

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
Course Structure for B.Tech ECE w.e.f AY: 2020-21
SEMESTER I

Subject Code	Category	Course Title	Contact Periods per week				Credits	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total marks
20MA1001	BS	Algebra and Calculus	3	1	0	4	4	40	60	100
20PH1001	BS	Applied Physics	3	0	0	3	3	40	60	100
20ES1001	ES	Problem Solving and Programming	3	0	0	3	3	40	60	100
20EN1001	HS	English	2	0	0	2	2	40	60	100
20PH1501	BS	Applied Physics Lab	0	0	3	3	1.5	40	60	100
20EN1501	HS	English Language Lab	0	0	3	3	1.5	40	60	100
20ES1502	ES	Electronics and Communication Engineering Workshop	0	0	2	2	1	40	60	100
20ES1505	ES	Engineering and IT Workshop	0	0	4	4	2	40	60	100
20ES1506	ES	Problem Solving and Programming Lab	0	0	3	3	1.5	40	60	100
20MC8001	MC	Mandatory course I	Induction Program							
		Counselling/Mentoring	0	0	1	1	0	--	--	--
		Sports/Hobby Clubs/Activities	0	0	2	2	0	--	--	--
		Activity Point Programme	During the Semester					20 Points		
		Total	11	1	18	30	19.5	360	540	900

NARAYANA ENGINEERING COLLEGE:: GUDUR

20MA1001	ALGEBRA & CALCULUS							R-2020
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
I	3	1	0	64	4	40	60	100

Pre-requisite: Intermediate Mathematics

Course Objectives:

1. To familiarize the students with the theory of matrices and quadratic forms
 2. To analyze first order ordinary differential equations.
 3. To enlighten the learners in the concepts of higher order differential equation and its applications
 4. To explain the series expansions using mean value theorems and the concepts of multivariable differential calculus.
 5. To summarize the procedure to solve the partial differential equations.
5. To explain the student with mathematical tools needed in evaluating multiple integrals and its applications.

Course Outcomes: After successful completion of the course, the student will be able to **Blooms taxonomy Level**

CO 1 Solve the system of Linear Equations **(BL-3)**

CO 2 Solve first order differential equations utilizing the standard techniques for separable, exact, linear, homogeneous, or Bernoulli cases. **(BL-3)**

CO 3 Obtain the complete solution of a higher order differential equations **(BL-2)**

CO 4 Make use of the Taylor's and Maclaurin's Series and Maxima, Minima for the given function **(BL-3)**

CO 5 Apply a range of techniques for solutions of first order Linear and non linear Partial Differential Equations (PDE) **(BL-3)**

CO 6 Apply the techniques of Multiple integrals for the Area of the region bounded by curves and volume **(BL-3)**

CO-PO Mapping														
CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2												
CO2	3	3	1											
CO3	3	3	1											
CO4	3	2												
CO5	3	3	1											
CO6	3	2												

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1 MATRICES

14 h

Introduction to matrices, Definition of Rank ,Definition of Echelon form , Problems, Solving System of Non-Homogeneous equations- Definition, Conditions for Consistency, Problems, Solving System of Homogeneous equations- Definition, Problems, Eigen values & Eigen Vectors- Definition, Problems ,properties of Eigen values & Eigen Vectors(Without proof), Cayley – Hamilton Theorem -Statement(Without proof),finding inverse and power of a matrix by Cayley-Hamilton Theorem, Diagonalization of a Matrix-Definition, similarity of a matrix ,modal matrix, spectral matrix,powers of a matrix, problems on Diagonalization of a matrix, Quadratic Forms- Definition, Finding Matrix from Q.F, Index, signature, rank and nature of the quadratic forms, Reduction of Q.F. into a canonical form by linear transformation , Reduction of Q.F. into a canonical form by orthogonal transformation.

At the end of the Module 1, students will be able to:

1. Solve the system of homogenous and non-homogenous linear equations.(BL-3)
2. Obtain the Eigen values and Eigen vectors of a matrix.(BL-2)
3. Identify special properties of matrix and for using this information to study the nature of the linear equations. (BL-3)
4. Find the inverse and powers of a square matrix.(BL-1)
5. Obtain the diagonalization form of the matrix.(BL-2)

MODULE -2 FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS 9h

Exact Differential equation - Definition, condition for exactness, problems, Non - Exact Differential equations- Integrating factor , Method1: Integrating factor by inspection, problems, Method2: Finding Integrating factor , problems, Method3: Finding Integrating factor , problems, Method4: Finding Integrating factor , problems, Method5: Finding Integrating factor , problems, Linear differential Equation- Definition, Working rule to find general solution, problems, Bernoulli's differential Equation- Definition, Working rule to find general solution, problems, Applications of Differential equation of First order: Newton's law of Cooling-Explanation of the concept, problems, Law of natural growth and Decay- Explanation of the concept, problems and Simple Electric Circuits-Explanation of the concept, problems.

At the end of the Module 2, students will be able to:

1. Identify the first order ordinary differential equations. (BL-3)
2. Solve the first order ordinary differential equations. (BL-3)
3. Apply the techniques of first order ordinary differential equations in Newton's law of cooling, Natural growth & Decay problems. (BL-3)

MODULE-3 HIGHER ORDER ORDINARY DIFFERENTIAL EQUATIONS 10h

Non-Homogenous Linear Differential equation of second and higher order with constant coefficients-Definition, complete solution, operator D, rules for finding Complimentary function, problems, inverse operator, General method for finding Particular Integral.

Non-homogeneous Linear Differential Equations of Second & Higher order with Constant coefficients with RHS term of the type e^{ax} , $\sin ax$, $\cos ax$, Polynomial in X, $e^{ax}v(x)$, X.V(x)-Explanation of the concept & problems, Method of variation of parameters- Explanation of the concept & problems, Euler- Cauchy equation- Definition, problems ,Legendre's Linear equation- Definition, problems. Applications to Higher order Differential Equations - L-C-R circuits, problems.

At the end of the Module 3, students will be able to:

1. Identify the higher order ordinary differential equations. (BL-3)

2. Solve the linear differential equations with constant coefficients by appropriate methods. (BL-3)
3. Solve the linear differential equations with variable coefficients by appropriate methods.(BL-3)
4. Make Use of the higher order ordinary differential equations techniques in electrical circuits. and in various engineering problems. (BL-3)

MODULE-4 MEAN VALUE THEOREMS & MULTIVARIABLE CALCULUS 9h

Taylor's and Maclaurin's theorems with remainders-Statements (without proof), problems on Taylor's series , problems on Maclaurin's series, Jacobean-Definition, Properties , problems ,Functional dependence-Definition , problems ,Maxima & Minima of function of two variables - Rules , Maxima & Minima of function of two variables without constraint- problems ,Maxima & Minima of function of two variables with constraint- problems, Lagrange's Method of Undetermined multipliers, problems.

At the end of the Module 4, students will be able to:

1. Demonstrate the given function as a series of Taylor's and maclurin's with remainders.(BL-2)
2. Illustrate series expansions of functions using mean value theorems. (BL-2)
3. Apply Jacobean concept to deal with problems in change of variables.(BL-3)
4. Obtain the maxima and minimum values of the function for two variables.(BL-2)

MODULE-5 PARTIAL DIFFERENTIAL EQUATIONS 11h

Definition ,Formation of PDE by the Method of Elimination of arbitrary constants, problems ,Method of Elimination of arbitrary functions, problems, Method of Separation of Variables-Explanation of the concept& problems, First order linear partial differential equations-Definition, Solutions of first order linear PDE-Working rule of Lagrange's Method, problems ,First order non-linear partial differential equations- Definition, Solutions of first order non-linear partial differential equations-Standard form-I, problems , Standard form-II, problems ,Standard form-III, problems, Standard form-IV, problems.

At the end of the Module 5, students will be able to:

1. Identify the basic properties of partial differential equations. (BL-3)
2. Outline partial differential equations. (BL-2)
3. Solve the applications of PDE by using the method of separation of variables (BL-3)

MODULE-6 MULTIPLE INTEGRALS 11h

Double Integrals- Introduction, Evaluation in Cartesian coordinates, problems, Evaluation in Polar coordinates, change of variables – Problems on Cartesian to Polar, Change of Order of Integration- Problems , Area enclosed by plane curves - Problems, Triple integrals- Introduction, Evaluation of Triple Integrals, Volume by Triple Integrals – Problems, Change of variables between Cartesian, cylindrical and spherical polar coordinates- Problems.

At the end of the Module 6, students will be able to:

1. Obtain double integrals in Cartesian and polar co-ordinates. (BTL-2)
2. Obtain the area bounded by a region using double integration techniques.(BTL-2)
3. Solve triple integrals.(BTL-3)
4. Obtain volumes by using triple integrals.(BTL-2)

Total hours: 64 hours

Text Book(s):

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.
2. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017
3. N. Bali, M. Goyal, C. Watkins, Advanced Engineering Mathematics, Infinity Science Press.

NARAYANA ENGINEERING COLLEGE :: GUDUR

20PH1001 Semester	Hours / Week			APPLIED PHYSICS			R2020	
	L	T	P	Total hrs	Credit	Max Marks		TOTAL
					C	CIE	SEE	
I	3	0	0	48	3	40	60	100

Pre-requisite: Fundamental concepts of Physics

Course Objectives:

1. To identify the importance of the optical phenomenon i.e. interference and diffraction related to its Engineering applications
2. To enable the students in understanding the importance of quantum physics
3. To learn the dynamics of free electrons in metals by applying Free electron theories on metals.
4. To explain and provide the knowledge about semiconductors
5. To teach the concepts related to superconductivity & nanomaterials which leads to their fascinating applications.
6. To impart knowledge in basic concepts of LASERs along with its Engineering applications.

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

- CO 1** Explain optical phenomenon i.e. interference, diffraction using Huygen's wave theory.
- CO 2** Comprehend and explain the concepts of matter waves, wave functions and its interpretation to understand the matter at atomic scale.
- CO 3** Comprehend Free electron theories on metals and apply them to learn the dynamics of free electrons in metals
- CO 4** Compute carrier concentration in semiconductors and to understand carrier transport mechanism in semiconductors
- CO 5** Understand the concepts of superconductors and nanomaterials to familiarize their applications in relevant fields.
- CO 6** Realize importance of LASERs in Engineering and Medical applications.

Reference Book(s):

1. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002.
2. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 13/e, Pearson Publishers, 2013.
3. B. V. Ramana, Higher Engineering Mathematics, Mc Graw Hill Education
4. H. K. Das, Er. Rajnish Verma, Higher Engineering Mathematics, S. Chand.

CO-PO Mapping														
CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	1									2		
CO2	3	2										2		
CO3	2	2										1		
CO4	3	2										2		
CO5	3	2				1						2		
CO6	3	2				1						2		
1: Low, 2-Medium, 3- High														

COURSE CONTENT

MODULE – 1 WAVE OPTICS

9h

Interference-Principle of Superposition, Interference of light, Conditions for sustained Interference ,derivation of conditions for constructive and destructive interference of reflected light from a thin film, Newton's Rings-experimental arrangement, Determination of Wavelength; Engineering applications of Interference

Diffraction-distinction between interference and diffraction, differences between Fresnel & Fraunhofer diffractions, Fraunhofer Diffraction at single slit(derivation, energy distribution curve) , Fraunhofer Diffraction at a Double slit (derivation, energy distribution curve), Theory of Diffraction Grating -Determination of Wavelength; Engineering applications of diffraction

At the end of the Module 1, students will be able to:

1. explain the need of coherent sources and the conditions for sustained interference (BL2)
2. describe the theory of interference of reflected light from a thin film (BL2)
3. explain the theory of Fraunhofer Diffraction of light at single and multiple slits (BL2)
4. identify engineering applications of interference and diffraction (BL3)
5. analyze the differences between interference and diffraction (BL4)

MODULE -2 INTRODUCTION TO QUANTUM MECHANICS

8h

Matter waves -de-Broglie hypothesis - properties, G.P. Thomson experiment, Phase and group velocities— Expression for group velocity; Heisenberg's uncertainty principle; Schrodinger's time dependent and independent wave equations – Physical significance of wave function-important characteristics of wave function, free particle energy, wave function, momentum; operators and expectation values, Eigen values and Eigen functions of a particle confined to one dimensional infinite square well (potential well).

At the end of the Module 2, students will be able to:

1. understand the concept of matter waves (BL2)
2. Recognize the difference between phase velocity and group velocity (BL2).
3. understand Physical significance of wave function (BL2)
4. Identify the importance of Schrodinger's wave equation in describing the motion of Elementary particles (BL3) .

MODULE-3 FREE ELECTRON THEORY OF METALS

8 h

Classical free electron theory-assumptions, expression for electrical conductivity, merits and demerits; Quantum free electron theory of metals-expression for electrical conductivity; Fermi-Dirac distribution, Mathiessen rule, causes of electrical resistance in metals, Bloch's theorem (Qualitative), Kronig - Penny Model (Qualitative), effective mass and Brillouin zones, Classification of solids into conductors, semiconductors and insulators based on energy band gap.

At the end of the Module 3, students will be able to:

1. Explain classical, Quantum free electron theory of metals (BL2).
2. Apply these theories to explain electrical conductivity in metals (BL3)
3. Explain formation of energy bands in solids (BL2) .
4. Understand the band structure of a solid and Classify materials as metals, insulators, or Semiconductors, and sketch a schematic band diagram for each one (BL2).

