessment, and Risk Control Strategies, Selecting a Risk Control Strategy, Quantitative versus Qualitative Risk Control Practices, Risk Management discussion Points, and Recommended Risk Control Practices.

UNIT – III

Planning for Security: Security policy, Standards and Practices, Security Blue Print, Security Education, Continuity strategies.

Security Technology: Firewalls and VPNs: Physical Design, Firewalls, And Protecting Remote connections.

UNIT – IV

Security Technology: Intrusion Detection, Access Control, and other Security Tools: Intrusion Detection and Prevention Systems-Scanning, and Analysis Tools- Access Control Devices.

Cryptography: Foundations of Cryptology, Cipher methods, Cryptographic Algorithms, Cryptographic Tools, Protocols for Secure Communications, Attacks on Cryptosystems

UNIT – V

Implementing Information Security: Information security project management, Technical topics of implementation, Non-Technical Aspects of implementation, Security Certification and Accreditation.

Security and Personnel: Positioning and staffing security function, Employment Policies and Practices, and Internal control Strategies.

Information Security Maintenance: Security management models, Maintenance model, and DigitalForensics.

Suggested Readings:

1. Michael E Whitman and Herbert J Mattord, "*Principles of Information Security*", Cengage Learning, 2011.
2. Thomas R Peltier, Justin Peltier, John Blackley, "*Information Security Fundamentals*",Auerbach Publications, 2010.
3. Detmar W Straub, Seymour Goodman, Richard L Baskerville, "*Information Security,Policy, Processes, and Practices",* PHI, 2008.
4. Mark Merkow and Jim Breithaupt *"Information Security Principle and Practices"*, Pearson Education, 2007

OE 704 CS

DATA BASE MANAGEMENT SYSTEMS

(Open Elective - II)

Instruction: 3L hours per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives:

- *To introduce three schema architecture and DBMS functional components.*
- *To learn formal and commercial query languages of RDBMS.*
- *To understand the principles of ER modeling and theory of normalization.*
- *To study different file organization and indexing techniques.*
- *To familiarize theory of serializablity and implementation of concurrency control, andrecovery.*

Course Outcomes: S*tudent will be*

- *Understand the mathematical foundations on which RDBMS are built.*
- *Model a set of requirements using the Extended Entity Relationship Model (EER), transform an EER model into a relational model, and refine the relational model using theory of Normalization.*
- *Develop Database application using SQL and Embedded SQL.*
- *Use the knowledge of file organization and indexing to improve database application performance.*
- *Understand the working of concurrency control and recovery mechanisms in RDBMS.*

UNIT – I

Introduction: Database System Applications, Purpose of Database Systems, View of Values, Nested Sub-queries, Complex Queries, Views, Modification of the Database, Joined Relations Data, Database Languages, Relational Databases, Database Design, Object–based and Semi-structured Databases, Data Storage and Querying, Transaction Management, Data Mining and Analysis, Database Architecture, Database Users and Administrators.

Database Design and the E-R Model: Overview of the Design Process, The Entity-Relationship Model, Constraints, Entity-Relationship Diagrams, Entity – Relationship Design Issues, Weak Entity Sets, Extended E-R Features, Database Design for Banking Enterprise, Reduction to Relational Schemas, Other Aspects of Database Design

UNIT – II

Relational Model: Structure of Relational Databases, Fundamental Relational-Algebra Operations, Additional Relational – Algebra Operations, Extended Relational - Algebra Operations, Null Values, Modification of the Databases.

Structured Query Language: Data Definition, Basic Structure of SQL Queries, Set Operations, Aggregate Functions, Null

UNIT – III

Advanced SQL: SQL Data Types and Schemas, Integrity Constraints, Authorization, Embedded SQL, Dynamic SQL, Functions and Procedural Constructs, Recursive Queries, Advanced SQL Features. Relational Database Design: Features of Good Relational Design, Atomic Domains and First Normal Form, Functional-Dependency Theory, Decomposition using Functional Dependencies.

UNIT – IV

Indexing and Hashing: Basic Concepts, Ordered Indices, B^+-tree Index Files, B-tree Index Files, Multiple-Key Access, Static Hashing, Dynamic Hashing, Comparison of Ordered Indexing and Hashing, Bitmap Indices.

Index Definition in SQL Transactions: Transaction Concepts, Transaction State, Implementation of Atomicity and Durability, Concurrent Executions, Serializability, Recoverability, Implementationof Isolation, Testing for Serializability

UNIT – V

Concurrency Control: Lock-based Protocols, Timestamp-based Protocols, Validation-based Protocols, Multiple Granularity, Multi-version Schemes, Deadlock Handling, Insert and Delete Operations, Weak Levels of Consistency, Concurrency of Index Structures.

Recovery System: Failure Classification, Storage Structure, Recovery and Atomicity, Log-Based Recovery, Recovery with Concurrent Transactions, Buffer Management, Failure with Loss of Nonvolatile Storage, Advanced Recovery Techniques, Remote Backup Systems.

Suggested Readings:

1. Abraham Silberschatz, Henry F Korth, S Sudarshan, "*Database System Concepts"*, McGraw-Hill International Edition, 6th Edition, 2010.
2. Ramakrishnan, Gehrke, "*Database Management Systems"*, McGraw-Hill InternationalEdition, 3rd Edition, 2003.
3. Elmasri, Navathe, Somayajulu, "*Fundamentals of Database Systems"*, Pearson Education,4th Edition, 2004.

OE 705 EC

EMBEDDED SYSTEMS

(Open Elective - II)

Instruction: 3L hours per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives:

- *To gain knowledge to design embedded systems.*
- *To understand the processor selection criteria for Embedded System Design.*
- *To gain the knowledge of ARM Cortex on Zynq for embedded systems.*
- *To gain the knowledge of tool chain for embedded systems.*
- *To understand the importance of RTOS in building real time systems*

Course Outcomes: S*tudent will be*

- *Design an embedded system.*
- *Distinguish between RISC and CISC*
- *Use the ARM Cortex for design of embedded system*
- *Use Embedded Software Development Tools for Designing Embedded System applications*
- *Apply their understanding in building real time systems*

UNIT-I

Introduction To Embedded Systems: The Embedded Design Life Cycle - Product Specification, Hardware/Software Partitioning, Iteration and Implementation, Detailed Hardware (selection fo processor) and Software Design, Hardware/Software Integration, Product Testing And Release, Maintenance and Upgradation.

UNIT-II

ARM Embedded Systems: The RISC design philosophy, The ARM design philosophy, ARM processor fundamentals, registers, current program status register, pipeline, exceptions, interrupts, and vector table, core extensions, architecture revisions, ARM processor families.

UNIT-III

Embedded processing with ARM CORTEX on Zynq: Fundamentals of FPGA, types of FPGA, case study of Xilinx FPGA, Processing System, programmable logic, programmable logic interfaces, security, Zynq 7000 family members, Zynq versus standard FPGA, Zynq versus standard processor.

UNIT-IV

Embedded Software Development Tools: Host and Target Machines, Cross Compilers, Cross Assemblers, Tool Chains, Linkers/Locators for Embedded Software, Address Resolution, and LocatorMaps. Getting Embedded Software into Target System: PROM

programmer, ROM emulator, In Circuit- Emulators, Monitors, Testing on Your Host Machine - Instruction Set Simulators, Logic Analyzers.

UNIT-V

Introduction to Real Time Operating Systems: Tasks and task states, tasks and Data, Semaphores and shared data. Operating system services: Message queues, mailboxes and pipes, timer functions, events, memory management, Interrupt routines in an RTOS environment.

Suggested Readings:

1. Arnold S Berger, "*Embedded Systems Design"*, South Asian edition, CMP Books, 2005.
2. Andrew Sloss, Dominic Symes, Chris Wright, *ARM "System Developer's Guide: Designingand Optimizing System Software",* Elsevier, 2004.
3. Louise H Crockett, Ross. A. Elliot et al "*The Zynq Book*", Edition 1, Strathclyde academicmedia, July 2014.
4. David E Simon, "*An Embedded software primer*", Pearson, 2012

OE 706 EC

DIGITAL IMAGE AND VIDEO PROCESSING

(Open Elective - II)

Instruction: 3L hours per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives:

- *To study the image fundamentals and mathematical transforms necessary for image Processing.*
- *To study the image enhancement techniques*
- *To study image restoration procedures.*
- *To study the image compression procedures.*

Course Outcomes: S*tudent will be able to*

- *Defining the digital image, representation of digital image, importance of image resolution, applications in image processing.*
- *Know the advantages of representation of digital images in transform domain, application of various image transforms.*
- *Know how an image can be enhanced by using histogram techniques, filtering techniques etc*
- *Understand image degradation, image restoration techniques using spatial filters and frequency domain*
- *Know the detection of point, line and edges in images, edge linking through local processing, global processing.*
- *Understand the redundancy in images, various image compression techniques.*
- *Know the video technology from analog color TV systems to digital video systems, how video signal is sampled and filtering operations in video processing.*
- *Know the general methodologies for 2D motion estimation, various coding used in video processing.*

UNIT I:

Fundamentals of Image Processing and Image Transforms:

Introduction, Image sampling, Quantization, Resolution, Image file formats, Elements of image processing system, Applications of Digital image processing. Introduction, Need for transform, image transforms, Fourier transform, 2 D Discrete Fourier transform and its transforms, Importance of phase, Walsh transform, Hadamard transform, Haar transform, slant transform Discrete cosine transform, KL transform, singular value decomposition, Radon transform, comparison of different image transforms.

UNIT II:

Image Enhancement:

Spatial domain methods: Histogram processing, Fundamentals of Spatial filtering, Smoothingspatial filters, Sharpening spatial filters. Frequency domain methods: Basics of filtering in frequency domain, image smoothing, image sharpening, Selective filtering.

Image Restoration:

Introduction to Image restoration, Image degradation, Types of image blur, Classification of image restoration techniques, Image restoration model, Linear and Nonlinear image restoration techniques, Blind deconvolution.

UNIT III:

Image Segmentation: Introduction to image segmentation, Point, Line and Edge Detection, Region based segmentation., Classification of segmentation techniques, Region approach to image segmentation, clustering techniques, Image segmentation based on thresholding, Edge based segmentation, Edge detection and linking, Hough transform, Active contour

Image Compression: Introduction, Need for image compression, Redundancy in images, Classification of redundancy

in images, image compression scheme, Classification of image compression schemes, Fundamentals of information theory, Run length coding, Shannon – Fano coding, Huffman coding, Arithmetic coding, Predictive coding, Transformed based compression, Image compression standard, Wavelet-based image compression, JPEG Standards.

UNIT IV:

Basic Steps of Video Processing: Analog Video, Digital Video. Time-Varying Image Formation models: Three-Dimensional Motion Models, Geometric Image Formation, Photometric Image Formation, Sampling of Videosignals, Filtering operations.

UNIT V:

2-D Motion Estimation: Optical flow, General Methodologies, Pixel Based Motion Estimation, Block- Matching Algorithm, Mesh based Motion Estimation, Global Motion Estimation, Region based Motion Estimation, Multi resolution motion estimation, Waveform based coding, Block based transform coding, Predictive coding, Application of motion estimation in Video coding.