MODULE-4 INTRODUCTION TO SEMICONDUCTORS

8 h

Origin of energy bands , Intrinsic semiconductors - density of charge carriers(derivation), Fermi energy , Electrical conductivity; extrinsic semiconductors - P-type & N-type , Density of charge carriers , Dependence of Fermi energy on carrier concentration and temperature; Direct and Indirect band gap semiconductors, Hall effect- Hall coefficient (derivation), Applications of Hall effect ; Drift and Diffusion currents , Einstein coefficients, Continuity equation(derivation) , Applications of Semiconductors.

At the end of the Module 4, students will be able to:

1. Outline the properties of n-type and p-type semiconductors (BL2).
2. Interpret the direct and indirect band gap semiconductors (BL2).
3. Identify the type of semiconductor using Hall effect (BL3).
4. Identify applications of semiconductors in electronic devices (BL3)

MODULE-5 SUPERCONDUCTORS AND NANOMATERIALS

8 h

Superconductors- Properties, Meissner's effect, BCS Theory, Josephson effect (AC & DC), Types of Superconductors, Applications of superconductors. Nano materials – Significance of nanoscale, Properties of nanomaterials: Physical, mechanical, Magnetic, Optical; Synthesis of nanomaterials: Top-down-Ball Milling, Bottom-up – Chemical vapour deposition; Applications of Nano materials.

At the end of the Module 5, students will be able to:

1. Explain how electrical resistivity of solids changes with temperature (BL2)
2. Classify superconductors based on Meissner's effect (BL2)
3. Explain Meissner's effect, BCS theory & Josephson effect in superconductors (BL2)
4. Identify the nano size dependent properties of nanomaterials (BL3)
5. Illustrate the methods for the synthesis and characterization of nanomaterials (BL2)
6. Apply the basic properties of nanomaterials in various Engineering branches (BL3)

MODULE-6 LASERS & OPTICAL FIBERS

7 h

Lasers: Spontaneous & stimulated emission of radiation, Population inversion, Pumping methods, Properties of lasers- monochromaticity, coherence, directionality, brightness, Types of lasers: Nd-YAG Laser, He-Ne Laser, Semiconductor laser; Applications.

Introduction to Optical Fibers- Total Internal Reflection- Critical angle of propagation- Acceptance angle- Numerical Aperture- Classification of fibers based on Refractive index profile- advantages of optical fibres.

At the end of the Module 6, students will be able to:

1. describe Spontaneous & stimulated emission of radiation (BL2)
2. Understand the basic concepts of LASER light Sources (BL2)
3. describe the construction and working of different types of Lasers (BL2)
4. identify the applications of lasers in various fields (BL3)

Text Book(s):

1. M. N. Avadhanulu, P.G. Kshirsagar & TVS Arun Murthy "A Text book of Engineering Physics"- S. Chand Publications, 11th Edition 2019.
2. B.K. Pandey and S. Chaturvedi, Engineering Physics, Cengage Learning, 2012.
3. S.O. Pillai, "Solid State Physics", 8th edition, New Age International Publishers, 2018.

Reference Book(s):

1. Shatendra Sharma, Jyotsna Sharma, "Engineering Physics", Pearson Education, 2018

2. Subrahmanyam, BrijLal, *A Textbook of Optics*, S. Chand, New Delhi, 2015
3. Kittel, C. —Introduction to Solid State Physics||. Wiley, 2005.
- 4.. K. Thyagarajan, *Engineering Physics*, McGraw-Hill Education (India) Pvt. Ltd, 2016.
5. AjoyGhatak, *Optics*, 5th Edition, McGraw Hill, 2012
- 6.O. Svelto, “Principles of Lasers”, Springer Science & Business Media, 2010.
- 7.William T. Silfvast, “Laser Fundamentals” 2nd edition, Cambridge University Press, 2004.
8. T. Pradeep, “A Text Book of Nanoscience and Nanotechnology”, Tata Mc Graw Hill, 2003

NARAYANA ENGINEERING COLLEGE:GUDUR

20ES1001	PROBLEM SOLVING AND PROGRAMMING						R20
Semester	Hours / Week			Total hrs	Credit	Max Marks	
	L	T	P		C	CIE	SEE
I	3	0	0	48	3	40	60
							TOTAL
							100

Pre-requisite: Mathematics Knowledge, Analytical and Logical skills

Course Objectives:

1. To understand various steps in Program development.
2. To understand the basic concepts in C Programming Language.
3. To learn how to write modular and readable C Programs.
4. To learn the syntax and semantics of a C Programming language.
5. To learn structured programming approach for problem solving.

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

- CO 1** Identify methods to solve a problem through computer programming. (BL - 3)
- CO 2** Understand the use of basic elements of C language. (BL - 2)
- CO 3** Understand the difference and the usage of various control statement. (BL - 2)
- CO 4** Apply the modular approach for solving the problems. (BL - 3)
- CO 5** Apply the Arrays and Pointers for solving problems. (BL - 3)
- CO 6** Explain User-Defined Data Types and Files. (BL - 2)

CO-PO Mapping														
CO	PO												PSO	
	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3											1	
CO2	1	2	1										1	
CO3	1	2	1		2								2	2
CO4	2	2	3	2	1							2	3	2
CO5	3	3	2	2								1	2	
CO6	2	2	2	2								1	2	
1: Low, 2-Medium, 3- High														

COURSE CONTENT

MODULE – 1 FUNDAMENTALS OF COMPUTERS AND PROGRAMMING 8h

Fundamentals of computers:History of Computers, Generations of Computer, The Computer System - The Input-Process-Output Concept, Components of Computer System, Operating System - Introduction, Objectives, Functions.

Introduction to Programming, Algorithms and Flowcharts:Programs and Programming, Programming languages, Compiler, Interpreter, Structured Programming Concept, Algorithms, Flowcharts, How to Develop a Program.

Fundamental Algorithms: Exchanging the values of Two Variables, Counting, Summation of a set of numbers, Factorial computation, Generation of the Fibonacci Sequence, Reversing the digits of an integer. At the end of the Module 1, students will be able to:

1. Illustrate the working of a Computer. (BL - 2)
2. Solve problems using language independent notations. (BL - 3)
3. Understand the compilers and interpreters. (BL - 2)
4. Understand Structured Programming. (BL - 2)
5. Develop algorithms and flowcharts for problems.(BL - 3)

MODULE -2 BASIC ELEMENTS OF C

7 h

Basics of C: Introduction, Character Set, Structure of a C Program, A Simple C Program, Variables, Data Types and Sizes, Declaration, How does The Computer Store Data in Memory, Identifiers, Keywords, Constants, Assignment, and Initialization.

Operators and Expressions: Arithmetic Operators, Relational Operators, Logical Operators, Bitwise Operators, Conditional Operator, Comma operator, sizeof operator, Expressions, L values and R values, Expression Evaluation- Precedence and Associativity, Type Conversion.

At the end of the Module 2, students will be able to:

1. Understand the basic structure of a program in C. (BL - 2)
2. Understand tokens in C language.(BL - 2)
3. Illustrate the working of expressions.(BL - 2)
4. Understand the precedence and Associativity rules of operators. (BL - 2)
5. Understand the rules of type conversion. (BL - 2)

MODULE-3 DATA INPUT / OUTPUT AND CONTROL STATEMENTS

8 h

Input and Output: Basic Screen and Keyboard I/O in C, Formatted Input and Output, Unformatted Input and Output Functions

Control Statements:Selection Statements - if, Nested if, if-else, Nested if-else, else-if ladder, switch Looping Statements - while, do-while, for, Nested loops, Unconditional Statements - goto, break, continue, return.

At the end of the Module 3, students will be able to:

1. Explain the Formatted and Unformatted I/O functions. (BL - 2)
2. Understand Selection Statements. (BL - 2)
3. Understand Looping Statements. (BL - 2)
4. Explain Unconditional Statements. (BL - 2)

MODULE-4 FUNCTIONS AND PROGRAM STRUCTURE

8 h

Functions: Introduction, Using Functions, Passing Arguments to a Function, Working with Function, Scope and Extent, Recursion, The C Preprocessor.

Program Structure: Storage classes, Automatic variables, External variables, Static variables, Register variables, Multifile programs.

At the end of the Module 4, students will be able to:

1. Understand the basic concept of functions. (BL - 2)
2. Understand concept of Recursion and Preprocessor. (BL - 2)
3. Explain storage specifiers. (BL - 2)

MODULE-5**ARRAYS AND POINTERS****9 h**

Arrays and Strings: Introduction, One-Dimensional Array, Multidimensional Arrays, Passing Arrays to Function, Strings - Declaration, Initialization, Printing Strings, String Input, Character Manipulation, String Manipulation, Arrays of Strings.

Pointers: Fundamentals, Pointer Declarations, Operations on pointers, Passing Pointers to a Function, Pointers and Arrays, Arrays of Pointers, Pointer to Pointer, Pointer to Functions, Command line arguments, Dynamic Memory Management.

At the end of the Module 5, students will be able to:

1. Understand the concept of Arrays. (BL - 2)
2. Understand the concept of pointers. (BL - 2)
3. Explain Dynamic Memory Management. (BL -2)

MODULE-6**USER-DEFINED DATA TYPES AND FILES****8 h**

Structures and Unions: Basics of Structures, Nesting of Structures, Arrays of Structures, Structures and Pointers, Structures and Functions, Self-Referential Structures, Unions, Bit-fields, Enumerations, typedef.

Files: Introduction, Using Files in C, Working with Text Files, Random Accesses to Files of Records.

At the end of the Module 6, students will be able to:

1. Explain user defined data types. (BL - 2)
2. Understand the concept of Self-Referential Structures. (BL - 2)
3. Understand the working of files. (BL - 2)

Total hours:**48 Hours****Text Book(s):**

1. Pradip Dey, and Manas Ghosh, "Programming in C", 2018, Oxford University Press.
2. Byron Gottfried, Schaum's Outline of Programming with C, 4th Edition, 2018, McGraw-Hill

Reference Books :

1. Brian W. Kernighan, and Dennis M. Ritchie, "The C Programming Language", 2nd Edition, Pearson.
2. Ajay Mittal, Programming in C: A Practical Approach, 3/e, Pearson Publication
3. SCHILDT and HERBERT, C: The Complete Reference, 4th Edition, McGraw Hill, 2020
4. SOMASHEKARA, M. T., GURU, D. S., MANJUNATHA, K. S., Problem Solving with C, 2nd Edition, PHI Learning, 2018
5. Paul Deitel, Deitel & Harvey Deitel, C How to Program, 6th Edition, Pearson Education
6. Jeri R. Hanly, Elliot B. Koffman, Ashok Kamthane and A. Ananda Rao, Programming in C and Data Structures, 1st Edition, Pearson Education, 2010.
7. H. Cheng, C for Engineers and Scientists, Mc.Graw-Hill International Edition Education / PHI, 2009
8. Yashavant P. Kanetkar, Let us C, 16th Edition, BBP Publications, Delhi, 2017.
9. R.G. Dromey, "How to Solve it by Computer". Pearson, 2014.
10. Anita Goel, Computer Fundamentals, Pearson Publication, 2010.

NARAYANA ENGINEERING COLLEGE :: GUDUR

20EN1001	ENGLISH							R2020
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
I	2	0	0	32	2	40	60	100

Pre-requisite: Knowledge of fundamentals of English Language & Grammar

Course Objectives:

1. To enhance the linguistic and communicative competence.
2. To improve the Language proficiency of students in English with an emphasis on Vocabulary, Reading and Writingskills.
3. To provide knowledge of grammatical structures & rules and encourage their appropriate use.
4. To expose the students to Reading skills and apply the skill & strategies of a successful reader
5. To acquaint the students with effective strategies of paragraphs, note making, text editing, review writing and formal correspondence such as letter writing, e mail, and memos.
6. To aid the students acquire appropriate and adequate knowledge on writing Technical Reports.

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

CO 1 Acquire in depth knowledge on formulating appropriate sentences with grammatical accuracy and vocabulary building. **(B.L:2)**

CO 2 Understand the factors that influence in use of grammar and learn to use sentences unambiguously. **(B.L:2)**

CO 3 Impart effective strategies for professional written communication using devices of coherence & cohesion with adequate support & detail. **(B.L:3)**

CO 4 Provide knowledge of use of phrases & clauses and improve effective writing Note making & Paraphrasing. **(B.L:2)**

CO5 Understanding the grammar rules for synthesis of sentences and use prewriting strategies to plan to write dialogues, reviews and edit the text effectively. **(B.L:2)**

CO6 Master the skills and sub skills of reading and use strategies for reading effectively and provide knowledge on the structure and format of technical writing. **(B.L:3)**

CO-PO Mapping														
CO	PO												PSO	
	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1									2		2		
CO2	1									2		2		
CO3	1									3		2		
CO4	1									2		3		
CO5	1									3		3		
CO6	1									3		3		

: Low, 2-Medium, 3- High

COURSE CONTENT

- Module – I GRAMMAR& VOCABULARY BUILDING 6h**
Grammar :Parts of speech: Noun (Countables&Uncountables, Singulars & Plurals, Kinds of Nouns), Pronoun, Verb, Adverb, Adjective - Kinds of Sentences & Sentence Structures – Question forms – Word order in Sentence
Vocabulary Building : Concept of word formation – Synonyms & Antonyms – Homonyms & Homophones – Prefixes & suffixes – Commonly confused Words – One word substitutes – Idioms & Phrasal Verbs
At the end of the Module 1, students will be able to:
1. Acquire in depth knowledge on basic grammar concepts.
 2. Understand the meaning of suffixes & Prefixes, idioms and phrasal verbs.
 3. Learn meaning and usage of Vocabulary.
- Module – II GRAMMAR&WRITING -I 8h**
Grammar : Subject Verb agreement – Pronoun-antecedent agreement – Verbs: auxiliary verbs (Primary & Modal)- Tenses
Writing : Principles of writing: clarity, simplicity, brevity, single focus, organization of thoughts - Sentence Structure – Joining the sentences - sequencing the ideas - introduction and conclusion – Punctuation.
At the end of the Module II, students will be able to:
1. Learn to use sentences clearly.
 2. Understand the usage of grammar.
 3. Learn the importance of use of Auxiliary verbs.
- Module – III GRAMMAR&WRITING-II 10h**
Grammar : Direct & Indirect Speech – Active and Passive Voice – Comparison of Adjectives – Articles – Prepositions
Writing : Paragraph Writing - Phrases & Clauses – Conditionals - Business letters and Emails and Memos - Structure/ template of common business letters and emails: inquiry/ complaint/ placing an order
At the end of the Module III, students will be able to:
1. Understand and learn the nuance of writing business letters, e-mails, memos and effective paragraphs
 2. Learn to use devices of coherence & cohesion with adequate support & detail
 3. Learn the use of prepositions and active & passive voice in engineering and scientific contexts.
- Module – IV GRAMMAR&WRITING-III 10h**
Grammar : Phrasal Verb – Cause and effect – Verb noun Collocations & adjective-noun collocations – correcting common errors in grammar and usage - Misplaced modifiers, idiomatic expressions
Writing : Note Making- organizing techniques: providing a suitable title, headings and sub headings; methods of sequencing - Paraphrasing - techniques of paraphrasing: Replacement of words and phrases, change of sentence structures.
At the end of the Module IV, students will be able to:
1. Understand the usage of phrases and clauses in sentences
 2. Learn grammatical rules to encourage their appropriate use in writing
 3. Learn to write effective note making and paraphrase
- Module – V GRAMMAR&WRITING-IV 8h**
Grammar : Question formation (Wh- questions, Yes or No questions, Tag questions)-If Clauses— Simple, Compound, Complex Sentences - Correcting common errors in grammar and usage
Writing : Editing short texts - Dialogue writing - Writing Definitions (short and long) – compare and contrast paragraphs- Writing of Reviews : Book / Play / Movie - focus on appropriate vocabulary and structure - language items like special vocabulary and idioms used
At the end of the Module V, students will be able to:
1. Acquire the knowledge of applying the grammatical rules for synthesis of sentences
 2. Learn to write dialogues for various contexts

3. Learn to edit the text and writing reviews

Module – VI READING SKILLS

6h

Reading Skills : Types of reading: Skimming, Scanning, Intensive & Extensive Reading - Effective

Reading-Tips Reading Comprehension

Scramble Sentences

Complete the passage using contextual clues

Identifying Main Ideas using Scanning Technique

Identifying Specific Ideas using Skimming Technique

Writing : Describing – Report Writing: definition - purpose – types – structure - formal and informal reports - stages in developing report- proposal, progress and final reports –examples

At the end of the Module VI, students will be able to:

1. Master the skills and sub skills of reading
2. Learn the structure and format of technical reports
3. Learn to write description of things, process, places and persons

Text Books:

1. Green, David Contemporary English Grammar –Structures and Composition, MacMillan India, 2014
2. Raymond Murphy’s English Grammar with CD, Murphy, Cambridge University Press, 2012
3. Michael Swan, (2017) Practical English Usage (Practical English Usage), 4th edition, UK: Oxford University Press.
4. Ashraf, M Rizvi. Effective Technical Communication. Tata McGraw-Hill, 2006.

Reference Books

1. English Conversation Practice –Grant Taylor, Tata McGraw Hill, 2009.
2. Hewings, Martin. Cambridge Academic English (B2). CUP, 2012
3. Meenakshi Raman and Sangeeta Sharma, Professional Communication, Second Edition, Oxford University Press, India, 2017
4. Michael McCarthy, Felicity O’Dell, (2015) English Vocabulary in Use Advanced (South Asian Edition), UK: Cambridge University Press
5. Spoken English, R.K. Bansal & JB Harrison, Orient Longman, 2013, 4th edition.

NARAYANA ENGINEERING COLLEGE:GUDUR

20PH1501	APPLIED PHYSICS LAB						R2020	
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
I	0	0	2	36	1	40	60	100

Pre-requisite: Nil

Course Objectives:

1. To provide student to learn about some important experimental techniques in physics with knowledge in theoretical aspects so that they can excel in that particular field. To prepare students for performing requirement analysis and design of variety of applications.
2. To enable the students to understand the concepts of interference and diffraction and their applications.
3. To educate students to recognize the applications of laser in finding the wavelength, slit width and its role in diffraction studies
4. To make the students to understand the important parameters of optical fibres and metals

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

CO 1 learn important concepts of physics through involvement in the experiments by applying theoretical knowledge.

CO 2 understand the concepts of interference and diffraction and their applications.

CO 3 recognize the applications of laser in finding the wavelength, slit width and its role in diffraction studies

CO 4 understand the important parameters of optical fibres and metals

CO-PO Mapping														
CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	1										2		
CO2	2	1				1						2		
CO3	2	1				1						2		
CO4	2	1										2		
1: Low, 2-Medium, 3- High														

COURSE CONTENT

Task -1: Determination of Hall voltage and Hall coefficient of a given semiconductor using Hall effect.

The objective :To determine

- a) sign of the charge carriers,
- b) charge carrier concentration,
- c) mobility of the charge carriers of a given semiconductor

Task - 2: To determine the resistivity of semiconductor by Four probe method

Objective:To determine the resistivity of semiconductor by Four probe method

Task -3: Determine the energy gap of a given semiconductor diode.

Objective:To plot characteristics between reverse saturation current and $10^3/T$ and find out the approximate value of Energy Band Gap in PN junction diode

TASK -4: Measurement of radius of curvature of a lens by Newton's rings method.

Objective:To determine the wavelength of sodium light by Newton's Ring method

The key idea behind Newtons ring experiment is the thin film formation between a plane-convex lens and a glass plate. Due to this thin film of air a path difference occurs in the waves which reflect from the lower surface of the lens and the top surface of the glass plate. As a result of it, they superimpose and develop the interference pattern.

TASK -5: Determine the thickness of the wire using wedge shape method

Objective:To calculate the thickness of a thin wire by forming interference fringes using an air wedge arrangement.

The key idea behind this experiment is the formation of thin wedge shaped film between two plane glass plates. Due to this thin film of air, a path difference occurs between waves reflected from top and bottom surface of the film. On superimposition of these waves an interference pattern containing a number of straight line fringes will be produced

TASK-6: Determination of wavelength by plane diffraction grating normal incidence method

Objectives: 1.To understand the types of diffraction

- 2.To familiarize with the principle of diffraction in plane transmission grating
3. To know the procedure for standardization of the grating
- 4.To determine the wavelengths of prominent spectral lines of mercury spectrum.

An arrangement, which is equivalent in its action to a large number of parallel slits of same width separated by equal opaque spaces is called diffraction grating. It is constructed by ruling fine equidistant parallel lines on an optically plane glass plate with the help of a sharp diamond point.

TASK -7: Dispersive power of a diffraction grating

objective: To determine Dispersive power of a diffraction grating

When white light passes through a grating, different wavelengths undergo different angles of diffraction. Hence white light split up into different colours and diffraction spectra of different orders will be produced. The angular dispersion or dispersive power of a grating is defined as the rate of change of angle of diffraction with the change of wavelength in a particular order of the spectrum.

TASK -8: Determination of wavelength of LASER light using diffraction grating

Objectives :1. To determine the concept of diffraction

2. To determine the wavelength of the given Laser source.

TASK -9:Laser: Diffraction at a single slit

Objective:Determination of width of a given single slit using laser diffraction method

Laser beam has high monochromaticity, coherence and directionality. Hence it forms a clear diffraction pattern and we can measure width of a single slit accurately.

TASK -10 Laser: Diffraction at a double slit

Objective:Determination of width of a given double slit using laser diffraction method.

With this experiment we can demonstrate diffraction nature of lasers and measure width of a double slit accurately.

Additional Experiments:

TASK -11 To determine the numerical aperture and acceptance angle of a given optical fibre

Objective: To determine the numerical aperture and acceptance angle of a given optical fiber.

In optical fibres light travel by multiple total internal reflections. Numerical aperture represents light gathering power of optical fibre. Acceptance angle represents maximum limiting angle at one end of optical fibre for the light ray to travel by multiple total internal reflections through the core region of the fibre.

1. Optical fibers may be used for accurate sensing of physical parameters and fields like pressure, temperature and liquid level.
2. For military applications like fiber optic hydrophones for submarine and underwater sea application and gyroscopes for applications in ships, missiles and aircrafts.

TASK -12: Determination of Fermi energy of a metal.

Objective: To determine Fermi energy of a metal.

Fermi energy represents highest energy level occupied by the electron at 0 K in a metal.

CO4

Text Book(s):

1. C. L. Arora, "Practical Physics", S. Chand & Co., New Delhi, 3rd Edition, 2012.

2. Vijay Kumar, Dr. T. Radhakrishna, "Practical Physics for Engineering Students", S M Enterprises, 2nd Edition, 2014.

Reference Book(s):

1. S. Balasubramanian, M.N. Srinivasan "A Text book of Practical Physics"- S Chand Publishers, 2017.

2. C.H. Bernard and C.D. Epp, John Wiley and Sons, "Laboratory Experiments in College Physics" Inc., New York, 1995.

3. Dr. Ruby Das, C.S. Robinson, Rajesh Kumar and Prasanth Kumar "A text book of Engineering Physics Practical", 1st edition, Sahu University Science Press, 2010.

4. Jayaraman, "Engineering Physics Laboratory Manual", 1st edition, Pearson Education, 2014.

NARAYANA ENGINEERING COLLEGE:GUDUR

20EN1501	ENGLISH LANGUAGE LAB							R2020
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
I	0	0	3	48	1.5	40	60	100

Pre-requisite:Basic English Grammar

Course Objectives:

1. To expose the students to develop knowledge and awareness of English phonetics be able to read and produce phonemic transcriptions
2. To sensitize the students to the nuances of English speech sounds, word accent, intonation and rhythm
3. To develop strategies appropriately to improve one's ability to listen and Use listening skills to create more effective, less confrontational, more productive professional and personal communication
4. To demonstrate his/her ability to write error free written communication
5. To distinguish main ideas from specific details and make use of contextual clues to infer meanings of unfamiliar words from context

To provide a structured methodology for participants to prepare and deliver an effective, high impact presentation that meets the objectives and brings results

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

CO 1 Understand how speech sounds are used to create meaning. Apply their knowledge of English phonetics and phonology to improve their own pronunciation.

CO 2 Recognize and use pitch patterns to signal complete and incomplete thought groups and Speak confidently and intelligibly within groups and before an audience.

CO 3 Discuss and respond to content of a lecture or listening passage orally and/or in writing and make inferences and predictions about spoken discourse

CO 4 Produce coherent and unified paragraphs with adequate support and detail and can write a paragraph with a topic sentence, support, and concluding sentence

CO 5 To help the students to cultivate the habit of reading passages for competitive exams such as GRE, TOEFL, GMAT etc.

CO 6 Learn, practice and acquire the skills necessary to deliver effective, presentation with clarity and enable them to prepare resume with cover letter.

CO-PO Mapping														
CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	SO 1	SO 2
CO1	1									3		2		
CO2	1									2		3		
CO3	1									3		3		
CO4	1									2		3		
CO5	1									3		3		
CO6	1									3		3		

1: Low, 2-Medium, 3- High

COURSE CONTENT

Module - 1

Introduction to Phonetics :
Introduction to Sounds of Speech – Vowels – Consonants -
Listening with a focus on pronunciation
Reading Newspaper – Highlighting Vowels and Consonants **CO1**

Module – 2

Syllabification:
Word Stress, Rules of word stress
Practice on Intonation and Stress **CO2**

Module – 3

Listening Skills :
Types of Listening Skills
Active listening and anticipating the speaker
Listening for Specific & General Details
Listening Comprehension **CO3**

Module – 4

Defining & Describing: Objects, Places and Events
Video Speech Writing
Review Writing (Books / Movies / Products..etc..) **CO4**

Module – 5

Reading Comprehension
Everyday English – Grammar, Vocabulary, LSRW Skills,
Summarizing and Note making
Vocabulary Building **CO5**

Module – 6

JAM
Role Play
Giving and Asking Directions
Information Transfer **CO6**

Text Book(s):

1. A Textbook of English Phonetics for Indian Students 2nd Ed T.Balasubramanian.(Macmillan),2012
2. Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.