Suggested Readings:

1. Digital Image Processing – Gonzaleze and Woods, 3rdEd., Pearson.
2. Video Processing and Communication – Yao Wang, JoemOstermann and Ya–quin Zhang.1st Ed., PH Int.
3. S.Jayaraman, S.Esakkirajan and T.VeeraKumar, “Digital Image processing, TataMcGraw Hill publishers, 2009
4. Digital Image Processing and Analysis-Human and Computer Vision Application with CVIP Tools – ScotteUmbaugh, 2nd Ed, CRC Press, 2011.
5. Digital Video Processing – M. Tekalp, Prentice Hall International.
6. Digital Image Processing – S.Jayaraman, S.Esakkirajan, T.Veera Kumar – TMH, 2009.
7. Multidimentional Signal, Image and Video Processing and Coding – John Woods, 2ndEd, Elsevier.
8. Digital Image Processing with MATLAB and Labview – Vipula Singh, Elsevier.
9. Video Demystified – A Hand Book for the Digital Engineer – Keith Jack, 5tEd., Elsevier

OE 707EC

SATELLITE COMMUNICATION AND APPLICATIONS

(Open Elective - II)

Instruction: 3L hours per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives:

- *To familiarize with basic concepts related to satellite Communication.*
- *To understand Sub-Systems of Satellites and Launches.*
- *To design the Earth Station antennas.*
- *To know about the parameters affecting the Satellite System Performance.*
- *To understand the applications of satellites.*

Course Outcomes: *Student will be*

- *Able to have knowledge about the Satellite communications Principles and Properties.*
- *Able to know about the Space craft subsystems and Launch vehicles.*
- *Able to design the Satellite Earth station antennas*
- *Able to analyze the effects of various parameters on Satellite System performance.*
- *Able to understand the applications of Satellite Communication.*

UNIT–I

Origin of Satellite communications, A Brief History of Satellite Communication, Basic principles and properties of satellite communication. Earth segment, Space segment, Interpretation of Kepler's Laws. Orbital Mechanics: The Equation of the Orbit, Describing the Orbit, Locating the Satellite in the Orbit, Orbital effects in communication system Performance: Doppler shift, Range variation, Eclipse and Sun-Transit Outage.

UNIT– II

Space craft sub systems, Equipment Reliability and Space Qualification: Space Qualification, Reliability, and Redundancy, Satellite launch and launch vehicles and Mechanics of Launching a Synchronous Satellite.

UNIT– III

Earth Stations: Earth Station Design for Low System Noise Temperature, Design of large antennasand small earth station antennas. Low noise amplifiers and High power Amplifiers for Satellite communication.

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, **Propagation on Satellite-Earth paths:** Attenuation, depolarization,

atmospheric absorption, Tropospheric Multipath effects and Land and Sea Multipath, Multipath Effects in System Design, Faraday rotation in the Ionosphere, Ionospheric scintillations, Rain and ice effects.

UNIT– V

Satellite Navigation Applications: Global and Regional Satellite Navigation Systems-Operating Principles, Advantages, Limitations, Current Status and Applications, Remote Sensing Satellites.

Suggested Readings:

1. Wilbur L. Pitchand and Henri G. Suyderhoud, Robert A. Nelson, "*Satellite Communication Systems Engineering",* 2nd edn.3rd Impression, Pearson Education.2008.
2. Timothy Pratt and Charles Nestian. W, "*Satellite Communication",* John Wiley and Sons, 1988.
3. Tri T. Ha, "*Digital Satellite Communication"*, Tata McGraw- Hill, Special Indian Edition2009.

OE 708 EE

OPTIMIZATION TECHNIQUES

(Open Elective - II)

Instruction: 3L hours per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives:

- *To understand the need and basic concepts of operations research and classify the optimization problems.*
- *To study about the linear programming and non-linear programming concepts and their applications*
- *To understand various constrained and un-constrained optimization techniques and their applications.*
- *To understand the concepts and implementation of Genetic Algorithms to get the optimum solutions*
- *To study the concepts of Met heuristics Optimization techniques*

Course Outcomes: *Student will be*

- *Analyze any problem of optimization in an engineering system and able to formulate a mathematical model to the problem and solving it by the techniques that are presented.*
- *Solve problems of L.P. by graphical and simplex methods.*
- *Apply various constrained and un-constrained optimization techniques for the specific problems.*
- *Could able to implement the Genetic Algorithms to solve the for optimum solution.*
- *Understands the concepts to use the Met heuristics Optimization techniques*

UNIT – I

Introduction: Definitions, Characteristics, Objective function, Classification of optimization problems, Engineering applications and limitations. Single-Variable Optimization, Multivariable Optimization with No Constraints, Multivariable Optimization with Equality Constraints and Multivariable Optimization with Inequality Constraints: Kuhn–Tucker Condition

UNIT – II

Linear Programming: Definitions and Formulation of the LPP, Construction of L.P. Models, Slack and surplus variables, Standard form, Canonical form and matrix form of LP Problems. Artificial Variables, solution by the Big-M method, Duality principle, Dual problems and numerical problems.

UNIT – III

Random Search Methods concepts: Direct Search Methods - Univariate Method, Gradient of a Function, Indirect Search Methods - Gradient of a Function, Steepest Descent (Cauchy) Method, Newton's Method.

UNIT – IV

Binary Genetic Algorithm: Genetic Algorithms Natural Selection on a Computer, Components of a Binary Genetic Algorithm. Selecting the Variables and the Cost Function. Variable Encoding and Decoding, the Population, Natural Selection, Selection, Mating. Mutations, the Next Generation and Convergence, Components of a Continuous Genetic Algorithm.

UNIT – V

Met heuristics Optimization: Concepts of Simulated Annealing, Theoretical approaches, Advantages and disadvantages, applications, Ant Colony Algorithms - Introduction, Collective behavior of social insects, Formalization and properties of ant colony optimization.

Suggested Readings:

1. Rao, S.S., *"Engineering Optimization: Theory and Practice",* John Wiley & Sons, Inc., 2009
2. Taha, H.A., *"Operations Research, Pearson Education India",* New Delhi, India, 2008.
3. Randy L. Haupt and Sue Ellen Haupt, *"Practical genetic algorithms"* second edition, a John Wiley & sons, inc., publication -2004.
4. Sharma J.K., "*Operation Research: Theory and Applications"* Fifth Edition, Macmillan Publishers, New Delhi, India, 2013.
5. J. Dreo A. Petrowski, P. Siarry E. Taillard, *"Metaheuristics for Hard Optimization"* Springer.

OE 709 EE

NON-CONVENTIONAL ENERGY SOURCES

(Open Elective - II)

Instruction: 3L hours per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives:

- *To understand the different types of energy sources*
- *To Understand the need of non-conventional energy sources and their principles*
- *To understand the limitations of non-conventional energy sources*
- *To outline division aspects and utilization of renewable energy sources for diriment application*
- *To analyze the environmental aspects of renewable energy resources*

Course Outcomes: *Student will be able to*

- *Know the different energy resources and need of renewable energy resources*
- *Understand the concepts of working of fuel cell systems along with their applications*
- *Describe the use of solar energy and the various components and measuring devices used in the energy production and their applications*
- *Appreciate the need of Wind Energy and their classification and various components used in energy generation and working of different electrical wind energy system*
- *Understand the concept of OTEC technology, Biomass energy resources and different types of biogas Plants used in India*

UNIT- I

Review of Conventional and Non-Conventional energy sources, Need for non-conventional energy sources Types of Non-conventional energy sources, Fuel Cells, Principle of operation with special reference to H2O2 Cell, Classification and Block diagram of fuel cell systems, Ion exchange membrane cell, Molten carbonate cells, Solid oxide electrolyte cells, Regenerative system, Regenerative Fuel Cell, Advantages and disadvantages of Fuel Cells, Polarization, Conversion efficiency and Applications of Fuel Cells.

UNIT-II

Solar energy, Solar radiation and its measurements, Solar Energy collectors, Solar Energy storage systems, Solar Pond, Application of Solar Pond, Applications of solar energy.

UNIT-III

Wind energy, Principles of wind energy conversion systems, Nature of wind, Power in the Wind, Basic components of WECS, Classification of WECS, Site selection considerations, Advantages and disadvantages of WECS, Wind energy collectors, Wind electric generating and control systems, Applications of Wind energy, Environmental aspects.

UNIT-IV

Energy from the Oceans, Ocean Thermal Electric Conversion (OTEC) methods, Principles of tidal power generation, Advantages and limitations of tidal power generation, Ocean waves, Wave energy conversion devices, Advantages and disadvantages of wave energy, Geo-thermal Energy, Types of Geo-thermal Energy Systems, Applications of Geo-thermal Energy.

UNIT-V

Energy from Biomass, Biomass conversion technologies / processes, Photosynthesis, Photosynthetic efficiency, Biogas generation, Selection of site for Biogas plant, Classification of Biogas plants, Details of commonly used Biogas plants in India, Advantages and disadvantages of Biogas generation, Thermal gasification of biomass, Biomass gasifies.

Suggested Readings:

1. Rai G.D, *"Non-Conventional Sources of Energy",* Khandala Publishers, New Delhi, 1999.
2. M. M. El-Wakil, *"Power Plant Technology"*, McGraw Hill, 1984.

OE 710 ME

INDUSTRIAL ROBOTICS

(Open Elective - II)

Instructions: (3L) hrs per week *Duration of SEE: 3hours*
CIE: 30 Marks *SEE: 70 Marks*
Credits: 3

Course Objectives:

- The program provides in-depth knowledge in the areas of flexible automation covering its varied aspects such as system design, electro mechanics, sensors, instrumentation, artificial intelligence, robotic vision, project engineering.
- To understand the basic concepts associated with the design and Functioning and applications of Robots
- To study about the drives and sensors used in Robots
- To learn about analyzing robot kinematics and robot programming

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

- The course provides comprehensive knowledge in technical expertise and hands-on experience.
- Students will have an in-depth knowledge of designing, engineering and commissioning equipment that are used in automated manufacturing, assembly, and handling applications.
- The students can able to apply the basic engineering
- To learn about knowledge for the design of robotics.
- Will understand robot kinematics and robot programming.
- Will understand application of Robots
- To learn about force and torque sensing
- To learn about application of robot

UNIT-I

Introduction to industrial robotics: Safety, introduction to industrial robotics, components of the robot, controller/logic function, teach pendant/interface, manipulator, degrees of freedom, and axis numbering, base types. **Classification of robots:** power source, geometry of the work envelope, drive systems: classification and operation, so classification, **end-of-arm tooling:** multiple tooling, positioning of EOAT.

UNIT-II

Programming and file management: planning, subroutines, writing the program, testing and verifying, normal operation, file maintenance.

automation sensors: limit switches, proximity switches, tactile and impact sensors, temperature sensors, fluid sensors, position sensors, sound sensors, connection to the robot, sensor selection criteria.

vision systems: components of a vision system, image analysis, lighting.

UNIT-III

Integration and networking: types of networks, communication protocols,, integration,**;** programmable logic controllers (PLCS) and human-machine interfaces (HMIS)L basic components of the PLC, operation of the PLC, human–machine interfaces.

maintenance and troubleshooting: preventive maintenance, arc flash, troubleshooting, crash recovery, repair tips, parts swapping versus fixing the problem, precautions before running the robot.

UNIT-IV

Robot handling: The handling task, Robot characteristics for handling, Robot assembly. Case studies Application characteristics.

Robot welding: The spot welding process, Robot spot welding, The robot task, The arc welding process, Robot MIG welding.

Machining with robots: Application characteristics. **Spray painting applications:** The spray painting process, Spray painting robot anatomy and characteristics. Programming techniques. **Innovative robot applications** in the automation of manufacturing processes., assembly automation, applications in inspection.