Reference Book(s): English Pronunciation in Use. Intermediate & Advanced, Hancock, M. 2009.CUP

1.Rizvi,Ashraf.M.,Effective Technical Communication,McGrawHill,New Delhi.2005

2.Raman, Meenakshi & Sangeetha Sharma. Technical Communication: Principles and Practice, Oxford University Press, New Delhi.2011

NARAYANA ENGINEERING COLLEGE: GUDUR

20ES1502 ELECTRONICS AND COMMUNICATION ENGINEERING WORKSHOP R2020

Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P			C	CIE	SEE
I	0	0	2	32	1	40	60	100

Pre-requisite:

Course Objectives:

1. To introduce electronic components, measuring instruments and tools used in Electronic workshop.
 2. To equip with the knowledge of understanding data sheets of electronic components.
 3. To give practical experience on soldering the electronic components on a PCB
 4. To introduce EDA tools and TINA Software
5. To provide knowledge about the different types of transmission media such as guided and unguided media.

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

- CO 1** Identify discrete components, measuring instruments and ICs (BL-2)
- CO 2** Assembling and testing of simple electronic circuit over a PCB (BL-2)
- CO3** Understand EDA tools and TINA Software (BL-1)
- CO 4** Understand about the different types of transmission media such as guided and unguided media. (BL-1)

CO-PO Mapping

CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2			1									1	
CO2	1	1											2	
CO3	1		1										1	
CO4		2											1	

1: Low, 2-Medium, 3- High

COURSE CONTENT	CO
Task-1: Familiarization of commonly used tools in Electronics and Communication.	CO 1
Objective: To introduce tools used in Electronics and Communication.	
Task-2: Familiarization of Electronic Measuring Instruments	CO 1
Objective: To introduce measuring instruments used in Electronics and Communication.	
Task-3: Familiarization/Identification of electronic components	CO 1
Objective: To introduce electronic components used in Electronics.	
Task-4: Testing of electronic components	CO 2
Objective: To introduce Testing Procedure used for Electronic components	
Task-5: Study of Cathode Ray Oscilloscope (CRO)	CO 1
Objective: To study controls of CRO and measure Amplitude, Frequency and Phase of time varying signals.	
Task-6: Single Side PCB Fabrication	CO 2
Objective: To provide in-depth core knowledge in the fabrication of Printed Circuit Boards.	
Task-7: Introduction to EDA Tools	CO 3
Objective: To introduce EDA tools.	
Task-8: Assembling and Testing of simple electronic circuits on breadboards	CO 2
Objective: To give practical expose of electronic circuits on a Breadboard	
Task-9: To familiar with the optoelectronic devices	CO 2
Objective: To give practical experience on the different types of optoelectronic devices such as LED, photodiode, LDR, Photo Transistor and Photo Isolator.	
Task -10: To study about the transmission media	CO 4
Objective: To provide knowledge about the different types of transmission media such as guided and unguided media.	
Task-11: Familiarization of PA system with different microphones, loud speakers, mixer etc	CO 2
Objective: To give practical experience on Public addressing (PA) system.	
Task-12: To introduce about the TINA Software	CO 3
Objective: To introduce TINA tools.	
Additional Experiments	
Task 13: Interpret data sheets of discrete components and IC's	CO 1
Objective: To equip with the knowledge of understanding data sheets of electronic Components.	
Task14: Understand working of various Communication Systems	CO 4
Objective: To provide knowledge in understanding working of various communication Systems.	

Text Book(s):

1. G. Kennedy, B. Davis and Srm Prasanna," Electronic Communication Systems", TMH.
2. R S Khandpur, Printed Circuit Boards- Design Fabrication, Assembly and Testing, Tata Mc Graw Hill Publishing Company Limited, Ist edition 2008 .
3. TINA/ORCAD.PADS software User manual.
4. R.S. Sedha, "A Textk Book of Applied Electronics", S. Chand Publication.

Reference Book(s):

1. R.S. Sedha, "A Textk Book of Electronic Circuit", S. Chand Publication.
2. Dr K N Hari Bhat and Dr D Ganesh Rao, "Principles of Communication Systems", Cengage India.
3. Raghunandan G H, Raju hajare,"An Introduction to Basic Electronics Concepts and Applications - Concepts and Applications", Cengage Publications

NARAYANA ENGINEERING COLLEGE:GUDUR

20ES1505 ENGINEERING & IT WORK SHOP R2020
PART – A ENGINEERING WORK SHOP

Semester	Hours / Week			Total hrs	Credits	Max Marks		TOTAL
	L	T	P			CIE	SEE	
II	0	0	4	64	2	40	60	100

Pre-requisite: Basic mathematics.

Course Objectives:

1. To know basic workshop processes and adopt safety practices while working with various tools and equipments
2. To identify, select and use various marking, measuring, holding, striking and cutting tools & equipments.
3. To know about the internal parts of a computer, assembling a computer from the parts, preparing a computer for use by installing the operating system
4. To gain knowledge about the usage of tools like Word processors, Spreadsheets, Presentations
5. To learn about Networking of computers and use Internet facility for Browsing and Searching

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

CO1 Understand the safety aspects in using the tools and equipments. (BL-2)

CO2 Apply tools for making models in respective trades of engineering workshop. (BL-3)

CO3 Apply basic electrical engineering knowledge to make simple house wiring circuits and check their functionality. (BL-3)

CO4 Understand to disassemble and assemble a Personal Computer and prepare the computer ready to use (BL-2)

CO5 Apply knowledge to interconnect two more computers for information sharing (BL-3)

COURSE CONTENT (TRADES FOR PRACTICE)

Trade -1 Carpentry

Familiarity with different types of woods and tools used in wood working and make following joints from out of 300x40x25mm soft wood stock.

- a) Half-Lap joint.
- b) Mortise and Tenon joint

Trade-2 Fitting

i.] Familiarity with different types of tools used in fitting and do the fitting exercises out of 80 x 50 x 5 mm M.S. stock

- a) V-fit b) Dovetail fit

Trade - 3 Sheet Metal Work

Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job from out of 22 or 20 gauge G.I. sheet

- a) Tapered tray b) Conical funnel

Trade - 4 Electrical House Wiring

Familiarities with different types of basic electrical circuits and make the following electrical connections

- a) Two lamps in series
- b) Two way switch
- c) Tube light
- d) Two lamps in parallel with 3 pin plug and switches

Trade 5 – Welding

Familiarity with different types of tools used in welding and do the following welding exercises

1. Single V butt joint
2. Lap joint

Text Book(s):

1. Hajra Choudhury S.K., Hajra Choudhury A.K., Nirjar Roy S.K. “Elements of Workshop Technology” Vol-I 2008 & Vol-II 2010 Media Promoters & Publishers Pvt. Limited, Mumbai.
2. Kalpakjian S. and Steven S. Schmid, “Manufacturing Engineering and Technology” 4th Edition, Pearson Education India Edition, 2002.
3. P. Kannaiah & K. L. Narayana “Workshop manual” 2nd Ed., Scitech Publications Pvt. Ltd., Hyderabad, 2008.

Reference Book(s):

1. Gowri P., Hariharan and Suresh Babu A., “Manufacturing Technology-I”, Pearson Education 2008.

PART-B IT WORKSHOP LAB

Course Objectives:

1. To provide Technical training on Productivity tools like Word processors, Spreadsheets, Presentations.
2. To make the students know about the internal parts of a computer, assembling, installing the operating system.
3. To teach connecting two or more computers.

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

CO 1 Understand functionalities of a computer and operating system. (BL-2)

CO 2 Practice Word processors, Presentation and Spreadsheet tool.(BL-2)

CO 3 Connect computer using wired and wireless connections.(BL-2)

CO-PO Mapping														
CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1													
CO2	1													
CO3	1													
1: Low, 2-Medium, 3- High														

COURSE CONTENT

Task-1 Learn about Computer

Identify the internal parts of a computer and its peripherals. Represent the same in the form of diagrams including Block diagram of a computer. Write specifications for each part of a computer including peripherals and specification of Desktop computer. Submit it in the form of a report.CO 1

Task -2 Assembling a Computer

Disassemble and assemble the PC back to working condition. Troubleshoot the computer and identify working and non-working parts. Identify the problem correctly by various methods available (eg: beeps). Record the process of assembling and trouble-shooting a computer.CO 1

Task-3 Install Operating systemCO 1

Install Linux, any other operating system (including proprietary software) and make the system dual boot or multi boot. Record the entire installation process.

Task-4 Operating system featuresCO 1

Record various features that are supported by the operating system(s) installed. Submit a report on it. Access CD/DVD drives, write CD/DVDs, access pen drives, print files, etc. Install new application software and record the installation process.

Task-5 Word Processor CO 2

Create documents using the word processor tool. Tasks to be performed are inserting and deleting the characters, words and lines, Alignment of the lines, Inserting header and Footer, changing the font, changing the colour, including images and tables in the word file, making page setup, copy and paste block of text, images, tables, linking the images which are present in other directory, formatting paragraphs, spell checking, etc. Prepare project cover pages, content sheet and chapter pages at the end of the task using the features studied. Submit a report of the word processor considered.

Create documents using the word processor tool. Mail Merge in word processor for creating appointment orders for 10 employee records in excel.

Task-6 Spreadsheet CO 2

To create, open, save the spreadsheet and format them as per the requirement. Some of the tasks to be practiced are Managing the worksheet environment, creating cell data, inserting and deleting cell data, format cells, adjust the cell size, applying formulas and functions, preparing charts, sorting cells, working with pivot tables and charts. Submit a report of the Spreadsheet application considered.

Task-7 Presentations CO 2

To create, open, save and run the presentations, Select the style for slides, format the slides with different fonts, colors, create charts and tables, insert and delete text, graphics and animations, bulleting and numbering, hyperlink, set the time for slide show, Record slide show. Submit a report of the Presentation tool considered.

Task-8 Wired network & Wireless network CO 3

Select a LAN cable, Identify the wires in the cable, Define the purpose of each wire, Study the RJ45 connector, Use crimping tool to fix the cable to the connector, Test the cable using LAN tester, Connect two or more computers using cross and straight cables, Configure the computers, share the data between the computers.

Additional Experiments:

Task -1 IoT

CO 3

Raspberry Pi Study the architecture of Raspberry pi, configure software, Install SD card, Connect the cables, Install Raspbian (or any other) operating system, Configure Wi-Fi, Remotely connect to your Raspberry Pi.

Task -2 Outlook, Macros

CO 3

Practice the following tasks and submit report

A. Configure outlook and access mails.

Create Macros in word and spreadsheet tools

Text Book(s):

1. B.Govindarajulu, "IBM PC and Clones Hardware Trouble shooting and Maintenance", 2nd edition, Tata McGraw-Hill, 2002
2. "MOS study guide for word, Excel, Powerpoint & Outlook Exams", Joan Lambert, Joyce Cox, PHI.
3. "Introduction to Information Technology", IITL Education Solutions limited, Pearson Education.

NARAYANA ENGINEERING COLLEGE::GUDUR

20ES1506	PROBLEM SOLVING AND PROGRAMMING LAB							R20
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
I	0	0	3	48	1.5	40	60	100

Pre-requisite: Mathematics Knowledge, Analytical & Logical Skills

Course Objectives:

1. To work with the compound data types
 2. To explore dynamic memory allocation concepts
 3. To able to design the flowchart and algorithm for real world problems
 4. To able to write C programs for real world problems using simple and compound data types
- i. To employee good programming style, standards and practices during program development

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

- CO 1** Translate algorithms into programs (In C language) (BL - 2)
- CO 2** Code and debug programs in C program language using various constructs. (BL - 3)
- CO 3** Solve the problems and implement algorithms in C. (BL - 3)
- CO 4** Make use of different data types to handle the real time data (BL - 3)

Reference Book(s):

1. Rusen, “Networking your computers and devices”, PHI
2. Bigelows, “Trouble shooting, Maintaining & Repairing PCs”, TMH.

CO-PO Mapping														
CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	2											1	
CO2	2	2	2										2	1
CO3	2	2	3	1	2								2	2
CO4	2	2	3	1	1								2	2

1: Low, 2-Medium, 3- High

COURSE CONTENT

CO

Task-1

1. Practice DOS and LINUX Commands necessary for execution of C Programs.
2. Study of the Editors, Integrated development environments, and Compilers in chosen platform.

Write, Edit, Debug, Compile and Execute Sample C programs to understand the programming environment.

CO 1

Task-2

Practice programs: Finding the sum of three numbers, exchange of two numbers, largest of two numbers, to find the size of data types, Programs on precedence and associativity of operators, sample programs on various library functions.

CO 1

Task-3

1. Write a C program to calculate the factorial of a given number
2. Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 & 1. Subsequent terms are found by adding the preceding two terms in the sequence. Write a C program to generate the first n terms of the sequence.

Write a program to find the roots of a Quadratic equation. CO1

Task-4

1. Write a program to generate the series of prime numbers in the given range.
2. Write a program to reverse the digits of a number.

Write a C program to find the sum of individual digits of a positive integer. CO 2

Task-5

1. Write a program to check for number palindrome.
2. Write a program to find the maximum of a set of numbers.

Write a C program to find the GCD (greatest common divisor) of two given integers CO 2

Task-6

1. Write a program to find the sum of positive and negative numbers in a given set of numbers.
2. Write C code to reverse the elements of the array. For example, [1,2,3,4,5] should become [5,4,3,2,1]

Write a C program to find factorial of a given integer number using recursion CO 3

Task-7

1. Write a C program that use pointers to find Addition of Two Matrices

Write a C program that use functions to find Multiplication of Two Matrices CO 3

Task-8

1. Write a program to accept a line of characters and print the number of Vowels, Consonants, blank spaces, digits and special characters.

Write a C program to check whether a given string is a palindrome or not, without using any built-in functions. CO 3

Task-9

1. Illustrate the use of auto, static, register and external variables.
2. Write a program to read and print student information using structures

Write a C program to define a union and structure both having exactly the same members using the sizeof operators print the sizeof structure variables as well as union variable CO 4

Task-10

1. Write a program to split a "file" into two files, say file1 and file2. Write lines into the 'file' from standard input. Read the contents from 'file' and write odd numbered lines into file1 and even numbered lines into file2.

Write a program to merge two files. CO 4

Additional Experiments

Task-1

1. Programs on bitwise operators.

Programs on bit fields. CO4

Task-2

1. Write a program to read a set of strings and sort them in alphabetical order.

Programs on implementation of structures using files.

CO 4

Text Book(s):

1. "How to Solve it by Computer", R.G. Dromey, 2014, Pearson.
2. Programming in C and Data Structures, J.R.Hanly, Ashok N. Kamthane and A.Ananda Rao, Pearson Education, 1st Edition, 2010.

Reference Book(s):

1. "The C Programming Language", Brian W. Kernighan, Dennis M. Ritchie, 2nd Edition, Pearson.
2. "Let us C", YeswantKanetkar, BPB publications
3. "Pointers in C", YeswantKanetkar, BPB publications, 16th Edition, 2017
4. Computer Science, A Structured Programming Approach Using C by Behrouz A. Forouzan& Richard F. Gilberg, 3rd Edition, Cengage Learning
5. C Programming A Problem-Solving Approach, Behrouz A. Forouzan& E.V. Prasad, F. Gilberg, 3rd Edition, Cengage Learning
6. Programming with C RemaTheraja, Oxford, 2018
7. Programming in C, 3rd Edition, 2015, Ashok N. Kamthane, Pearson Education
8. Programming in C, 3/e : A Practical Approach by Ajay Mittal, Pearson Publication
9. Problem Solving with C by SOMASHEKARA, M. T., GURU, D. S., MANJUNATHA, K. S., PHI Learning, 2nd Edition, 2018
10. C Programming with problem solving, J.A. Jones & K. Harrow, Dreamtech Press, 2001
11. Byron Gottfried, Schaum's Outline of Programming with C, 4th Edition, 2018, McGraw-Hill

SEMESTER II

Subject Code	Category	Course Title	Contact Periods per week				Credits	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total marks
20CH1001	BS	Chemistry	3	0	0	3	3	40	60	100
20MA1004	BS	Vector Calculus and Transforms	3	1	0	4	4	40	60	100
20ES1004	ES	Basic Electrical Engineering	3	0	0	3	3	40	60	100
20ES1007	ES	Introduction to Python Programming	2	0	0	2	2	40	60	100
20CH1501	BS	Chemistry Lab	0	0	3	3	1.5	40	60	100
20ES1509	ES	Basic Electrical Engineering Lab	0	0	2	2	1	40	60	100
20ES1504	ES	Engineering Graphics Lab	0	1	4	5	3	40	60	100
20ES1510	ES	Introduction to Python Programming Lab	0	0	2	2	1	40	60	100
20EN1502	HS	Oral Communication Skills Lab	0	0	2	2	1	40	60	100
		Counselling/Mentoring	0	0	1	1	0	--	--	--
		Sports/Hobby Clubs/Activities	0	0	2	2	0	--	--	--
		Activity Point Programme	During the Semester				20 Points			
		Total	11	2	16	29	19.5	360	540	900

NARAYANA ENGINEERING COLLEGE:GUDUR

20CH1001	CHEMISTRY (COMMON TO ECE,EEE&CSE)						R2020	
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	
II	3	0	0	48	3	40	60	
							TOTAL	
							100	

Pre-requisite: Nil

Course Objectives:

1. To impart technological aspects of modern chemistry and its applications
2. Understands the chemistry behind electrochemical energy systems
3. To train the students on the principles and applications of polymers
4. Learn analytical methods useful in characterization of compounds.

Course Outcomes: After successful completion of the course, the student will be able to: BL

- CO 1** understand the fundamental concepts of chemistry to predict the structure and bonding of materials 1
- CO 2** Infer the knowledge about various kinds of electro chemical cells. 2
- CO 3** Describe various energy storage devices and emerging technologies 2
- CO 4** understand the mechanism and applications of different polymers in electronic devices 2
- CO 5** familiarize the various sources of renewable energy and their harnessing 2
- CO 6** Apply the electromagnetic radiation to the spectroscopy methods for the analysis of engineering 3

CO-PO Mapping														
CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2										1		
CO2	3	2					2					1		
CO3	3	1	2			1	2					2		
CO4	3	2				2	1					1		
CO5	3	1	1			2	1					2		
CO6	3	1										2		

1: Low, 2-Medium, 3- High

COURSE CONTENT

STRUCTURE AND BONDING MODELS

Planks quantum theory, photo electric effect, dual nature of matter -Debroglies equation, Heisenberg uncertainty principle, molecular orbital theory – bonding in homo- and hetero nuclear diatomic molecules – energy level diagrams of O₂ and CO, etc. π-molecular orbital's of butadiene and benzene, calculation of bond order, crystal field theory – salient features – splitting in octahedral and tetrahedral geometry.

At the end of the Module 1, students will be able to:

1. Understand the fundamental concepts of chemistry to predict the structure, properties and bonding of Engineering materials.(BL-1)

2. Illustrate the molecular orbital energy level diagram of different molecular species. (BL-2)
3. Apply crystal field theory for octahedral and tetrahedral molecules. (BL-3)
4. Outline the Planck quantum theory. (BL-2)
5. Explain Heisenberg uncertainty principle. (BL-2)

ELECTRO CHEMISTRY

Electrode potential, EMF of an electrochemical cell, problems on emf Nernst equation; Electrodes – concepts, reference electrodes (standard hydrogen, Calomel electrode, and glass electrode), potentiometry- potentiometric titrations (redox titrations), concept of conductivity, conductometric titrations (acid-base titrations), photovoltaic cell – working and applications.

At the end of the Module 2, students will be able to:

1. Demonstrate competency in the basic concepts of electrochemical cells. (BL-2)
2. Explain the significance of electrode potentials. (BL-2)
3. List the different types of electrodes. (BL-1)
4. Differentiate between potentiometric and conductometric titrations. (BL-2)
5. Illustrate the construction of PV cell. (BL-2)

BATTERY TECHNOLOGY

Basic concepts, classification of batteries, Important applications of batteries, Modern batteries- zinc-air, lithium cells- Li ion cell, Li-MnO₂ cell, Ni-cd cell, lead acid storage cell. Fuel cells Introduction- classification of fuel cells – hydrogen and oxygen fuel cell, methanol and oxygen fuel cell, SOFC - Merits of fuel cell

At the end of the Module 3, students will be able to:

Classify batteries into different types. (BL-2)

1. Explain the concept involved in the construction of batteries. (BL-2)
2. Identify the significance of batteries. (BL-3)
3. Compare the merits of different fuel cells. (BL-2)
5. Distinguish between different types of batteries. (BL-2)

POLYMER CHEMISTRY

Basic concepts of polymer, chain growth and step growth polymerization, coordination polymerization, copolymerization with specific examples and mechanisms of polymer formation. Plastics - Thermoplastics and Thermosetting, Preparation, properties and applications of PVC, Bakelite, urea-formaldehyde, Nylons- Elastomers- Buna-S, Buna-N- preparation, properties and applications. Conducting polymers – poly acetylene, poly aniline, mechanism of conduction and applications.

At the end of the Module 4, students will be able to:

1. Identify different types of polymers. (BL-3)
2. Distinguish between thermoplastic and thermosetting resins. (BL-2)
3. Explain the preparation, properties and applications of some plastic materials. (BL-2)
4. Apply the knowledge of advanced polymers, conducting polymers for different applications. (BL-3)
5. Outline the properties of polymers and various additives added and different methods of forming plastic materials. (BL-2)

ENERGY SCIENCE

fuels-classification of fuels characteristics solid fuels-coal, analysis of coal ,refining of petroleum, alternative and non conventional sources of Energy-solar, wind, Geo, Hydro power ,Bio mass advantages and disadvantages, Nuclear energy-Nuclear fission and fusion reactions Nuclear waste disposal

MODULE-VI INSTRUMENTAL METHODS AND APPLICATIONS

Electronic Spectroscopy –EMR, Beer-Lambert's law and its, Applications, instrumentation of UV-visible spectrophotometer. *IR Spectroscopy* - Types of vibrations, Instrumentation of IR spectrophotometer and its applications. Chromatography-Introduction ,Principle and instrumentation of Gas Chromatography (GC) and thin layer chromatography, separation of gaseous mixtures and liquid mixtures

At the end of the Module 6, students will be able to:

1. Explain the different types of spectral series in electromagnetic spectrum (BL-2)
2. Understand the principles of different analytical instruments (BL-2)
3. Explain the different applications of analytical instruments (BL-2)
4. Outline the Beer-Lambert's law. (BL-2)

Total hours:

48hours

Text Book(s):

1. P.C.Jain & Monika Jain, *Engineering Chemistry*, Dhanpat Ray Publishing Company (P) Ltd, New Delhi, 16th edition, 2013.
2. K. N. Jayaveera, G. V. Subba Reddy and C. Ramachandraiah, *Engineering Chemistry*, McGraw Hill Publishers, New Delhi.
3. Energy scenario beyond 2100, by S. Muthu Krishna Iyer.

Reference Book(s):

1. J. D. Lee, *Concise Inorganic Chemistry*, Oxford University Press, 5th edition 2010.
2. Skoog and West, *Principles of Instrumental Analysis*, Thomson, 6th edition, 2007.
3. Peter Atkins, Julio de Paula and James Keeler, *Atkins' Physical Chemistry*, Oxford University Press, 10th edition, 2010.

NARAYANA ENGINEERING COLLEGE: GUDUR

20MA1004 VECTOR CALCULUS & TRANSFORMS(VC&T)							R2020
Semester	Hours / Week			Total hrs	Credit	Max Marks	
	L	T	P		C	CIE	SEE
II	3	1	0	64	3	40	60
							TOTAL
							100

Pre-requisite: Intermediate Mathematics

Course Objectives:

1. To illustrate the physical interpretation of gradient, divergence and curl
2. To apply the basic concepts of vector integration and their applications.
3. To understand the concepts of Laplace transforms and its properties.
4. To apply the concepts of Laplace, transform to solve the ordinary differential equations.
5. To understand the concepts of Fourier series.
6. To understand the concepts of Fourier transforms and its properties.

Course Outcomes: After successful completion of the course, the student will able to:

CO 1 Interpretate the different operators such as gradient, curl and divergence to find out point function (BL 3)

CO 2 Apply the fundamental theorems of vector integration to evaluate area and volumes.
(BL 3)

CO 3 Utilize the concept of the Laplace transforms and convert into time domain to frequency domain.
(BL 3)

CO 4 Apply the Inverse Laplace transforms techniques to solve the differential equations.
(BL 3)

CO 5 Develop the Fourier Series to the given periodic functions. (BL 3)

CO 6 Make use of Fourier transform to illustrate discrete/continuous function. (BL 3)

CO-PO Mapping														
CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2										3	
CO2	3	2	2										3	
CO3	3	3	1										2	
CO4	3	3	2										3	2
CO5	3	3	2										2	2
CO6	3	3	2										2	2

1- Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1 VECTOR DIFFERENTIATION 9 h

Introduction to vector differentiation, Definition of Scalar and Vector point functions, Definition of Vector differential operator, Gradient of a Scalar point function- Definition of Gradient of a scalar point function and properties (without proof), Definition of Directional Derivative, Definition of level surface, Different Problems, Divergence of a Vector point function - Definition, Definition of Solenoidal vector and problems, Curl of a vector point function - Definition of Curl, definition of Irrotational vector, Problems, Laplacian operator - Definition and related problems, Vector Identities–Statements(without proof).

At the end of the Module 1, students will be able to:

1. Understand the concepts of Vector Differentiation.(BL-2)
2. Apply del to scalar and vector point functions.(BL-3)
3. Illustrate the physical interpretation of gradient, divergence and curl.(BL-2)
4. Calculate directional derivatives and gradients (BL-1)
5. Apply Vector Differentiation concepts in fluid mechanics (BL-3)

MODULE -2 VECTOR INTEGRATION 11h

Introduction to vector integration, Line integrals-Explanation, Work done by a Force- Explanation, problems, Surface integral-Explanation and formula for surface integrals(without proof), Problems, Volume integral-Explanation and formula for volume integral (without proof), Problems, Green's Theorem-Statement (without proof), Problems, Gauss divergence Theorem- Statement (without proof), Problems, Stoke's theorem - Statement (without proof), Problems.