UNIT-V

Lean Manufacturing With Robotics for Low Volume, Small Batch Runs: Changeover for Small Batches, the Design of a Robotic Work-Cell, Automating the machining process, Automating the welding process and Automating the material removal process for small batch runs, Automating small batch runs for press tending and palletizing, automating the palletizing process for small batch runs, Tools for small batch and high changeover production

Lean Manufacturing with Robotics for High Volume: Large Batch Run, Robotic Machine Tending for High Production, Robotic Cellular Manufacturing

Suggested Reading:

1. Keith Dinwiddie Industrial Robotics / Edition 1 by , Publisher: Cengage Learning
2. Rex Miller, Mark R. Miller Robots and Robotics: Principles, Systems, and Industrial Applications,
3. Groover M P (Author) Industrial Robotics Technology, Programming &Application, Tata McGraw Hill Education
4. Larry T. Ross, Stephen W. Fardo, and Michael F. Walach Industrial Robotics Fundamentals: Theory and Applications, 3rd Edition
5. Andrew Glaser Industrial Robotics Industrial Press publisher

OE 711 ME

NANO TECHNOLOGY
(Open Elective - II)

Instructions: (3L) hrs per week *Duration of SEE: 3hours*
CIE: 30 Marks *SEE: 70 Marks*
Credits: 3

Course Objectives:

- To familiarize Nano materials and technology.
- To understand Nano structures, fabrication and special Nano materials.
- Graduates will have successful careers as engineers in the multidisciplinary field of Nanotechnology
- Graduates will be able to pursue advanced studies and involve in a process of lifelong learning.
- Graduates will address societal problems professionally, ethically with due attention to environmental issues.

Course Outcomes:

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

- Independently carry out research/investigation and development work to solve practical problems in Nanotechnology..
- Write and present a substantial technical report/document.
- Demonstrate a degree of mastery over Nanotechnology.
- Employ modern engineering and nanotechnology concepts to cater the needs of the community
- Provide solutions to varied engineering and scientific problems up to molecular/atomic scales through the interpretation of data using modern sophisticated Instruments and computational tools

UNIT-I

Introduction: Nan scale, Properties at Nan scale, advantages and disadvantages, importance of Nano Technology, Bottom-up and Top-down approaches, challenges in Nanotechnology.

UNIT-II

Materials of Nano Technology: Introduction-Si-based materials, Ge-based materials, Smart materials, metals, Ferroelectric materials, Polymer materials, GaAs & InP (III-V) group materials, Nano tribology and Materials, Principles and analytical techniques of XRD, SEM, TEM and STM/AFM.

UNIT-III

Nano Structures: Zero dimensional Nano structure (Nano Particles)- Synthesis procedure, characterization techniques, properties and applications of Nano Particles

One dimensional Nano structures (Nano Wires, Nano Tubes)- Various Synthesis procedure, characterization procedure and principles involved, properties and applications of Nano Wires, Types of Nano Tubes, Synthesis procedure, characterization properties and applications of Nano Tubes.

UNIT-IV

Nano Fabrication: Introduction, Basic fabrication techniques (Lithography, thin film deposition, and doping) MEMS fabrication techniques, Nano fabrication techniques (E-beam Nano-imprint fabrication, Epitaxial and strain engineering, Scanned probe techniques).

UNIT-V

Special Nano Materials: Nano Composites: Introduction, Synthesis procedures, various systems (metal-polymer, metal- ceramics and polymer-Ceramics), Characterization procedures, applications. Nano Biomaterials: Introduction, Biocompatibility, anti-bacterial activity, principles involved, applications.

Suggested Reading:

1. A.K.Bandyopadyay, Nano Materials, New Age Publications, 2007.
2. T. Pradeep, Nano: The Essentials: Understanding Nanoscience and Nanotechnolgy, Tata McGraw-Hill, 2008.
3. Carl. C. Koch, Nano Materials Synthesis, Properties and Applications, Jaico Publishing House, 2008.
4. Willia Illsey Atkinson, NanoTechnology, Jaico Publishing House, 2009.

OE 712 ME

CMOS AND MIXED SIGNAL CIRCUIT DESIGN

(Open Elective - II)

Instructions: (3L) hrs per week *Duration of SEE: 3hours*
CIE: 30 Marks *SEE: 70 Marks*
Credits: 3

Course Objectives:

- *To familiarize Nano materials and technology.*
- *To understand Nano structures, fabrication and special Nano materials.*
- *Graduates will have successful careers as engineers in the multidisciplinary field of Nanotechnology*
- *Graduates will be able to pursue advanced studies and involve in a process of lifelong learning.*
- *Graduates will address societal problems professionally, ethically with due attention to environmental issues.*

Course Outcomes:

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

- *Independently carry out research/investigation and development work to solve practical problems in Nanotechnology..*
- *Write and present a substantial technical report/document.*
- *Demonstrate a degree of mastery over Nanotechnology.*
- *Employ modern engineering and nanotechnology concepts to cater the needs of the community*
- *Provide solutions to varied engineering and scientific problems up to molecular/atomic scales through the interpretation of data using modern sophisticated Instruments and computational tools*

UNIT – I : Switched Capacitor Circuits: Introduction to Switched Capacitor circuits- basic building blocks, Operation and Analysis, Non-ideal effects in switched capacitor circuits, Switched capacitor integrators first order filters, Switch sharing, biquad filters.

UNIT – II : Phased Lock Loop (PLL): Basic PLL topology, Dynamics of simple PLL, Charge pump PLLs-Lock acquisition, Phase/Frequency detector and charge pump, Basic charge pump PLL, Non-ideal effects in PLLs-PFD/CP non-idealities, Jitter in PLLs, Delay locked loops, applications

UNIT – III : Data Converter Fundamentals: DC and dynamic specifications, Quantization noise, Nyquist rate D/A converters- Decoder based converters, Binary-Scaled converters, Thermometer-code converters, Hybrid converters

UNIT – IV : Nyquist Rate A/D Converters: Successive approximation converters, Flash converter,

Two-step A/D converters, Interpolating A/D converters, Folding A/D converters, Pipelined A/D converters, Time interleaved converters.

UNIT – V : Oversampling Converters: Noise shaping modulators, Decimating filters and interpolating filters, Higher order modulators, Delta sigma modulators with multibit quantizers, Delta sigma D/A

TEXT BOOKS:

Behzad Razavi, "Design of Analog CMOS Integrated Circuits", TMH Edition, 2002
Philip E. Allen and Douglas R. Holberg, "CMOS Analog Circuit Design", Oxford University Press, International Second Edition/Indian Edition, 2010.
David A. Johns,Ken Martin, "Analog Integrated Circuit Design", Wiley Student Edition, 2013

REFERENCE BOOKS:

Rudy Van De Plassche, "CMOS Integrated Analog-to- Digital and Digital-to-Analog converters", Kluwer Academic Publishers, 2003
Richard Schreier, "Understanding Delta-Sigma Data converters", Wiley Interscience, 2005.
R. Jacob Baker, "CMOS Mixed-Signal Circuit Design", Wiley Interscience, 2009.

OE 713 ME

PROFESSIONAL PRACTICE, LAW AND ETHICS

(Open Elective - II)

Instructions: (3L) hrs per week *Duration of SEE: 3hours*
CIE: 30 Marks *SEE: 70 Marks*
Credits: 3

Course Objectives:

- *To make the students understand the types of roles they are expected to play in the society as practitioners of the civil engineering profession*
- *To develop some ideas of the legal and practical aspects of their profession.*

Course Outcome: *The students will understand the importance of professional practice, Law and Ethics in their personal lives and professional careers. The students will learn the rights and responsibilities as an employee, team member and a global citizen*

UNIT - I

Professional Practice and Ethics: Definition of Ethics, Professional Ethics - Engineering Ethics, Personal Ethics; Code of Ethics - Profession, Professionalism, Professional Responsibility, Conflict of Interest, Gift Vs Bribery, Environmental breaches, Negligence, Deficiencies in state-of-the-art; Vigil Mechanism, Whistle blowing, protected disclosures. Introduction to GST- Various Roles of Various Stake holders

UNIT - II

Law of Contract: Nature of Contract and Essential elements of valid contract, Offer and Acceptance, Consideration, Capacity to contract and Free Consent, Legality of Object. Unlawful and illegal agreements, Contingent Contracts, Performance and discharge of Contracts, Remedies for breach of contract. Contracts-II: Indemnity and guarantee, Contract of Agency, Sale of goods Act -1930: General Principles, Conditions & Warranties, Performance of Contract of Sale.

UNIT - III

Arbitration, Conciliation and ADR (Alternative Dispute Resolution) system: Arbitration – meaning, scope and types – distinction between laws of 1940 and 1996; UNCITRAL model law – Arbitration and expert determination; Extent of judicial intervention; International commercial arbitration; Arbitration agreements – essential and kinds, validity, reference and interim measures by court; Arbitration tribunal appointment, challenge, jurisdiction of arbitral tribunal, powers, grounds of challenge, procedure and court assistance; Distinction between conciliation, negotiation, mediation and arbitration, confidentiality, resort to judicial proceedings, costs; Dispute Resolution Boards; Lok Adalats.

UNIT – IV

Engagement of labour related laws: Industrial disputes Act 1947, collective bargaining, industrial employment (standing orders) Act 1946, workmen's compensation Act 1923.

UNIT - V

Law relating to Intellectual property: Introduction – meaning of intellectual property, main forms of IP, Copyright, Trademarks, Patents and Designs, Secrets; Law relating to Copyright in India including Historical evolution of Copy Rights Act, 1957, Meaning of copyright – computer programs, Ownership of copyrights and assignment, Criteria of infringement, Piracy in Internet – Remedies and procedures in India; Law relating to Patents under Patents Act, 1970

TEXT BOOKS:

1. Professional Ethics: R. Subramanian, Oxford University Press, 2015.
2. Ravinder Kaur, Legal Aspects of Business, 4e, Cengage Learning, 2016.

REFERENCE BOOKS:

1. RERA Act, 2017.
2. Wadhera (2004), Intellectual Property Rights, Universal Law Publishing Co.
3. T. Ramappa (2010), Intellectual Property Rights Law in India, Asia Law House.
4. O.P. Malhotra, Law of Industrial Disputes, N.M. Tripathi Publishers.

OE 714 ME

ENTREPRENEURSHIP

(Open Elective - II)

Instructions: (3L) hrs per week *Duration of SEE: 3hours*
CIE: 30 Marks *SEE: 70 Marks*
Credits: 3

Course Objectives:

- *To provide students an exposure to concepts and procedure of idea generation.*
- *To ensure that students understand the nature of industry and related opportunities and challenges.*
- *To gain a preliminary understanding of business plan and its procedure.*
- *To enhance awareness of project management and its techniques.*
- *To understand behavioral issues and time management.*

Course Outcomes: *Student will be*

- *Able to understand the concept and essence of entrepreneurship.*
- *Able to identify business opportunities and nature of enterprise.*
- *Able to analyze the feasibility of new business plan.*
- *Able to apply project management techniques like PERT & CPM for effective planning and execution of projects.*
- *Able to use behavioral, leadership and time management aspects in entrepreneurial journey.*

UNIT I

Entrepreneurship: Definition, functions of entrepreneurship, types of entrepreneurs, significance of entrepreneurship, pros and cons of entrepreneurship, characteristics of entrepreneurs, entrepreneur vs. intrapreneur, first generation entrepreneurs. Role of women entrepreneurship. 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, intellectual property rights.

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: Definition of a project, 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. Time management: Approaches of time management, time management matrix and the urgency addiction.

Text Books:

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

References:

1. Robert D.Hisrich,Michael P.Peters, "Entrepreneurship",5/e,Tata Mc Graw Hill Publishing Company Limited.,2005.
2. Stephen R.Covey and A.Roger Merrill, "First Things First",Simon and Schuster Publication,2002.