At the end of the Module 2, students will be able to:

1. Find the work done in moving a particle along the path over a force field (BL-1)
2. Find the rate of fluid flow along and across curves .(BL-1)
3. Apply Green's, Stokes and Divergence theorem in double and triple integrals.(BL-3)
4. Use the divergence theorem in physical interpretation of the divergence of a Vector field. (BL-3)
5. Find the line integrals along simple closed curves on the Plane by Green's Theorem.(BL-1)
6. Apply Stokes' theorem in physical interpretation of the curl of a vector field. (BL-3)

MODULE-3 LAPLACE TRANSFORMS 12h

Introduction to Laplace Transforms, Definition of Laplace Transforms, Sufficient conditions for the existence of the L.T of a function, Laplace Transforms of standard Functions, First Translation (or) First Shifting theorem, Problems. Second Translation (or) Second Shifting theorem, Problems. Change of scale property, Problems. L.T .of derivatives, Problems. L.T. of integrals, Problems. Multiplication by 't', Problems. L.T. of Division by 't', Problems. Evaluation of integrals by L.T.- problems. L.T. of some special functions, Unit Step Function or Heaviside's Unit Function- Definition, L.T problems, Unit Impulse Function or Dirac Delta function- Definition, problems. Laplace Transform of Periodic Functions- Statement (without proof), Problems.

At the end of the Module 3, students will be able to:

1. Understand the concepts of Laplace transforms.(BL-2)
2. Solve Ordinary differential equations by Laplace transform techniques. (BL-3)

3. Find integrals by using Laplace transforms. (BL-1)
4. Understand the properties of the Heaviside (unit step) function, Dirac delta function and its applications. (BL-2)

MODULE-4 INVERSE LAPLACE TRANSFORMS

11h

Definition of Inverse Laplace Transforms, Inverse Laplace Transforms of standard Functions (without proof), Problems. Use of Partial Fractions to find Inverse Laplace Transform- problems. First Translation (or) First Shifting theorem- Statement (without proof), problems. Second Translation (or) Second Shifting Theorem- Statement (without proof), Problems. Change of scale property- Statement (without proof), problems. Inverse L.T of derivatives- Statement (without proof), problems. Inverse L.T to finite integrals-Statement (without proof), problems. Multiplication by Powers of s 's Statement (without proof), Problems. Division by s 's Statement (without proof), problems. Convolution theorem-statement (without proof), problems. Applications to Ordinary Differential Equations-Working method Explanation, problems.

At the end of the Module 4, students will be able to:

- 1 Understand the concepts of inverse Laplace Transforms (BL-2)
- 2 Develop the wave functions by inverse Laplace transforms.(BL-6)
- 3 Obtain inverse Laplace transforms by Convolution Theorem (BL-3)
- 4 Develop the heat equations by using inverse Laplace transforms (BL-6)
- 5 Solve the higher order differential equations by the Laplace transform. (BL-3)

MODULE-5 FOURIER SERIES

11h

Introduction to Fourier Series, Periodic function-definition, properties(without proof), Euler's formulae(without derivation), Dirichlet's conditions, Fourier series in $[0, 2\pi]$, - formula(without derivation), Problems, Fourier series in $[-\pi, \pi]$ - formula(without derivation), Problems, Fourier series for even and odd functions in $[-\pi, \pi]$ - formula(without derivation), Problems, Fourier series in $[0, 2l]$ - formula(without derivation), problems, Fourier series in $[-l, l]$ - formula(without derivation), problems, Fourier series for even and odd functions in $[-l, l]$ - formula(without derivation), problems Half -Range Fourier sine Series in $(0, \pi)$ and $(0, l)$ - Formula(without derivation), Problems, Half-Range Fourier cosine Series in $(0, \pi)$ and $(0, l)$ -Formula(without derivation), Problems.

At the end of the Module 5, students will be able to:

1. Find the Fourier series expansion of the given function. (BL-1)
2. Apply Fourier series and its properties in various engineering problems. (BL-3)
3. Find the Half-Range Fourier Sine & Cosine series in $(0, \pi)$ and $(0, l)$. (BL-1)
4. Understand the properties of periodic functions, represent it as a Fourier series (BL-2)

MODULE-6 FOURIER TRANSFORMS

10h

Introduction to Fourier Transforms, Fourier integral theorem Statement (without proof) , Fourier sine and cosine integrals formula(without derivation), problems, Fourier Transform formula(without derivation) & Inverse Fourier Transform formula (without derivation), Properties of Fourier Transforms (without proof), problems , Fourier Sine Transform formula & Inverse Fourier sine Transform formula (without derivation) , problems, Fourier Cosine Transform formula & Inverse Fourier cosine Transform formula (without derivation) , problems, Finite Fourier Sine Transform- Finite Fourier Sine Transform formula & Inverse finite Fourier sine transform formula (without derivation), problems, Finite Fourier Cosine Transform- Finite Fourier Cosine Transform formula & Inverse finite Fourier cosine transform formula (without derivation), problems.

At the end of the Module 6, students will be able to:

1. Understand the concepts of Fourier transforms. .(BL-2)
2. Apply the properties of Fourier transforms to various engineering problems.(BL-3)
3. Solve boundary value problems by Fourier integral transforms.(BL-3)
5. Make use of the Fourier transforms and its inverse in practical applications of engineering. (BL-3)

Total hours:

64hours

Text Book(s):

1. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers.
2. N.P. Bali and Manish Goyal, "A Text Book of Engineering Mathematics", Laxmi Publication.
3. Ramana B.V., "Higher Engineering Mathematics", McGraw Hill Publishers

Reference Book(s):

1. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley.
2. Veerarajan T., "Engineering Mathematics", Tata McGraw-Hill.
3. Dr. M Anita, "Engineering Mathematics-I", Everest Publishing House, Pune.

NARAYANA ENGINEERING COLLEGE:GUDUR

20ES1004	BASIC ELECTRICAL ENGINEERING							R2020
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
II	3	0	0	48	3	40	60	100

Pre-requisite: Fundamental of mathematics and physics

Course Objectives:

1. To understand Types of electrical elements and KCL & KVL.
2. To analyze Peak and RMS values of AC circuits.
3. To understand Balanced and Unbalanced three Phase AC circuits .
4. Analyze EMF and Torque Equations of DC Machines.
5. To understand the Applications of Transformers and AC Machines.

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

- CO 1** Analyze DC circuits along with Voltage and Current sources .(BL-4)
- CO 2** Analyze the AC electrical circuits with RLC circuits. (BL-4)
- CO 3** Solve the real and reactive power for a three phase circuit .(BL-3)
- CO 4** Understand the operation and construction of DC machine.(BL-2)
- CO 5** Understand the operation and construction of single and three phase transformer.(BL-2)
- CO 6** Explain the operation and construction of AC Machines.(BL-2)

CO-PO Mapping														
CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3										2	3
CO2	3	3	3										2	3
CO3	3	3	3	2									3	3
CO4	3	3	3	2									3	3
CO5	2	2	3	2										
CO6	3	3	3	2										

COURSE CONTENT

MODULE – 1 DC CIRCUITS 8h

Introduction to Voltage, Current, Power, Direct Current (DC), Alternating Current (AC), Difference between DC and AC, Applications of DC and AC - Types of electrical elements – Ohm’s Law - Electrical circuit elements (R, L and C) – Voltage and Current sources – KCL & KVL – Analysis of simple (Series and Parallel) circuits with DC Excitation.

At the end of the Module 1, students will be able to:

1. Analysis of Series and Parallel circuits with DC Excitation(BL-2)
2. Understand the Voltage, Current, Power, Direct Current (DC), Alternating Current.(BL-2)
3. Explain the Electrical circuit elements (R, L and C).(BL-2)

MODULE -2 AC CIRCUITS 7h

Representation of sinusoidal waveforms – Peak and RMS values – Phasor representation – Real Power, Reactive Power, Apparent Power, Complex Power, Power Factor – Analysis of Single phase AC circuits consisting of R, L, C, RL, RC, RLC series and parallel circuits.

At the end of the Module 2, students will be able to:

1. Understand the Representation of sinusoidal waveforms, Peak and RMS values, Phasor representation of AC network. (BL-2)
2. Solve the Reactive Power, Apparent Power, Complex Power, Power Factor of a AC circuits. (BL-3)
3. Explain the Single phase AC circuits.(BL-2)

MODULE -3 NETWORK THEOREMS 9h

Super position theorem, Compensation theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Tellegen's theorem, Millman's theorem, Reciprocity theorem; Application of network theorems in solving DC and AC circuits.

At the end of the Module 3, students will be able to:

1. Understand the Application of network theorems in solving DC circuits. (BL-2)
2. Understand the Application of network theorems in solving AC circuits. (BL-2)
3. Explain various theorems. (BL-2)

MODULE -4 DC MACHINES 8h

Principle of operation of DC Generator - EMF Equation – Types of Generators – Magnetization and Load Characteristics – Applications – Principle of operation of DC Motor – Torque Equation – Types of Motors – Characteristics – Applications.

At the end of the Module 4, students will be able to:

5. Explain the Types of Generators. (BL-2)
6. Understand the Characteristics and Applications of DC Machines. (BL-2)
7. Explain the Torque Equation and Types of Motors. (BL-3)

MODULE -5 TRANSFORMERS 8h

Principle of operation of Single phase Transformer – Types – EMF Equation – Applications – Three phase AC Circuits (Balanced and Unbalanced) - Principle of operation of three phase Transformer – Application – Selection of single phase or three phase transformer at consumer premises.

At the end of the Module 5, students will be able to:

1. Explain the types of Transformer. (BL-2)
2. Explain the Applications of Transformer. (BL-2)
3. Understand the single phase and three phase transformer at consumer premises. (BL-2)

MODULE-6 AC MACHINES 8h

Principle of operation of Alternator – Characteristics- applications – Principle of operation of single phase Induction Motor – Characteristics – Applications - Principle of operation of three phase Induction Motor – Characteristics – Applications.

At the end of the Module 6, students will be able to:

1. Understand the concept of different type of AC machines. (BL-2)
2. Understand the Characteristics and Applications of AC Machines. (BL-3)
3. Explain the Principle of operation of three phase Induction Motor. (BL-2)

Total hours:

48 hours

Text Book(s):

1. A Sudhakar and Shyam Mohan SP, "Circuits and Networks: Analysis and Synthesis", TMH, 5th Edition, New Delhi, 2015.
2. Basic Electrical Engineering –By T.K.Nagasarkar and M.S. Sukhija Oxford University Press..

Reference Book(s):

- 1.S.Sivanagaraju, G.Kishor&C.Srinivasa Rao, "Electrical Circuit Analysis", Cengage Learning, 1st Edition, 2010.
2. A .Chakrabarti : Circuit Theory (Analysis and Synthesis), Dhanpat Rai &Co
3. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 2013
4. A. E. Clayton and N. N. Hancock, "Performance and design of DC machines", CBS Publishers, 2004
5. Ravish R., Network Analysis and Synthesis, 2/e, McGraw-Hill, 2015.

NARAYANA ENGINEERING COLLEGE:GUDUR

20ES1007	INTRODUCTION TO PYTHON PROGRAMMING						R20
Semester	Hours / Week			Total hrs	Credit	Max Marks	
	L	T	P		C	CIE	SEE
II	2	0	0	32	2	40	60
							TOTAL
							100

Pre-requisite: Knowledge of Mathematics and Basic Programming Language

Course Objectives:

1. To learn the fundamentals of python.
 2. To implement python programs for conditional loops and functions.
 3. To handle the compound data using python lists, tuples, sets, dictionaries.
 4. To learn the files, modules, packages concepts.
 5. To introduce the concepts of class and exception handling using python.
5. To train in regular expression concepts.

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

- CO 1** Summarize the fundamental concepts of python programming. (BL - 2)
- CO 2** Apply the basic elements and constructs the python to solve logical problems.(BL-3)
- CO 3** Organize data using different data structures of python .(BL - 3)
- CO 4** Implement the files modules and packages in programming. (BL - 3)
- CO 5** Apply object oriented &exception handling concepts to build simple applications.(BL - 3)
- CO 6** Implement the concepts ofTurtle Graphics. (BL - 3)

CO-PO Mapping														
CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	2											1	
CO2	2	3	1	2									1	1
CO3	2	2	2	2	2							2	2	
CO4	2	2	2	1	1							1	3	2
CO5	2	2	2	1								1	2	2
CO6	2	1	2	1								1	2	2

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1 INTRODUCTION TO PYTHON 5h

Introduction: History of Python, Features of Python Programming, Applications of Python Programming, Running Python Scripts, Comments, Typed Language, Identifiers, Variables, Keywords, Input/output, Indentation, Datatypes, Type Checking, range(), format(), Math module.

At the end of the Module 1, students will be able to:

1. Learn the basics of python. (BL - 1)
2. Write the python programs. (BL - 1)
3. Understand concept of type checking. (BL - 2)

MODULE -2 OPERATORS EXPRESSIONS AND FUNCTIONS 5 h

Operators and Expressions: Arithmetic, Assignment, Relational, Logical, Boolean, Bitwise, Membership, Identity, Expressions and Order of Evaluations, Control Statements.

Functions: Introduction, Defining Functions, Calling Functions, Anonymous Function, Fruitful Functions and Void Functions, Parameters and Arguments, Passing Arguments, Types of Arguments, Scope of variables, Recursive Functions.

At the end of the Module 2, students will be able to:

1. Solve the problems using operators, conditional and looping. (BL - 3)
2. Solve the problems using the functions. (BL -3)
3. Apply the principle of recursion to solve the problems. (BL-3)

MODULE-3 STRINGS, LISTS, TUPLES, AND DICTIONARIES 6h

Strings, Lists, Tuples, and Dictionaries: Strings-Operations, Slicing, Methods, List-Operations, slicing, Methods, Tuple- Operations, Methods, Dictionaries- Operations, Methods, Mutable Vs Immutable, Arrays Vs Lists, Map, Reduce, Filter, Comprehensions.

At the end of the Module 3, students will be able to:

1. Write programs for manipulating the strings. (BL - 1)
2. Understand the knowledge of data structures like Tuples, Lists, and Dictionaries. (BL - 2)
3. Select appropriate data structure of Python for solving a problem. (BL -3)

MODULE-4 FILES, MODULES AND PACKAGES 6h

Files, Modules and Packages: Files- Persistent, Text Files, Reading and Writing Files, Format Operator, Filename and Paths, Command Line Arguments, File methods, Modules- Creating Modules, Import Statement, Form. Import Statement, namespacing, Packages- Introduction to PIP, Installing Packages via PIP(Numpy).

At the end of the Module 4, students will be able to:

1. Understand the concepts of files. (BL - 2)
2. Implement the modules and packages. (BL - 3)
3. Organize data in the form of files. (BL - 3)

MODULE-5 OBJECT ORIENTED PROGRAMMING, ERRORS AND EXCEPTIONS 5h

OOP in Python: Object Oriented Features, Classes, self variable, Methods, Constructors, Destructors, Inheritance, Overriding Methods, Data hiding, Polymorphism.

Error and Exceptions: Difference between an error and Exception, Handling Exception, try except block, Raising Exceptions.

At the end of the Module 5, students will be able to:

1. Apply object orientation concepts. (BL -3)
2. Apply the exception handling concepts. (BL -3)
3. Implement OOPs using Python for solving real-world problems. (BL -3)

MODULE-6 TURTLE GRAPHICS 5h

Turtle Graphics: Move and Draw, Turtle Operations, Turtle object, Simple Graphics, The Vagrant, The Beautiful Patterns, Drawing with Colors.

At the end of the Module 6, students will be able to:

1. Understand the concepts of Turtle Graphics. (BL -2)

2.Develop GUI applications using Python. (BL -3)

Total hours:

48Hours

Text Book(s):

1. VamsiKurama, Python Programming: A Modern Approach, Pearson, 2017.
- 2.Allen Downey, Think Python, 2ndEdition,Green Tea Press

Reference Books :

1. R. Nageswara Rao, “Core Python Programming”, 2nd edition, Dreamtech Press, 2019.
2. Allen B. Downey, “Think Python”, 2ndEdition, SPD/O’Reilly, 2016.
3. Martin C.Brown, “The Complete Reference: Python”, McGraw-Hill, 2018.
4. Mark Lutz, Learning Python, 5th Edition, Orielly, 2013.
5. Wesley J Chun, Core Python Programming, 2nd Edition, Pearson, 2007
- 6.Kenneth A. Lambert, Fundamentals of Python, 1st Edition, Cengage Learning, 2015

NARAYANA ENGINEERING COLLEGE:GUDUR

20CH1501	CHEMISTRY LAB (COMMON TO ECE,EEE&CSE)							R2020
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
I	0	0	3	48	1.5	40	60	100

Pre-requisite: Nil

Course Objectives: The objective of the laboratory sessions is to enable the learner to get hands-on experience on the principles discussed in theory sessions and to understand the applications of these concepts in engineering.

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

- CO 1** **determine** the cell constant and conductance of solutions
- CO 2** Perform quantitative analysis using instrumental methods
- CO 3** utilize the fundamental laboratory techniques for analyses such as titrations, separation/purification\ and Spectroscopy
- CO 4** analyze and gain experimental skill.

CO-PO Mapping														
CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3													
CO2	3													
CO3	3													
CO4	3													

1: Low, 2-Medium, 3- High

COURSE CONTENT

CO

Task-1 : Conductometric titration of (i) strong acid vs. strong base, (ii) weak acid vs. strong base

Objective

1. perform a conductometric titration of a mixture of strong acid and weak acid with a strong base,
2. determine the equivalence point of the titration by plotting titration curve using conductance values and amount of the base added during titration,
3. state the advantages conductometric titrations,

CO2

Task-2 : Determination of cell constant and conductance of solutions

Objective:

1. To determine conductivity of the given water sample. by using conductivity meter
2. To understand the specific conductance.

CO 1

Task-3- Verify Lambert-Beer's law

Objective: 1. To use spectroscopy to relate the absorbance of a colored solution to its concentration.

2. To prepare a Beer's Law Plot to determine the concentration of an unknown.

CO 2

Task-4: pH metric titration of (i) strong acid vs. strong base, (ii) weak acid vs. strong base

Objective:

1. To perform a potentiometric titration of an acidic solution of known molarity.
2. To graph the volume of base added vs the pH and to determine the equivalence point
3. To calculate the molarity of the basic solution

CO 2

Task-5: Estimation of Ferrous Iron by Dichrometry.

Objective:

1. determine the percentage of ferrous iron in an unknown sample by redox titration with potassium dichromate solution .
2. The student will pre-treat the sample to obtain the iron in the reduced (+2 oxidation) state.
3. The student will use a solution of primary standard as the titrant

CO 3

Task-6 : Potentiometry - determination of redox potentials and emfs

Objective:

1. Determine the concentration of an unknown iron(II) solution. By using potentiometer
2. Discuss how the potential changes with relative concentration of oxidised/reduced form,
3. perform a redox titration of ammonium iron (II) sulphate using potassium dichromate as oxidizing agent,
4. determine the equivalence point of the redox titration by plotting titration curve using potential change values and amount of oxidizing agent added during titration,

CO 3

Task-7 : Preparation of a polymer

Objective: To prepare phenol formaldehyde resin. (Bakelite)

1. Understand the differences between linear and cross linked polymers.
2. Compare and contrast the recycling properties of linear and cross linked polymers.
3. Compare the combustion properties of various types of material.
4. Define the following terms: polymer, monomer, repeat unit, cross linking, biopolymer

CO 4

Task-8: Thin layer chromatography

Objective:

1. To separate spinach pigments using thin layer chromatography
2. To describe the method of chromatography and its applications

CO 2

Task-9: Identification of simple organic compounds by IR

Objective:

- 1.To learn various function groups encountered in organic chemistry
- 2.To learn important roll of IR spectroscopy in the study of structure of organic compounds
- 3.To develop skill in the recognition of characteristic absorption bands
- 4.to identify compound by an investigation of its IR spectrum

CO 3

Task-10 : Determination of Strength of an acid in Pb-Acidbattery**Objective:**

- 1.To determine the half –reactions involved in spontaneous oxidation –reduction reactions.
2. Explain the function of the lead storage and dry cell batteries ...electrolysis involving two lead strips immersed in sulfuric acid.

CO 4

Additional Experiments:**Task-11 :**Measurement of 10Dq by spectrophotometricmethod**Objective**

1. The purpose of the experiment is three-fold. First, the student verifies that the spectrochemical series based on this model are generally in poor agreement with experimental values obtained from visible spectra (3). However, because of the octahedral symmetry it is true that the splitting of the d levels predicted by crystal field theory is qualitatively correct.

CO 4

Task-12 :Models of potential energysurfaces**Objective:**

1. Distinguish between potential energies and potential energy surfaces (PESs).
2. Identify the saddle point, the reactant and product valleys and plateaus on the contour diagram of PESs
3. Distinguish between attractive and repulsive potential energy surfaces.

CO4

Text Book(s):

1. A Textbook of Quantitative Analysis, Arthur J. Vogel.
2. Jain & Jain. Engineering Chemistry: Dhanapathrai Publications.,2015.
- 3.S.S.Dara, Experiments and Calculations in Engineering Chemistry: S-Chand Publications, Revised edition,2008.

Reference Book(s):

1. S.K. Bhasin and Sudha Rani, “Laboratory Manual on EngineeringChemistry”, Dhanpat Rai Publishing Company, New Delhi, 2nd edition.
- 2Sunitha Rattan, “Experiments in Applied Chemistry”, S.K. Kataria&Sons,New Delhi, 2nd edition.

NARAYANA ENGINEERING COLLEGE:GUDUR

20ES1509	BASIC ELECTRICAL ENGINEERING LAB						R2020	
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	
II	0	0	2	32	1	40	60	
	TOTAL							100

Pre-requisite: Basic knowledge of Electrical circuits and Machines

Course Objectives:

1. To Verification of KCL, KVL and Superposition theorem.
2. To conduct testing on DC and AC Machines.

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

- CO 1** Verify basic Kirchhoff's laws and solving Electrical Circuits(BL-1)
- CO 2** Analyze the simple DC circuits using Pspice(BL-3)
- CO 3** Understand the performance characteristics of DC Machines. (BL-2)
- CO 4** Understand the performance characteristics of AC Machines (BL-2)

CO-PO Mapping														
CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	1										2	3
CO2	2	2	2										2	3
CO3	3	2	2										2	3
CO4	3	3	2										2	3

1: Low, 2-Medium, 3- High

COURSE CONTENT

CO

PART-A

Task 1 - Verification of Kirchhoff laws.

Objectives:

- a) To Verify the KCL
- b) To Verify the KVL

CO 1

Task -2 Determine Real and Reactive power for a given RLC circuits

Objectives:

- a) To find Real and Reactive power for a given RLC circuits

CO 1

Task-3 Brake test on DC shunt motor. Determination of performance curves.

Objectives:Plot the following characteristics

- i) Efficiency Vs Output
- ii) Line current Vs Output

- iii) Speed Vs Output
- iv) Torque Vs Output
- v) Line current Vs Torque CO 3

Task-4 Speed Control of DC shunt motor.

Objectives: Plot the following characteristics

- i) To Control the speed of DC Motor by Armature Control Method.
- ii) To Control the speed of DC Motor by Field Control Method. CO 2

Task-5 O.C. & S.C. Tests on Single phase Transformer.

Objectives: Predetermination of the following

- a) Efficiency at different load conditions and different power factors
- b) Regulation at different load conditions and different power factors
- c) Output vs. Efficiency curves CO 4

Task 6 - Brake Test on Three Phase Induction Motor.

Objectives: To determine the performance characteristics,

- a) Efficiency Vs Output
- b) Line current Vs Output
- c) Speed Vs Output
- d) Torque Vs Output CO 3

Task 7 - Measurement of current in various branches and verify by calculation. Drawing of phasor diagram.

Objectives: To verify the series and parallel RLC circuits CO 1

Task 8-Magnetization characteristics of DC shunt generator. Determination of critical field resistance and critical speed

Objectives:

- a) Predetermine the OCC at different speeds
- b) Determine the critical field resistance
- c) Obtain critical speed for a given shunt field resistance CO 3

Task 9-Swinburne's test on Dc machine

Objectives: To determine the Efficiency of DC motor and Generator CO 3

Task 10 -Load test on DC shunt generator. Determination of characteristics.

Objectives:

- a) Determine the external & internal characteristics
- b) Deduce the armature reaction curve CO 3

Task 11 - Simulation of DC Circuits

Objectives: To simulate a simple DC circuits using PSpice

CO 2

Task 12 -Mesh and Nodal Analysis

Objectives:To simulate a simple DC circuits using PSpice

CO 2

Text Book(s):

1. Basic Electrical and Electronics Engineering, M.S.Sukhija, T.K.Nagsarkar, Oxford University.
2. Basic Electrical and Electronics Engineering, S.K Bhattacharya, Pearson Education, 2012

NARAYANA ENGINEERING COLLEGE:GUDUR

20ES1504	ENGINEERING GRAPHICS LAB							R2020
Semester	Hours / Week		Totalhrs	Credits	Max Marks	CIE	SEE	TOTAL
II	L	T	P		C			
	0	1	4	80	3	40	60	100

Pre-Requisite:BasicMathematics(Geometry)

CourseObjectives:

1. To impart skills on using drawing instruments
2. To convey exact and complete information of any physical object.
3. To Construct Engineering Curves.
4. To Learn and practice basic AutoCAD commands.
5. To Instruct the utility of drafting & modelling packages in orthographic and isometric drawings
6. To understand the applications of AUTOCAD for modeling physical objects

CourseOutcomes: At the end of the course, student will be able to:

- CO1** Define the qualities of precision and accuracy in engineering drawing.(BL-1)
CO2 Draw engineering curves with different methods(BL-3).
CO3 Develop the orthographic projection of points and straight lines(BL-3)
CO4 Construct the planes and simple solids.(BL-3).
CO5 Understand and practice basic AUTOCAD commands(BL-2)
CO6 Construct isometric views using AUTOCAD(BL-3).

CO-PO Mapping														
CO	PO											PSO		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2				1							1	1	1
CO2	2	1			1							1	1	2
CO3	2	2			1							2	2	2
CO4	2	2			2	1						2	2	2
CO5	1	1	1		1							1	1	3
CO6	2	2	2		2							1	2	3

1:Low,2-Medium,3-High

COURSE CONTENT

Part-A Manual Drawing

TASK– 1 Introduction and Conic sections 10h

Introduction to Engineering graphics:

Principles of Engineering Graphics and their significance; various instruments used, drawing sheet sizes and title block, lettering, BIS conventions, types of lines and dimensioning methods.