OE 714 ME

INDUSTRIAL ADMINISTRATION AND FINANCIAL

(Open Elective - II)

Instructions: (3L) hrs per week *Duration of SEE: 3hours*
CIE: 30 Marks *SEE: 70 Marks*
Credits: 3

Course Objectives:

- *Aware about types of business forms, organization structures, plant layouts, merits, demerits and applications.*
- *Understand method study procedure, PME, time study techniques and wage Incentives.*
- *Importance of PPC and improving quality by control charts and sampling plants..*
- *Optimization of inventory to minimize total cost and other optimization techniques like LPP, project management techniques.*
- *Estimate selling price of a product, TVM and budgeting techniques, depreciation methods.*

Course Outcomes: *Up on successful completion of this course, the students will be able to:*

- *Understand business forms, organization structures and plant layouts.*
- *Implementation of method study and estimation of standard time.*
- *Understand types of production, functions of PPC, quality control by charts and sampling.*
- *Implement optimization techniques like LPP, assignment and project management techniques.*
- *Understand BEA, estimation of depreciation, selling price of a product and capital budgeting techniques.*

UNIT – I

Industrial Organization: Definition and significance of industry. Meaning and characteristics of business organization, types of various business organizations along with their merits and demerits.
Plant location and layouts: Meaning of plant location and layout, factors affecting plant location and layout.Types of layout and their merits and demerits.

UNIT – II

Work study: Definitions, Objectives of method study and time study. Steps in conducting method study. Symbols and charts used in method study. Principles of motion economy. Calculation of standard time– by– time study and work sampling. Performance rating factor, Types of ratings Jobs evaluation and performance appraisal, Wages, incentives, bonus, wage payment plans

UNIT – III

Inspection and quality control : Types and objectives of inspection S.Q.C., its principles quality control by chart and sampling plans. Quality circles, introduction to ISO.
Production planning and control: Types of manufacture. Types of production. Principles of PPC and its function, Production control charts.

UNIT – IV

Optimization: Introduction to linear programming and graphical solutions. Assignment problems,Project Management: Introduction to CPM and PERT. Determination of critical path
Material Management: Classification of materials. Materials planning, Duties of purchase manager, Determination of economic order quantities. Types of materials purchase.

UNIT – V

Cost accounting: elements of cost, various costs, Types of overheads, Depreciation. Methods of calculating depreciation fund. Nature of financial management, Time value of Money, Cost of Capital, Operating Leverage, Financial Leverage, Composite Leverage

Suggested Reading:

1. Pandey I.M., "Elements of Financial Management", Vikas Publ. House, New Delhi, 1994
2. Khanna O.P., "Industrial Engineering and Management", Dhanapat Rai & Sons.
1. Everrete E Admaa & Ronald J Ebert , "production and Operations Management", 5thEd. , PHI , 2005.
2. S N Chary, "Production and Operations Management", 3rdEd. , Tata McGraw Hill, , 2006
5. Pannerselvam, "production and Operations Management", Pearson Education, 2007.

PC 751 EC

MICROWAVE LABORATORY
(Professional core)

Instruction: 2P hours per week *Duration of SEE: 2 hours*
CIE: 25 marks *SEE: 50 marks*
Credits: 1

Course objectives:

1. *Understand the characteristics of RKO and Gunn oscillator.*
2. *Measurement of frequency and wavelengths would be learnt by the student.*
3. *VSWR various TEES would be understood by the student.*
4. *Radiation pattern would be learnt by the student for horn antenna.*
5. *How to Create, Simulate and Analyze the different types of Micro strip Antennas by using EM simulation software.*

List of experiments

1. Characteristics of Reflex Klystron oscillator, finding the mode numbers and efficiencies of different modes.

2. Characteristics of Gunn diode oscillator, Power Output Vs Frequency, Power Output Vs Bias Voltage.

3. Measurement of frequency and Guide wavelength calculation:

    a. Verification of the relation between Guide wavelength, free space wavelength and cutoff
    Wavelength of X- band rectangular waveguide.

    b. Verification of the straight line relation between $(1/\lambda g)^2$ and $(1/\lambda 0)^2$ and finding the dimension of the guide.

4. Measurement of low and high VSWRs: VSWR of different components like matched terminals, capacitive and inductive windows, slide screw tuner for different heights of the tuning posts etc.

5. Measurement of impedance for horn antenna, Matched load and slide screw tuner.

6. To find the S-parameters of Directional coupler.

7. To find the S-parameters of Tees: E plane, H plane and Magic Tee.

8. To find the S-parameters of Circulator.

9. Measurement of radiation patterns for basic microwave antennas like horn and parabolic reflectors in E-plane and H-plane. Also to finding the gain, bandwidth and beamwidth these antennas.

10. How to Create, Simulate and Analyze the Dipole Antenna Structure by using EM simulation software

11. How to Create, Simulate and Analyze a Microstrip Rectangular Patch Antenna by using EM simulation software

12. How to Create, Simulate and Analyze a Probe Feed Patch Antenna by using EM simulation software

13. How to Create, Simulate and Analyze a The Triangular Microstrip Antenna by using EM simulation software

NOTE: At least 10experiments to be carried out during the semester

Suggested Readings:

1. M L Sisodia& G S Raghuvanshi, "Basic Microwave Techniques and Laboratory Manual", New Age International (P) Limited, Publishers.

2. Ramesh Garg, Prakash Bhartia, Inder Bahl and Apisak Ittipiboon "Microstrip Antenna Design HandBook" Artech House Publishers, 2001 ,

PC 752 EC

ELECTRONIC DESIGN AND AUTOMATION LABORATORY (PROFESSIONAL CORE)

Instruction: (2P) hrs per week *Duration of SEE: 2 hours*

CIE: 25 Marks *SEE: 50 Marks*

Credits: 1

Course Objectives:

- *To understand the programming constructs of Verilog HDL.*
- *To demonstrate the programming models of Verilog HDL: gate level, data flow, behavioural and structural modelling.*
- *To study the VLSI back end tools.*
- *To develop basic models of digital circuits using VLSI back end tools.*
- *To carry out mini projects using Verilog HDL.*

Course Outcomes:

Student will be

- *Able to achieve knowledge of Verilog HDL programming.*
- *Able to write programs in HDL at various levels of abstraction.*
- *Achieve knowledge of working with back end tools of VLSI.*
- *Able to develop models for basic designs using back end tools.*
- *Able to understand, formulate and develop models for various designs using HDL and back end tools.*

List of Experiments:

Part A

Write the Code using VERILOG, Simulate and synthesize the following:

1. Arithmetic Units: Adders and Subtractors.
2. Encoders, Decoders, Priority Encoder and Comparator.
3. 8 – Bit Parallel Adder using four bit tasks and functions.
4. Arithmetic and Logic Unit with minimum of eight instructions.
5. D, SR and JK Flip flops.
6. Registers/Counters.
7. Sequence Detector using Mealy and Moore type state machines.
8. Shift input data right arithmetic by the number of positions specified by another input shift by using conditional operator.
9. Convert BCD number into seven segment code.
10. Realize a four-bit ring counter with asynchronous reset and clear inputs.
11. Design a clock generator where its output clk produces 50 pulses in the period of 20 time units at a duty cycle of 60%. The clk must start from zero.
12. Swap contents of two registers with temporary register.

13. Read and write operations form Random Access Memory.
14. 4-bit pseudo-random Binary sequence generator using a linear feedback shift registers.
15. Calculating the Factorial of Positive

Integers. Note:

1. All the codes should be implemented appropriately using Gate level, Dataflow and Behavioral Modeling.
2. All the programs should be simulated using test benches.
3. Minimum of two experiments to be implemented on FPGA/CPLD boards.

Part B

A. Transistor Level implementation of CMOS circuits

1. Basic Logic Gates: Inverter, two input NAND and NOR gates.
2. Half Adder and Full Adder.
3. 4:1 Multiplexer.
4. 2:4 Decoders.

B. Implementation of ASIC design flow

1. Four-bit ripple carry adder using one bit full adder.
2. Four-bit carry look-ahead adder.
3. Four-bit universal shift register.
4. Synchronous and asynchronous counters.
5. 8-bit register with parallel load and shift left modes of operation.

General Note: Mini Project cum Design exercise:

The student must design, develop code and test and design the following problems:

i) 8 bit CPU
ii) Generation of different waveforms using DAC
iii) RTL code for Booth's algorithm for signed binary number multiplication
iv) Development of HDL code for MAC unit and realization of FIR Filter
v) Design of 4 - bit thermometer to Binary Code Converter

Suggested Readings:

1 Samir Palnitkar, "*Verilog HDL: A Guide to Digital Design and Synthesis*", Pearson Education, 2005.
2 Jan M Rabaey, A. Chandrakasan and B. Nikolic., *Digital Integrated Circuits,* Prentice Hall of India, 2003.

PW 761 EC

PROJECT STAGE - 1

Instruction: 4 hours per week *Duration of SEE: ----*
CIE: 50 marks *SEE: 0 marks*
Credits: 2

Course Objectives:

1. *To enhance practical and professional skills.*
2. *To familiarize tools and techniques of systematic Literature survey and documentation*
3. *To expose the students to industry practices and team work.*
4. *To encourage students to work with innovative and entrepreneurial ideas*

Course Outcomes:

1. *demonstrate the ability to synthesize and apply the knowledge and skills acquired in the academic program to real-world problems*
2. *evaluate different solutions based on economic and technical feasibility*
3. *effectively plan a project and confidently perform all aspects of project management*
4. *Demonstrate effective written and oral communication skills*

The department can initiate the project allotment procedure at the end of VI semester and finalize itin the first two weeks of VII semester.

The department will appoint a project coordinator who will coordinate the following:

Collection of project topics/ descriptions from faculty members (Problems can also be invited from the industries)

Grouping of students (max 3 in a group)Allotment of project guides

The aim of project work is to develop solutions to realistic problems applying the knowledge and skills obtained in different courses, new technologies and current industry practices. This requires students to understand current problems in their domain and methodologies to solve these problems. To get awareness on current problems and solution techniques, the first 4 weeks of VII semester will be spent on special lectures by faculty members, research scholars, post graduate students of the department and invited lectures by engineers from industries and R&D institutions. After completion of these seminars each group has to formalize the project proposal based on theirown ideas or as suggested by the project guide

Seminar schedule will be prepared by the coordinator for all the students from the 5th week to thelast week of the semester which should be strictly adhered to.

Each group will be required to:

1. Submit a one page synopsis before the seminar for display on notice board.
2. Give a 30 minutes presentation followed by 10 minutes discussion.
3. Submit a technical write-up on the talk.

At least two teachers will be associated with the Project Seminar to evaluate students for the awardof sessional marks which will be on the basis of performance in all the 3 items stated above.

The seminar presentation should include the following components of the project:

1. Problem definition and specification
2. Literature survey
3. Broad knowledge of available techniques to solve a particular problem.
4. Planning of the work, preparation of bar (activity) charts
5. Presentation- oral and written.

PW 762 EC

SELF STUDY PROJECT

Instruction: 4 hours per week *Duration of SEE: ----*
CIE: 50 marks *SEE: 0 marks*
Credits: 2

Course Objectives:

1. *Understanding real life problems*
2. *Problem solving techniques*
3. *Working independently*
4. *Drawing conclusions from analysis*
5. *Date interpretation & presentation skills*

Course Outcomes: *Student will be able to*

1. *Use of library, literature review*
2. *Hunting/ Understanding the problem of social relevance / practical importance*
3. *Learn data analysis/ synthesis*
4. *Learn to choose right path/ optimum solutions*
5. *Learn presentation (Oral/technical/professional writing skills)*

Procedure:

1. Student will choose problem on his/her own depending on his/her interest
2. Department will designate one coordinator in each semester for this course
3. Student will choose on their own, their mentor, who can be from department/ from other department or outside college (from industry/National organisations)
4. Topic need not be in ECE. It can be from any discipline but should have social relevance/practical importance.
5. Student will carry out work on his/her own by carrying out systematic literature survey, data/information collection, hence identify the problem.
6. Analyse/synthesis the data/information, choose proper tool/technique to solve the problem.
7. Should be able to interpret data and draw concrete conclusions.
8. Should write professional/technical report (Max. 50 pages per semester) giving all details, references, conclusion, and scope for future work, underline importance of the work carried out.
9. Will present his work before mentor/HOD/one examiner (from sister department)
10. Marks to be awarded by examining report and performance in defence (Viva) to be conducted by mentor and external examiner (from other department)

Self-Study project will be carried out independently by each student (not in group). If a single big problem is identified, three or four students can attempt, but activity of each student will be separate, report will be separate.

PC 653 EC

SUMMER INTERNSHIP*

Instruction: 6 weeks *Duration of SEE: --*
CIE: 50 marks *SEE: --*
Credits: 2

Course Objectives:

- *To give an experience to the students in solving real life practical problems with all its constraints.*
- *To give an opportunity to integrate different aspects of learning with reference to real life problems.*
- *To enhance the confidence of the students while communicating with industry engineers and give an opportunity for useful interaction with them and familiarize with work culture andethics of the industry.*

Course Outcomes: *Student will be*

- *Able to design/develop a small and simple product in hardware or software.*
- *Able to complete the task or realize a prespecified target, with limited scope, rather thantaking up a complex task and leave it.*
- *Able to learn to find alternate viable solutions for a given problem and evaluate thesealternatives with reference to prespecified criteria.*
- *Able to implement the selected solution and document the same.*

Summer Internship is introduced as part of the curricula for encouraging students towork on problems of interest to industries. A batch of two or three students will be attached to a person from an Electronics Industry / R & D Organization / National Laboratory/Any other program approved by the department for a period of 8 weeks. This will be during the summer vacation following the completion of the VI semester course. One faculty member will act as an internal guide for each batch to monitor the progress and interacts with the industry guide.

After the completion of the project, students will submit a brief technical report on the project executed and present the work through a seminar talk to be organized by the department. Award of sessional are to be based on the performance of the student at the work place to be judged by industry guide and internal guide (25 Marks) followed by presentation before the committee constituted by the department (25 Marks). One faculty member will co- ordinate the overall activity of Summer Internship.

***Students have to undergo summer internship of 6 Weeks duration at the end of semester VI andcredits will be awarded after evaluation in VII semester**

SCHEME OF INSTRUCTION

B. Tech (ELECTRONICS AND COMMUNICATION ENGINEERING)
CBCS-AICTE MODEL CURRICULAM
Proposed from the Academic year 2020-21

VIII - SEMESTER

S.No.	Course Code	Course Title	Scheme of Instruction			Contact hr/week	Scheme of Examination		Credits
			L	T	P		CIE	SEE	
Theory									
1	PE #	Professional Elective-V	3	0	0	3	30	70	3
2	PE#	Professional Elective-VI	3	0	0	3	30	70	3
3	OE#	Open Elective-III	3	0	0	3	30	70	3
4	PW 861 EC	Project Stage-II	0	0	12	12	50	100	6
5	PW 862 EC	Self Study Report	0	0	4	4	50	0	2
Total			**9**	**0**	**16**	**25**	**190**	**310**	**17**

L : Lectures
CIE : Continuous Internal Evaluation
T : Tutorials
SEE : Semester End Examination
P : Practicals
BS : Basic Sciences
PC : Professional Core
PE : Professional Elective
OE : Open Elective
HS : Humanities and social sciences

professional elective-V
1. PE 801 EC Optical Commutation
2. PE 802 EC Low Power VLSI Design
3. PE 803 EC Internet of Things
4. PE 804 EC RF Circuit Design

professional elective-VI
1. PE 805 Wireless Sensor Networks
2. PE 806 Software Defined Radio
3. PE 807 GRNSS and Augmentation System
4. PE 808 Radar Systems

Open Elective-III

1. OE 801BM Basic Medical Equipment
2. OE 802CS Data Science Using R
3. OE 803EC Mobile Communication
4. OE 804EC Internet of Things and Applications
5. OE 805EC Global and Regional Satellite Navigation System
6. OE 806EE Applications of Electrical Energy
7. OE 807ME Composite Material Applications

PE 801 EC

OPTICAL COMMUNICATIONS

(Professional Elective - V)

Instruction: 3L hours per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives:

1. *To become familiar with the fundamental concepts of Light, Basic laws of light, various types of Optical fibers, modes and configurations.*
2. *To acquaint with theoretical analysis of the Signal propagation and distortion during propagation of light in Optical Fibers.*
3. *To become familiar with Optical sources, Optical detectors and Optical amplifiers*
4. *To understand the design principles of Digital and Analog links*
5. *To know the operating principles of WDM and components for its realization*

Course Outcomes: S*tudent will be*

1. *Able to apply Optical Laws to provide solutions to the problems of Optical Waveguides*
2. *Able to deal with the Optical Communication System designs.*
3. *Able to carry out the calculations of various noise powers at Optical Receivers*
4. *Able to design the Optical Link Power Budget and Rise Time Budget for the given applications*
5. *Able to design the WDM systems with various system considerations*

UNIT – I

Overview of Optical Fiber Communications: The evolution of optical fiber systems, Elements of an Optical fiber transmission link, Optical fibers, Nature of light – basic optical laws and definitions – Modes and configurations, Mode of theory of circular waveguides, Single and multi- mode step index and graded index fibers.

UNIT – II

Signal degradation in Optical fibers: Attenuation, Signal distortion in optical waveguides, Mode coupling, and Design optimization of single mode fibers.

Optical sources: Semiconductors as optical sources and their fabrication, LED's and Laser diodes, Linearity of sources, Modal, partition and reflection noise

UNIT – III

Photo detectors: Physical principles of PIN and APD, Photo detector noise, Detector response time, Avalanche multiplication noise, Temperature effect on Avalanche gain, Comparisons of Photo detectors.

Optical receiver operation: Fundamental receiver operation, Digital receiver performance calculation. Preamplifiers types, Analog receivers

UNIT – IV

Point-to-Point Optical links: System considerations, Link power budget, Rise time budget, Noise effects on system performance. Overview of analog links, Carrier noise ratio in analog systems

UNIT – V

Optical Amplifiers & WDM: Introduction to optical amplifiers, Basic applications and types of Optical amplifier, WDM concepts and Components, operational principles, passive components, Tunable sources and Tunable filters.

Suggested Readings:

1. Gerd Keiser, "*Optical Fiber Communications*", 3rd Edition, Tata McGraw- Hill publishing company Limited, New Delhi, 2000.
2. D.C.Agarwal, *"Fiber Optic Communication*", 2nd Edition, Wheeler publishing, New Delhi, 1993.
3. D. K. Mynbaev, L.L. Scheiner, "*Fiber-Optic Communications Technology*", Pearson education, New Delhi, 2006.

PE 802 EC

LOW POWER VLSI DESIGN

(Professional Elective - V)

Instruction: 3L hours per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives:

1. *To understand major evolutions, effects on transistor characteristics*
2. *To learn the Power estimation techniques of CMOS circuits.*
3. *To familiarize with dynamic power optimization techniques.*
4. *To familiarize with leakage power optimization techniques.*
5. *Know Low Power Very Speed Dynamic Digital circuit designs.*

Course Outcomes: S*tudent will be*

1. *Understand major evolutions in MOS and its behaviour*
2. *Estimate power in CMOS circuits*
3. *Use dynamic power reduction techniques in designs*
4. *Use leakage power reduction techniques in designs*
5. *Use advance fast computation methods.*

UNIT-I

MOS transistor major evolutions-Bulk CMOS technologies, SOI technologies, MOS transistor saturation and sub threshold currents, tunnel currents, Leakage current components, scaling effects, Innovative transistor architectures

UNIT-II

Power Estimation Techniques: Circuit Level – Modeling of Signals, Signal Probability Calculations, Statistical techniques for combinational circuits, Power estimation at circuit level, High Level Power Estimation.

UNIT-III

Power Optimization Techniques – I: Dynamic Power Reduction – Dynamic Power Component, Circuit Parallelization, Voltage Scaling Based Circuit Techniques, Circuit Technology – Independent Power Reduction, Circuit Technology Dependent Power Reduction;

UNIT-IV

Power Optimization Techniques – II: Leakage Power Reduction – Leakage Components, Design Time Reduction Techniques, Run-time Stand-by Reduction Techniques, Run-time Active Reduction Techniques, techniques to reduce leakage in Cache Memories.

UNIT-V

Power Optimization Techniques – III: Low Power Very Fast Dynamic Logic Circuits, high throughput CMOS circuit techniques, Low Power Arithmetic Operators- addition and multiplication, Energy Recovery Circuit Design

Suggested Readings:

1. Kaushik Roy and Sharat Prasad, "*Low-Power CMOS VLSI Circuit Design"*, Wiley Interscience Publications, 2000
2. Christian Piguet, "*Low Power CMOS Circuits Technology, Logic Design and CAD Tools"*, 1st Indian Reprint, CRC Press, 2010
3. Jan M Rabaey, A Chandrakasan, Borvioje N *"Digital Integrated Circuits Design Perspective*" PHI-2nd edition, 2005

PE 803 EC

INTERNET OF THINGS

(Professional Elective - V)

Instruction: 3L hours per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives:

1. *Discuss fundamentals of IoT and its applications and requisite infrastructure*
2. *Describe Internet principles and communication technologies relevant to IoT*
3. *Discuss hardware and software aspects of designing an IoT system*
4. *Describe concepts of cloud computing and Data Analytics*
5. *Discuss business models and manufacturing strategies of IoT products*

Course Outcomes: *Student will be able to*

1. *Understand the various applications of IoT and other enabling technologies.*
2. *Comprehend various protocols and communication technologies used in IoT*
3. *Design simple IoT systems with requisite hardware and C programming software*
4. *Understand the relevance of cloud computing and data analytics to IoT*
5. *Comprehend the business model of IoT from developing a prototype to launching a product.*

UNIT- I

Introduction to Internet of Things

IOT vision, Strategic research and innovation directions, Iot Applications, Related future technologies, Infrastructure, Networks and communications, Processes, Data Management, Security, Device level energy issues.

UNIT- II

Internet Principles and communication technology

Internet Communications: An Overview – IP, TCP, IP protocol Suite, UDP. IP addresses – DNS, Static and Dynamic IP addresses, MAC Addresses, TCP and UDP Ports, Application Layer Protocols – HTTP, HTTPS, Cost Vs Ease of Production, Prototypes and Production, Open-Source Vs Closed Source.

UNIT- III

Prototyping and programming for IoT

Prototyping Embedded Devices – Sensors, Actuators, Microcontrollers, SoC, Choosing a platform, Prototyping Hardware platforms – Arduino, Raspberry Pi. Prototyping the physical design – Laser Cutting, 3D printing, CNC Milling.

Techniques for writing embedded C code: Integer data types in C, Manipulating bits - AND, OR, XOR, NOT, Reading and writing from I/ O ports. Simple Embedded C programs for LED Blinking, Control of motor using switch and temperature sensor for arduino board.

UNIT- IV

Cloud computing and Data analytics

Introduction to Cloud storage models -SAAS, PAAS, and IAAS. Communication APIs, Amazon webservices for IoT, Skynet IoT Messaging Platform.

Introduction to Data Analytics for IoT - Apache hadoop- Map reduce job execution workflow.

UNIT- V

IoT Product Manufacturing - From prototype to reality

Business model for IoT product manufacturing, Business models canvas, Funding an IoT Startup, Mass manufacturing - designing kits, designing PCB,3D printing, certification, Scaling up software, Ethical issues in IoT- Privacy, Control, Environment, solutions to ethical issues.

Suggested Readings:

1. *"Internet of Things"* - Converging Technologies for smart environments and Integrated Ecosystems, River Publishers.
1. Adrian McEwen, Hakim Cassimally, "*Designing the Internet of Things",* Wiley India Publishers
2. Daneil W lewies, "*Fundamentals of embedded software: where C meets assembly",* Pearson.
3. Arshdeep Bahga*, "Internet of things -A hands on Approach"* Universities press.

PE 804 EC

RF CIRCUIT DESIGN

(Professional Elective - V)

Instruction: 3L hours per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

***Course Objectives**:*

1. *To introduce students the basic transmission line theory, single and multiport networks, RF component modeling.*
2. *To offer students experience on designing matching and biasing networks & RF transistor amplifier design.*
3. *To educate students fundamental RF circuit and system design skills.*
4. *To extend the knowledge to analyze & Design the RF circuits using the high frequency passive components.*
5. *To differentiate between RF, Digital and mixed circuit Design.*

***Course Outcomes:** Student will be able to*

1. *Differentiate the Circuit Component Behavior at RF frequencies*
2. *Identify the Design Constraints at RF frequencies*
3. *Analyze RF circuits, networks and behavior based on scattering parameters.*
4. *Demonstrate capability of RF Design and development of various RF components.*
5. *Design RF Amplifies, Mixers, Filters,* Dividers, Combiners, Oscillators and other sub blocks.

UNIT – I:

RF passive components & Transmission Line Analysis Importance of RF Design- Frequency Spectrum- RF Behaviour of Passive Components: High frequency resistors, High frequency capacitors, High frequency inductors. Chip components and circuit board considerations: chip resistors, chip capacitors, and surface Mount Inductors. Types of Transmission lines - Equivalent Circuit representation – R, L, C, G parameters of different line configurations. Terminated Lossless Transmission lines- special terminations: Short circuit, open circuit and quarter wave transmission lines. Sourced and loaded transmission lines: Power considerations, input impedance matching, return loss and insertion loss.

UNIT – II:

Smith chart & Single- and Multiport Networks: Reflection coefficient, Normalized impedance. Impedance transformation: Standing wave ratio, special transformation conditions – Admittance transformation- parallel and series RL&RC connections- basic definitions of single and multi port networks- interconnecting networks.

UNIT – III

RF filter Design: Scattering parameters: Definition, meaning, chain scattering matrix, conversion between S and Z parameters, Signal flow chart modelling and generalization. Basic Resonator and Filter configurations: Low pass, high pass, band pass and band stop type filters. Filter implementation using unit element and Kuroda's Identities Transformations- Coupled filters.

UNIT – IV:

Active RF Component Modeling & Matching and Biasing networks: Diode Modeling: nonlinear and linear models. Transistor models: Large signal and small signal BJT Models, Large signal small signal FET Models- Scattering parameter device characterization. Impedance Matching using discrete components: Two component matching networks, Forbidden regions, Frequency response and Quality factor, T and Pi matching networks. Amplifier classes of operation and biasing networks: Classes of operation and efficiency of Amplifiers, Biasing networks for BJT, biasing networks for FET.

UNIT – V:

RF Transistor Amplifier, Oscillator and Mixer Design: Characteristics of Amplifiers- Amplifier power relations: RF source, Transducer power gain, Additional power relations. Stability considerations: Stability circles, unconditional stability, and stabilization methods. Unilateral and Bilateral design for constant gain, Noise figure circles, and constant VSWR circles. Basic oscillator Model: Negative resistance oscillator, Feedback oscillator Design, Design steps, Quartz Oscillators – Fixed frequency, High frequency Oscillator – Basic Characteristics of Mixers: Concepts, Frequency Domain Considerations, Single ended Mixer design, Single and Double balanced Mixers.

Suggested Readings:

1. Reinhold Ludwig, Pavel Bsetchko, *"RF Circuit Design—Theory and applications*", Pearson Education India, 2000.
2. Devendra K.Misra, "*Radio Frequency and Microwave communication circuits – Analysis and Design",* Wiely Student Edition – John Wiley & Sons, Inc.
3. Peter L.D. Abrif, *"Design of RF and Microwave Amplifiers and Oscillators*", Artech House, 2000.

PE 805 EC

WIRELESS SENSOR NETWORKS

(Professional Elective - VI)

Instruction: 3L hours per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives:

1. To *understand the fundamentals of wireless sensor networks and its application to critical real time scenarios.*
2. *To study the various protocols at various layers and its differences with traditional protocols.*
3. *To understand the issues pertaining to sensor networks and the challenges involved in managing a sensor network.*

Course Outcomes: *Student should be able*

1. To *understand the state-of-the-art in network protocols, architectures and applications*
2. *To Explain the Fundamental Concepts and applications of ad hoc and wireless sensor networks*
3. *To Describe the MAC protocol issues of Adhoc and sensor networks*
4. *To Discuss the WSN routing issues by considering QoS measurements*
5. *To understand the state-of-the-art techniques and protocols in QoS and Energy management for wireless* sensor networks.

UNIT - I

Introduction: Fundamentals of wireless communication technology, the electromagnetic spectrum radio propagation, characteristics of wireless channels, modulation techniques, multiple access techniques, wireless LANs, PANs, WANs, and MANs, Wireless Internet.

UNIT - II

Introduction to adhoc/sensor networks: Key definitions of adhoc/ sensor networks, unique constraints and challenges, advantages of ad-hoc/sensor network, driving applications, issues in adhoc wireless networks, issues in design of sensor network, sensor network architecture, data dissemination and gathering.

UNIT - III

MAC Protocols : Issues in designing MAC protocols for adhoc wireless networks, design goals, classification of MAC protocols, MAC protocols for sensor network, location discovery, quality, other issues, S-MAC, IEEE 802.15.4.

UNIT - IV

Routing Protocols: Issues in designing a routing protocol, classification of routing protocols, table-driven, on-demand, hybrid, flooding, hierarchical, and power aware routing protocols.

UNIT - V

QoS and Energy Management : Issues and Challenges in providing QoS, classifications, MAC, network layer solutions, QoS frameworks, need for energy management, classification, battery, transmission power, and system power management schemes.

Suggested Readings:

1. C. Siva Ram Murthy, and B. S. Manoj, *"AdHoc Wireless networks* ", Pearson Education - 2008.
2. Feng Zhao and Leonides Guibas, *"Wireless sensor networks* ", Elsevier publication - 2004.
3. Jochen Schiller*, "Mobile Communications",* Pearson Education, 2nd Edition, 2003.
4. William Stallings, *"Wireless Communications and Networks ",* Pearson Education – 2004
5. Holger Karl and Andreas Willing, *"Protocols and Architectures for Wireless Sensor Networks",* John Wiley and Sons, 2005.
6. Waltenegus Dargie and Christian Poellabauer, *"Fundamentals of Wireless Sensor Networks:Theory and Practice",* First Edition, John Wiley and Sons, 2010.

PE 806 EC

SOFTWARE DEFINED RADIO

(Professional Elective - VI)

Instruction: (3L) hours per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives:

1. *To provide fundamental concepts in SDR.*
2. *To explore the reconfigurable features of modern radio communication systems.*
3. *To demonstrate SDR on any DSPs and FPGAs.*

Course Outcomes: *Studentwill be able to*

1. *Understand the basic architecture and design principles of SDR.*
2. *Analyze the parameters of analog RF components as front-end block in implementation of SDR.*
3. *Understand the concepts of digital converter and frequency converter fundamentals.*
4. *Understand the digital hardware architectures and development methods.*
5. *Implement SDR on available hardware devices like DSPs and FPGAs.*

UNIT – I

Introduction to Software Defined Radio: A Traditional Hardware Radio Architecture, Signal Processing Hardware History, Software Defined Radio Project Complexity-Challenges and issues regarding the implementation of SDR.

UNIT – II

A basic software defined radio architecture transmission Lines: Introduction to 2G Radio Architectures, Hybrid Radio Architecture, Basic Software Defined Radio Block Diagram, System Level Functioning Partitioning, Digital Frequency Conversion Partitioning

UNIT – III

Signal Processing Hardware Components: Introduction to SDR Requirements for Processing Power DSPs, DSP Devices, DSP Compilers, Reconfigurable Processors, Adaptive Computing Machine FPGAs.

UNIT – IV

Software architecture and components: Introduction, Major Software Architecture Choices, Hardware –Specific Software Architecture, Software Standards for Software Radio, Software Design Patterns, Component Choices, Real Time Operating Systems, High Level Software Languages, Hardware Languages.

UNIT – V

Smart antennas using software radio:

Introduction, 3G smart Antenna Requirements, Phased Antenna Array Theory, Using Software Radio Principles to Antenna Systems, Smart Antenna Architectures, Optimum Combining/ Adaptive Arrays, DOA Arrays, Beam Forming for CDMA, Downlink Beam Forming.

Suggested Readings:

1. Paul Burns, "*Software Defined Radio for 3G",* Artech House, 2002
2. Tony J Rouphael, "*RF and DSP for SDR",* Elsevier Newnes Press, 2008
3. JoukoVanakka, *"Digital Synthesizers and Transmitter for Software Radio*", Springer, 2005

PE 807 EC

GRNSS AND AUGMENTATION SYSTEMS

(Professional Elective - VI)

Instruction: 3L hours per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives:

1. *To explain the basic principle of GPS and its operation.*
2. *To make the students to understand signal structure, errors, coordinate systems*
3. *To make the students understand the GPS navigation and observation files.*
4. *Highlight the importance of integrating GPS with other systems.*
5. *To demonstrate the principle of DGPS and to facilitate the various augmentation systems.*

Course Outcomes: ***Student will be able to***

1. *Understand the principle and operation of GPS.*
2. *Frame various coordinate systems for estimating position.*
3. *Estimate the various errors and their effect on position estimation.*
4. *Use GPS in various fields such as navigation, GIS etc.*
5. *Apply DGPS principle and can also analyze various augmentation systems.*

UNIT- I

GPS fundamentals: Trilaiteration, Transit, GPS Principle of Operation, Architecture: Space, Control and User Segments, Operating frequencies, Orbits, Keplerian elements.

UNIT- II

GPS and UTC Time, Signal structure, SPS and PPS services, C/A and P-Codes, Geometry of ellipsoid, geodetic reference system, Geoid and Ellipsoid and Regional datum : Earth Centered Earth Fixed (ECEF) and Earth Centered Inertial (ECI) Coordinate systems and World Geodetic System (WGS 84) datum, Types of receivers, Spoofing and Anti-spoofing.

UNIT- III

GPS Error Models: Ionospheric error, Tropospheric error, Ephemeris error, Clock errors, Satellite and receiver instrumental biases, Multipath; GPS Navigation and Observation data formats, Various DOPs.

UNIT- IV

GPS Modernization: Future GPS satellites, New signals and their benefits, New Control Segment, Principle of operation of DGPS, architecture and limitations, GPS Applications: Surveying Mapping Marine, air and land Navigation, Military and Space Application. GPS Integration with Geographic Information System (GIS), Inertial Navigation System (INS), Pseudolite and Cellular.

UNIT- V

Other GRNSS: GLONASS, GALILEO, QZNSS, CNSS and IRNSS System. Relative advantages of SBAS, SBAS features and Principle of operation of Wide area augmentation system (WAAS), GPS Aided GEO Augmented Navigation (GAGAN) and Ground Based Augmentation System (GBAS): Local Area Augmentation System (LAAS).

Suggested Readings:

1. Ahmed El-Rabbany, *"Introduction to GPS",* Artech House Publishers, 2/e, Boston 2006.
2. Elliot D Kaplan and Christopher J Hegarty, "*Understanding GPS principles and applications",* Artech House Publishers, 2/e Boston & London 2005.
3. B.Hofmann-Wellenhof, H.Lichtenegger, and J.Collins, *"GPS Theory and Practice,"* Springer Verlog, 5/e, 2008.

PE 808 EC

SATELLITE COMMUNICATION

(Professional Elective - IV)

Instruction: 3L hours per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives:

1. *To familiarize with basic concepts related to satellite Communication.*
2. *To understand Sub-Systems of Satellites and Launches.*
3. *To design the Earth Station antennas.*
4. *To know about the parameters affecting the Satellite System Performance.*
5. *To understand the applications of satellites.*

Course Outcomes: S*tudent will be*

1. *Able to have knowledge about the Satellite communications Principles and Properties.*
2. *Able to know about the Space craft subsystems and Launch vehicles.*
3. *Able to design the Satellite Earth station antennas*
4. *Able to analyze the effects of various parameters on Satellite System performance.*
5. *Able to understand the applications of Satellite Communication.*

UNIT–I

Origin of Satellite communications, A Brief History of Satellite Communication, Basic principlesand properties of satellite communication. Earth segment, Space segment, Interpretation of Kepler's Laws. Orbital Mechanics: The Equation of the Orbit, Describing the Orbit, Locating the Satellite inthe Orbit, Orbital effects in communication system Performance: Doppler shift, Range variation, Eclipse and Sun-Transit Outage.

UNIT– II

Space craft sub systems, Equipment Reliability and Space Qualification: Space Qualification, Reliability, and Redundancy, Satellite launch and launch vehicles and Mechanics of Launching a Synchronous Satellite.

UNIT– III

Earth Stations: Earth Station Design for Low System Noise Temperature, Design of large antennasand small earth station antennas. Low noise amplifiers and High power Amplifiers for Satellite communication.

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, Propagation on Satellite-Earth paths: Attenuation, depolarization, atmospheric absorption,

Tropospheric Multipath effects and Land and Sea Multipath, Multipath Effects in System Design,Faraday rotation in the Ionosphere, Ionospheric scintillations, Rain and ice effects.

UNIT– V

Satellite Navigation Applications: Global and Regional Satellite Navigation Systems-Operating Principles, Advantages, Limitations, Current Status and Applications, Remote Sensing Satellites

Suggested Readings:

1. Wilbur L. Pitchand and Henri G. Suyderhoud, Robert A. Nelson, "*Satellite CommunicationSystems Engineering",* 2nd edn.3rd Impression, Pearson Education.2008.
2. Timothy Pratt and Charles Nestian. W, "*Satellite Communication",* John Wiley and Sons, 1988.
3. Tri T. Ha, "*Digital Satellite Communication"*, Tata McGraw- Hill, Special Indian Edition 2009.

OE 801 BM

BASIC MEDICAL EQUIPMENT

(Open Elective - III)

Instruction: (3L) hours per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives:

1. *State the Physiological reasons for using a particular piece of Biomedical Equipment.*
2. *Describe the operating principles of a wide range of biomedical equipment.*
3. *To familiarize the latest technologies of modern medicine*
4. *To make learners able to use new and updated diagnostic methodologies*
5. *To make learners capable enough of adopting the methods of recovery and improvinghealth with a service approach*

Course Outcomes: *Student will be able to*

1. *Perform tests to assess the performance and safety of various Equipment's.*
2. *Learn the maintenance of biomedical equipment.*

UNIT – I

Medical Monitoring and recording: Patient monitoring: System concepts, bedside monitoring systems, central monitors, heart rate and pulse rate measurement. Temperature measurement Blood pressure measurement: Direct and indirect methods. Respiration rate measurement: Impedance pneumograph, Apnoea detectors. Ambulatory monitoring: Arrhythmia monitor, data recording, replay and analysis, Telemetry.

UNIT – II

Physiotherapy and Electrotherapy Equipment: Diathermy machines: Short wave diathermy, Microwave diathermy and ultrasonic diathermy Electro diagnostic/Therapeutic apparatus: Nerve muscle stimulator, Functional electrical stimulator etc.

UNIT – III

Medical Imaging Equipment:

X-Ray machines: Properties and production of X-Rays, X-ray machine, Image Intensifier. X-ray computed tomography: basic principle and construction of the components. Ultrasonic Imaging: Physics of ultrasonic waves, medical ultrasound, and basic pulse echo apparatus. Magnetic Resonance Imaging: Principle, Image reconstruction techniques, Basic NMR components, biological effects,Merits.

UNIT – IV

Critical care Equipment:

Ventilators: Mechanics of respiration, artificial ventilators, Positive pressure ventilator, Types and classification of ventilators. Drug delivery system: Infusion pumps, basic components, implantable infusion system, closed loop control in infusion pump. Cardiac Defibrillators: Need for defibrillators, DC defibrillator, Implantable defibrillators, Defibrillator analyzer.

UNIT – V

Therapeutic Equipment:

Cardiac pacemakers: Need for cardiac pacemakers, External and implantable pacemakers, types. Dialysis Machine: Function of kidney, artificial kidney, Dialyzers, Membranes, Hemodialysis machine. Lithotripters: The stone diseases problem, Modern Lithotripter systems, extra corporeal shockwave therapy.

Suggested Readings:

1. R.S.Khandpur, "*Hand Book of Biomedical Instrumentation"*, Tata McGrawHill, SecondEdition, 2014.
2. John G.Webster, "*Medical Instrumentation Application and design"*, Wiley India Edition,2009.

OE 802 CS

DATA SCIENCE USING R

(Open Elective - III)

Instruction: (3L) hours per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives:

1. *To learn basics of R Programming environment: R language, R- studio and R packages*
2. *To learn various statistical concepts like linear and logistic regression, cluster analysis,time series forecasting*
3. *To learn Decision tree induction, association rule mining and text mining*

Course Outcomes: *Student will be able to*

1. *Use various data structures and packages in R for data visualization and summarization*
2. *Use linear, non-linear regression models, and classification techniques for data analysis*
3. *Use clustering methods including K-means and CURE algorithm*

UNIT- I

Introduction to R: Introduction, Downloading and Installing R, IDE and Text Editors, HandlingPackages in R.

Getting Started with R: Introduction, Working with Directory, Data Types in R, Few Commands for Data Exploration.

Loading and Handling Data In R: Introduction, Challenges of Analytical Data Processing, Expression, Variables, Functions, Missing Values Treatment In R, Using 'As' Operator To Change The Structure Of The Data, Victors, Matrices, Factors, List, Few Common Analytical Tasks, Aggregation And Group Processing Of A Variable, Simple Analysis Using R, Methods For Reading Data, Comparison Of R GUI's For Data Input, Using R With Databases And Business Intelligence Systems.

UNIT- II

Exploring Data In R: Introduction, Data Frames, R Functions for Understanding Data in Data Frames, Load Data Frames, Exploring Data, Data Summary, Finding the Missing Values, Invalid Values and Outliers, Descriptive Statistics, Spotting Problems In Data with Visualization.

UNIT- III

Linear Regression Using R: Introduction, Model Fitting, Linear Regression, Assumptions of Linear Regression, Validating Linear Assumption.

Logistic Regression: Introduction, What Is Regression? Introduction to Generalized Linear Model, Logistic Regression, Binary Logistic Regression, Diagnosing Logistic Regression, Multinomial Logistic Regression Model.

UNIT- IV

Decision Tree: Introduction, What Is a Decision Tree? Decision Tree Representation In R, Appropriate Problems For Decision Tree Learning, Basic Decision Tree Learning Algorithm, Measuring Features, Hypothesis Space Search In Decision Tree Learning, Inductive Bias In Decision Tree Learning, Why Prefer Short Hypotheses, Issues In Decision Tree Learning.

Time Series in R: Introduction, What Is Time Series Data, Reading Time Series Data, Decomposing Time Series Data, Forecasts Using Exponential Smoothing, ARIMA Models.

UNIT- V

Clustering: Introduction, What Is Clustering, Basic Concepts in Clustering, Hierarchical Clustering, K-Means Algorithm, CURE Algorithm, Clustering in Non-Euclidean Space, Clustering for Streams and Parallelism.

Association Rules: Introduction, Frequent Item set, Data Structure Overview, Mining Algorithm Interfaces, Auxiliary Functions, Sampling from Transaction, Generating Synthetic Transaction Data, Additional Measures of Interestingness, Distance Based Clustering Transaction and Association.

Text Mining: Introduction, Definition of Text Mining, A Few Challenges in Text Mining, Text Mining Verses Data Mining, Text Mining In R, General Architectures of Text Mining Systems, Pre-Processing of Documents In R, Core Text Mining Operations, Using Background Knowledge for Text Mining, Text Mining Query Languages.

Mining Frequent Patterns, Associations and Correlations: Basic Concepts and Methods.Frequent Item set, Closed Item set And Association Rules.

Frequent Item set: Mining Methods, Pattern Evaluation Methods, and Sentiment Analysis

Suggested Readings:

1. Seema Acharya, "*Data Analytics using R",* McGraw Hill education.
2. Nina Zumel and John Mount, "*Practical Data Science with R"*, Manning Shelter Island.
3. Crawley, Michael J., " *The R book",* John Wiley & Sons, Ltd

OE 803 EC

INTERNET OF THINGS AND APPLICATIONS

(Open Elective - III)

Instruction: 3L hours per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives:

1. *To introduce the concepts of automation in daily life.*
2. *To familiarize the concepts of all IoT based communication systems.*
3. *To understand the importance of cloud technologies in the field of IoT.*
4. *To get familiar with standard embedded boards like Raspberry Pi.*
5. *To study a real time system with a view of an application program interface (API).*

Course Outcomes: *Student will be*

1. *Able to design IoT based solutions for given problem statements.*
2. *Able to develop programs for Raspberry Pi.*
3. *Able to demonstrate the functionality of cloud communication.*
4. *Able to analyze the technologies used in IoT.*
5. *Able to incorporate multiple sensors to develop an IoT based system.*

UNIT- I

Introduction to Internet of Things

Definition and Characteristics of IoT, Physical Design of IoT: Things in IoT,IoT protocols, Logical Design of IoT: IoT functional Blocks, Communication Models, APIs, IoT enabling TEchnologies: Wireless Sensor Networks, Cloud Computing, Big Data Analytics IoT Applications: Smart Home, Smart Cities, Smart Environment, Smart Energy, Smart Retail and Logistics, Smart Agriculture and Industry, Smart Industry and smart Health (Ref1)

UNIT- II

Internet Principles and communication technology

Internet Communications: An Overview – IP, TCP, IP protocol Suite, UDP. IP addresses – DNS, Static and Dynamic IP addresses, MAC Addresses, TCP and UDP Ports, Application Layer Protocols – HTTP, HTTPS, Cost Vs Ease of Production, Prototypes and Production, Open Source
Vs Closed Source. Prototyping Embedded Devices – Sensors, Actuators, Microcontrollers, SoC, Choosing a platform, Prototyping Hardware platforms – Arduino, Raspberry Pi. Prototyping the physical design – Laser Cutting, 3D printing, CNC Milling.

UNIT- III

API Development and Embedded programming

Getting started with API, Writing a new API, Real time Reactions, Other Protocols, Techniques
for writing embedded code: Memory management, Performance and Battery Life, Libraries, Debugging. Developing Internet of Things: IoT design Methodology, Case study on IoT System for weather Monitoring.

UNIT -IV

IoT Systems - Logical Design using Python

Introduction to Python, Data Types and Structures, Control Flow, Functions, Modules, Packages, File Hnadling, Date/Time Operations., Classes, and Python packages for IoT, IoT Physical Devices and Endpoints: Raspberry Pi, Interfaces of Pi, Programming pi with Python - Controlling LED and LDR using Pi with python programming.

UNIT- V

Cloud computing and Data analytics and IoT Product Manufacturing

Introduction to Cloud storage models and Communication APIs, Amazon webservices for IoT, Skynet IoT Messaging Platform. Introduction to Data Analytics for IoT (Ref 1). Case studies illustrating IoT Design – Smart Lighting, Weather Monitoring, Smart Irrigation.(Ref 1) Business model for IoT product manufacturing, IoT Startups, Mass manufacturing, Ethical issues in IoT.

Suggested Readings:

1. Vijay Madisetti , ArshdeepBahga, "*Internet of Things (A Hands-on-Approach)",* VPT Publisher, 1st Edition, 2014
2. Adrian McEwen (Author), Hakim Cassimally", *"Designing the Internet of Things",* Wiley India Publishers
3. Kenneth A Lambert and B.L. Juneja*, "Fundamentals of Python*", Cenage Learning

OE 804 EC
GLOBAL AND REGIONAL SATELLITE NAVIGATION SYSTEM
(Open Elective - III)

Instruction: (3L) hours per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives:

1. *To explain the basic principle of GPS and its operation.*
2. *To make the students to understand signal structure.*
3. *To make the students understand the GPS errors.*
4. *Highlight the importance of integrating GPS with other systems.*
5. *To make the students understand about various GRNSS.*

Course Outcomes: *Student will be*

1. *Able to understand the principle and operation of GPS.*
2. *Able to understand the GPS Signal structure and services.*
3. *Able to understand about various errors.*
4. *Able to use of GPS in various fields such as navigation, GIS etc.*
5. *Able to understand principle of Operation of various GRNSS.*

UNIT- I

Introduction to Satellites, their properties, Orbits and Launch vehicles, Kepler's Laws, GPS fundamentals: Principle of Trilaiteration, Transit, GPS Operating Principle, And Architecture: Space, Control and User Segments and its Frequencies.

UNIT- II

GPS Signal structure: C/A and P-Codes, SPS and PPS services, GPS Coordinate Systems: Significance, Types of GPS receivers, Selective Availability, Spoofing and Anti-spoofing.

UNIT- III

GPS Errors: Ionospheric error, Tropospheric error, Ephemeris error, Clock errors, Satellite and receiver instrumental biases, Multipath; Dilution of Precision (DOP).

UNIT- IV

GPS Modernization: Future GPS satellites, New signals and their benefits, New Control Segment, Principle of operation of DGPS, architecture and limitations, GPS Applications: Surveying Mapping Marine, air and land Navigation, Military and Space Application. GPS Integration with Geographic Information System (GIS), Inertial Navigation System (INS), Pseudolite and Cellular.

UNIT- V

Other GRNSS: GLONASS, GALILEO, QZNSS, CNSS and IRNSS System: Principle of Operation, Features and their Current Status.

Suggested Readings:

1. Ahmed El-Rabbany, "*Introduction to GPS"*, Artech House Publishers, 2/e, Boston 2006.
2. Elliot D Kaplan and Christopher J Hegarty," *Understanding GPS principles and applications*", Artech House Publishers, 2/e Boston & London 2005.
3. B.Hofmann-Wellenhof, H.Lichtenegger, and J.Collins, "*GPS Theory and Practice,"* Springer Verlog, 5/e, 2008.

OE 805 EE

APPLICATIONS OF ELECTRICAL ENERGY

(Open Elective - III)

Instruction: (3L) hours per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives:

1. *To introduce the students and understand Utilization of electrical energy for various applications like industrial heating.*
2. *To understand various techniques of electric welding and types of batteries.*
3. *To understand the concept of illumination, and know the applications of various lamps to factory lighting, street lighting etc.*
4. *To understand the concept of electric traction including speed – time curves of different traction services.*
5. *To understand systems of train lighting.*

Course Outcomes: *Student will be*

1. *Identify a suitable heating scheme for a given application.*
2. *Identify proper welding technique and various characteristics of batteries.*
3. *Classify types of electric light sources based on nature and operation and their objectives, performance and reliability.*
4. *Determine the speed-time characteristics of various traction services and also estimate the energy consumption levels at various modes of operation.*
5. *Select proper train lighting scheme.*

UNIT-I

Industrial Heating: Advantages and methods of electric heating. Description, operation and performance of resistance ovens, Design of heating element. High frequency heating, Induction Heating, Induction furnaces, Core type, Coreless furnaces, Dielectric heating. Electric Arc furnaces, Direct Arc furnace, Indirect Arc furnaces.

UNIT- II

Electric welding: Classification of electric welding, welding transformer and its rating, various types of Electric arc welding and electric resistance welding.

Batteries: Lead acid batteries, SMF batteries, Construction and maintenance, Charging and rating of batteries.

UNIT- III

Illumination: Introduction, nature and production of light, Sensitivity of the eye, Units of light. The inverse square law and cosine law, Solid angle, Lighting calculations, Determination of M.S.C.P, Rousseau's construction, Discharge lamps, Sodium vapour lamps, Mercury vapour

lamps, Fluorescent lamp, Starting and power factor corrections, Stroboscopic effects, Neon signs, Application to factory lighting, Street lighting and Flood lighting.

UNIT- IV

Electric Traction: System of Electric Traction, Transmission of drive, Systems of track electrification, Traction mechanics, Speed time curves, Tractive effort, Power of Traction motor, specific energy consumption, Mechanics of train movement, Coefficient of adhesion.

UNIT – V

Train Lighting: Systems of train lighting, special requirements of train lighting, Methods of obtaining unidirectional polarity, Methods of obtaining constant output, Single battery system, double battery parallel block system, Principal equipment of double battery system, Coach wiring, Dynamo.

Suggested Reading:

1. Partab H, *"Art and Science of Utilization of Electric Power",* Dhanpat Rai & Sons, 1997.
2. K.B. Raina & S.K. Bhattacharya, *"Electrical Design, Estimating 1. and Costing*", Wiley Eastern Ltd., 1991.
3. Partab H, "*Modern Electric Traction",* Dhanpat Rai & Sons, 2000.
4. B.L.Theraja, *"A Text Book of Electrical Technology",* S.Chand & Company Ltd, Vol-I.

OE 806 ME

COMPOSITE MATERIAL APPLICATIONS

(Open Elective - III)

Instruction: (3L) hours per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives:

1. *To know the properties of fiber and matrix materials used in composites, as well as somecommon manufacturing techniques.*
2. *To know the various moulding process and architecture of composite laminates*
3. *To know how to estimate the laminate properties from lamina properties.*
4. *To understand the strength of an orthotropic lamina and measurement of basic compositeproperties.*

Course Outcomes: *Student will be able to*

1. *Understand the distinction of composites, its advantages, classification and applications*
2. *Predict the properties of composite lamina and laminate*
3. *Understand the testing of composites and design the structure using the appropriatedesign criteria.*

UNIT- I

Introduction to composite materials, general characteristics, Fibres, Matrix materials, interfaces, polymer matrix composites, metal matrix composites, ceramic matrix composites, carbon fibre composites.

UNIT- II

Molding Processes: hand layup, vacuum molding, compression molding, pultrusion molding, centrifugal molding, filament winding, prepegs and molding compounds and architecture of composite materials: laminates, sandwich composites and other architectures.

UNIT- III

Micromechanics of Composites: Mechanical properties: Production of Elastic constant, micromechanical approach, Halpin-Tsal equations, Transverse stresses. Thermal properties: Hydrothermal stresses, mechanics of load transfer from matrix to fibre.

UNIT- IV

Micromechanics of Composites: Elastic constants of a lamina, relations between engineering constants and reduced stiffness and compliances, variation of lamina properties with orientation, analysis of laminated composites, stresses and strains with orientation.

UNIT- V

Strength of an orthotropic lamina: Maximum stress theory, maximum strain criteria, maximum work (Tsai-Hill) criterion, quadratic interaction criteria. Designing with composite materials. Measurement of constituent material properties: Fibre tests, Matrix tests. Measurement of basic composite properties: Tensile test, compressive test, a plane shear test, interlaminar shear test, flexure test.

Suggested Readings:

1. Jones, R.M., *"Mechanics of Composite Materials",* McGraw Hill Co., 1967.
2. Ronald F. Gibson, "*Principles of Composite Materials Mechanics*", McGraw-Hill, Inc., 1994.
3. Krishan, K. Chewla, "*Composite Material*", Springer - verlag, 1987.
4. Carl. T. Herakovich, *"Mechanics of Fibrous Composites*", John Wiley Sons Inc., 1998.

PW 861 EC

PROJECT STAGE - II

Instruction: 12 weeks *Duration of SEE: ....*
CIE: 50 marks *SEE: 100 marks*
Credits: 6

Course Objectives:

1. *To enhance practical and professional skills.*
2. *To familiarize tools and techniques of systematic Literature survey and documentation*
3. *To expose the students to industry practices and team work.*
4. *To encourage students to work with innovative and entrepreneurial ideas*

Course Outcomes:

1. *demonstrate the ability to synthesize and apply the knowledge and skills acquired in theacademic program to real-world problems*
2. *evaluate different solutions based on economic and technical feasibility*
3. *effectively plan a project and confidently perform all aspects of project management*
4. *Demonstrate effective written and oral communication skills*

The aim of project work –II is to implement and evaluate the proposal made as part of project – I. Students can also be encouraged to do full time internship as part of project work-II based onthe common guidelines for all the departments. The students placed in internships need to write the new proposal in consultation with industry coordinator and project guide within two weeks from the commencement of instruction.

The department will appoint a project coordinator who will coordinate the following:

1. Re-grouping of students - deletion of inters hip candidates from groups made as partof project work-I
2. Re-Allotment of internship students to project guides
3. Project monitoring at regular intervals

All re-grouping/re-allotment has to be completed by the 1nd week of VIII semester so that students get sufficient time for completion of the project.

All projects (internship and departmental) will be monitored at least twice in a semester through student presentation for the award of sessional marks. Sessional marks are awarded by a monitoring committee comprising of faculty members as well as by the supervisor. The first review of projects for 25 marks can be conducted after completion of five weeks. The second review for another 25 marks can be conducted after 12 weeks of instruction.

Common norms will be established for the final documentation of the project report by the respective departments. The students are required to submit draft copies of their project report within one week after completion of instruction.

Note: Three periods of contact load will be assigned to each project guide.

PW 862 EC

SELF STUDY PROJECT

Instruction: 4 hours per week *Duration of SEE:*
CIE: 50 marks *SEE:*
Credits: 2

Course Objectives:

1. *Understanding real life problems*
2. *Problem solving techniques*
3. *Working independently*
4. *Drawing conclusions from analysis*
5. *Data interpretation & presentation skills*

Course Outcomes: *Student will be able to*

1. *Use of library, literature review*
2. *Hunting/ Understanding the problem of social relevance / practical importance*
3. *Learn data analysis/ synthesis*
4. *Learn to choose right path/ optimum solutions*
5. *Learn presentation (Oral/technical/professional writing skills)*

Procedure:

1. Student will choose problem on his/her own depending on his/her interest
2. Department will designate one coordinator in each semester for this course
3. Student will choose on their own, their mentor, who can be from department/ from other department or outside college (from industry/National organisations)
4. Topic need not be in ECE. It can be from any discipline but should have social relevance/practical importance.
5. Student will carry out work on his/her own by carrying out systematic literature survey, data/information collection, hence identify the problem.
6. Analyse/synthesis the data/information, choose proper tool/technique to solve the problem.
7. Should be able to interpret data and draw concrete conclusions.
8. Should write professional/technical report (Max. 50 pages per semester) giving all details, references, conclusion, and scope for future work, underline importance of the work carried out.
9. Will present his work before mentor/HOD/one examiner (from sister department)
10. Marks to be awarded by examining report and performance in defence (Viva) to be conducted by mentor and external examiner (from other department)

Self-Study project will be carried out independently by each student (not in group). If a single big problem is identified, three or four students can attempt, but activity of each student will be separate, report will be separate.