Geometrical constructions: simple constructions, construction of Pentagon, Hexagon by general method only.

Conic Sections: Types of conics: Ellipse, Parabola and Hyperbola (Eccentricity method only),
At the end of the TASK-1, students will be able to:

1. Understand of Geometrical Constructions. (BL-2)

Draw Conic Sections by using eccentricity method. (BL-3)

TASK--2 Orthographic Projections 11h

Objectives and Principle of projection,

Methods of projections, Comparison between first angle and third angle projection.

Projections of points: Projection of points placed in different quadrants,

Projection of straight lines: Fundamental concepts, Line parallel, perpendicular and inclined to one and two reference planes placed in first quadrant only,

Projections of planes: Projection of planes (Triangle, Square, Pentagon, Circle) parallel, perpendicular and inclined to one and two reference planes placed in first quadrant only

At the end of the TASK- 2, students will be able to:

1. Understand Orthographic Projection of points. (BL-2)

2. Draw Projection of lines inclined to one and two reference planes. (BL-3)

construct the Projection of planes inclined to one and two reference planes. (BL-3)

TASK–3 Projections of Solids 13 h

Types of solids ; Polyhedra, Solids of revolution,

Projections of regular solids (Prisms, Pyramids, Cylinders and Cone), with its axis perpendicular to one plane and parallel to other plane, Axis inclined to one plane and parallel to other plane.
At the end of the TASK-3, students will be able to:

1. Understand Projections of regular Solids. (BL-2)

Draw projections of Prisms, Pyramids, Cylinders And Cones (BL-3)

TASK–4 Isometric and Orthographic views 11h

Isometric Projections : Principles, Isometric scale, Isometric views, Conventions, Isometric views of lines, planes, simple solids (Cube, Cylinder, Cone), Conversion of Isometric views to Orthographic views.

At the end of the TASK-4, students will be able to:

1. Understand Principles of Isometric Projections and Isometric scale. (BL-

2) 2. Draw isometric views of simple solids (BL-2)

3. Apply the principles in Conversion of Isometric views into Orthographic views. (BL-3)

Part B Computer Aided Drafting

TASK–5 Introduction to AutoCAD 16 h

Basic drawing and editing commands: line, circle, rectangle, erase, view, undo, redo, snap, object editing, moving, copying, rotating, scaling, mirroring, layers, templates, polylines, trimming, extending, stretching, fillets, arrays, dimensions. Dimensioning principles and conventional representations.

At the end of the TASK- 5, students will be able to:

1. Understand the Basic AutoCAD commands. (BL-2)

2. Draw the templates of simple physical objects. (BL-3)

Apply the utility of drafting & modelling packages in orthographic and isometric drawings

NARAYANA ENGINEERING COLLEGE:GUDUR

20ES1510	INTRODUCTION TO PYTHON PROGRAMMING LAB							R20
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
II	0	0	2	32	1	40	60	100

Pre-requisite: Programming Knowledge

Course Objectives:

1. To gain knowledge on python programs basics
2. To prepare students for solving the programs on functions, data structures, Files
3. To prepare students for solving the programs on Classes, Exception Handling, Regular Expressions and Multi threading

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

- CO1** Understanding and use of python- Basic Concepts(BL -2)
- CO2** Solve the concepts of python functions and data structures(BL -3)
- CO3** Understand the concepts of files, modules, multithreading and regular expressions(BL -2)
- CO4** Solve the concepts of class and exception handling (BL -3)

CO-PO Mapping														
CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	1	2										1	
CO2	2	3	2	2									2	1
CO3	2	2	3	2	2								3	2
CO4	2	2	2	1	1								3	2

1-Low, 2-Medium, 3- High

COURSE CONTENT

CO

Task-1 - Python Basics

1. Running instructions in Interactive interpreter and a Python Script
2. Write a program to purposefully raise Indentation Error and Correct it
3. Write a program to compute distance between two points taking input from the user
(Pythagorean Theorem)
4. Write a program to convert a Binary number to Decimal number and verify if it is a Perfect number. CO 1

Task-2 - Conditional Statements

1. Write a program to determine if a given string is a Palindrome or not
2. Write a program for Fibonacci sequence is generated by adding the previous two terms by starting with 1 and 2, the first 10 terms will be: 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, ... CO 1

Task-3 - Functions

1. Write a function `ball_collide` that takes two balls as parameters and computes if they are colliding. Your function should return a Boolean representing whether or not the balls are colliding.
 Hint: Represent a ball on a plane as a tuple of (x, y, r) , r being the radius. If (distance between two balls centers) \leq (sum of their radii) then (they are colliding) CO 2

TASK-4 - Functions Continued

1. Write a function that draws a Pyramid with # symbols

```

      #
     ###
    #####
   #####
  #####
 
```

2. Choose any five built-in string functions of C language. Implement them on your own in Python. You should not use string related Python built-in functions. CO 2

TASK-5 - Strings

1. Write a program to use `split` and `join` methods in the string and trace a birthday with Diction b array data structure.

Write a program using `map`, `filter` and `reduce` functions CO 2

TASK-6 - Lists

1. Write program which performs the following operations on list's. Don't use built-in functions

- a) Updating elements of a list
- b) Concatenation of list's
- c) Check for member in the list
- d) Insert into the list
- e) Sum the elements of the list
- f) Push and pop element of list
- g) Sorting of list
- h) Finding biggest and smallest elements in the list

i) Finding common elements in the list CO 2

TASK-7 - Files (

1. Write a program to print each line of a file and count the number of characters, words and lines in a file.

2. Write a program that allows you to replace words, insert words and delete words from the file. CO 3

TASK-8 - Modules and Packages

1. Write a program for creating a module and import a module

Write a program to perform any two operations using Numpy CO 3

TASK-9-Class and Objects

1. Write a program for Class variables and instance variable and illustration of the self variable

i) Robot

ii) ATM Machine

CO 4

TASK-10 - Exception Handling

1. Write a program of exception handling to open a file while do not have write permissions

Write a Program to handle multiple errors with one except statement.

CO 4

TASK-11- Regular Expressions

1. Write a Python program to remove the parenthesis area in a string.

Sample data : ["example (.com)", "w3resource", "github (.com)", "stackoverflow (.com)"]

2. Write a program to match the name phone , emails, passwords and phone numbers using pattern matching

CO 3

TASK-12-Turtle

1. Write a turtle program to construct a clock dial

Write a turtle program to produce a flower in different colours

CO 3

Additional Experiments

TASK-1

1. Write a python program to find the resolution of an image
2. Write a python program to count the number of vowels and consonants
3. Write a python program to print the ASCII value of a character

Text Book(s):

1. VamsiKurama, Python Programming: A Modern Approach, Pearson, 2017.
2. Allen Downey, Think Python, 2nd Edition, Green Tea Press

Reference Books :

1. R. Nageswara Rao, "Core Python Programming", 2nd edition, Dreamtech Press, 2019.
2. Allen B. Downey, "Think Python", 2nd Edition, SPD/O'Reilly, 2016.
3. Martin C. Brown, "The Complete Reference: Python", McGraw-Hill, 2018.
4. Mark Lutz, Learning Python, 5th Edition, O'Reilly, 2013.
5. Wesley J Chun, Core Python Programming, 2nd Edition, Pearson, 2007
6. Kenneth A. Lambert, Fundamentals of Python, 1st Edition, Cengage Learning, 2015

NARAYANA ENGINEERING COLLEGE: GUDUR

20EN1502 ORAL COMMUNICATION SKILLS LAB

Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P			C	CIE	SEE
II	0	0	2	32	1	40	60	100

Task – 1: Introducing to others

Situational Dialogues, Ice - Breaking Activity, Introducing Oneself and Others – Greetings – Taking Leave, Think pair share, Oral Description of Pictures, Photographs, Products, and Process

Task – 2: Debate

What is Debate, How to Debate, Tips for Debate, Debate Practice, Explanation of Debate Techniques, Debate Videos Presentation

Task – 3: Group Discussion

What is Group Discussion, Types of Group Discussion, Tips and Techniques for Effective Group Discussion, Group Discussion Videos Presentation.

Task – 4: Professional Skills

Telephone Etiquette, Making an Appointment, Telephone Talk and Tips, Effective E-mail Resume Writing, Resume Cover Letter, Curriculum Vitae Preparation

Task – 5: Presentation Skills

Oral presentations (individual and group) through Seminars / PPTs, Importance of Body Language, Paper Presentation, Public Speaking Tips, Effective Presentation of renowned speakers.

Task – 6: Interview Skills

Interview Skills Introduction, Interview strategies, Interview questions, Successful Interview presentations and Mock Interviews.

Reference Books:

1. Rizvi, Ashraf. M., Effective Technical Communication, Mc Graw Hill, New Delhi. 2005
2. Raman, Meenakshi & Sangeetha Sharma. Technical Communication: Principles and Practice, Oxford University Press, New Delhi. 2011.
3. Chase, Becky Tarver. Pathways: Listening, Speaking and Critical Thinking. Heinley ELT; 2nd Edition, 2018.
4. English for Technical Communication for Engineering Students, Aysha Vishwamohan, Tata McGraw-Hill 2009
5. Communication Skills by Leena Sen, PHI Learning Pvt Ltd., New Delhi, 2009

SEMESTER III

Category	Course Title	Contact Periods per week				Credits	Scheme of Examination Max. Marks		
		L	T	P	Total		Int. Marks	Ext. Marks	Total Marks
BS	Complex Analysis and Numerical Methods	3	0	0	3	3	40	60	100
ES	Data Structures	2	0	2	4	3	40	60	100
ES	Electronic Devices and Circuits	3	0	0	3	3	40	60	100
PC	Digital Logic Design	3	0	0	3	3	40	60	100
PC	Network Theory	3	0	0	3	3	40	60	100
ES	Electronic Devices and Circuits Lab	0	0	3	3	1.5	40	60	100
PC	Digital Logic Design Lab	0	0	3	3	1.5	40	60	100
PC	Network Theory Lab	0	0	3	3	1.5	40	60	100
SC	Career Competency Development I	0	0	2	2	1	40	60	100
SC	Value Added Course/ Certificate Course I	0	0	0	0	1	40	60	100
MC	Mandatory Course II	2	0	0	2	0	00	00	00
	Counselling/Mentoring	0	0	1	1	0	--	--	--
	Sports/Hobby Clubs/Activities	0	0	2	2	0	--	--	--
	Activity Point Programme	During the Semester				20 Points			
	Total	16	0	16	32	21.5	400	600	1000

NARAYANA ENGINEERING COLLEGE: GUDUR

20MA1005	COMPLEX ANALYSIS & NUMERICAL METHODS							R-2020
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
III	3	0	0	48	3	40	60	100

Pre-requisite: inter mathematics

Course Objectives: This course aims to providing the knowledge for the student about on

1. Special functions and
2. Complex Variables Differentiation & Integration.
3. Various numerical methods for solving an algebraic and transcendental equations,
4. To interpolating the values through the polynomials,
5. To evaluation of integral values through the numerical methods
6. To solve ordinary differential equations through the numerical methods.

Course Outcomes: After successful completion of the course, the student will able to:

- CO 1** Apply the techniques of special functions in various engineering problems . (BL-3)
- CO 2** Identify the analyticity of complex functions to find the derivatives of complex functions. (BL-2)
- CO 3** Apply Cauchy’s integral formula and Cauchy’s integral theorem to evaluate improper integrals along contours. (BL-3)
- CO 4** Solve the Algebraic ,Transcendental Equations by using numerical methods & understand the concepts of Interpolation . (BL-3)
- CO 5** Solve the ordinary differential equations by using various numerical methods. (BL-3)

CO-PO Mapping														
CO	PO												PSO	
	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3												
CO2	3	3											1	
CO3	3	3											1	
CO4	3	3												
CO5	3	3											1	

1- Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1

Special Functions

Hours:10

Introduction to special functions, Beta function- Definition of beta function and its properties (with proof), Other forms of Beta function (with proof), Gamma function- Definition of Gamma function and its properties (with proof), Relation between Beta and Gamma functions (with proof)

At the end of the Module 1, students will be able to:

1. Understand Beta and Gamma functions and its relations. (BL-3)
2. Explain the applications and the usefulness of these special functions. (BL-2)
3. Use Beta & Gamma functions to evaluate different types of integral problems (BL-1)
4. Apply the techniques of special functions in various engineering problems. (BL-3)

MODULE -2 Complex variables – Differentiation Hours:10

Introduction to functions of complex variable-concept of Limit & continuity- Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate-construction of analytic function by Milne -Thomson method.

At the end of the Module 2, students will be able to:

1. Understand functions of Complex variable and its properties. (BL-3)
2. Evaluate derivatives of complex functions. (BL-5)
3. Understand the analyticity of complex functions. (BL-3)

MODULE-3 Complex Variables – IntegrationHours:8

Line integral-Contour integration, Cauchy's integral theorem (without proof), Cauchy's Integral formula (without proof), zeros of analytic functions, singularities, Laurent's series; Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals (around unit circle, semi-circle with $f(z)$ not having poles on real axis).

At the end of the Module 3, students will be able to:

8. Understand the integration of complex functions. (BL-3)
9. Apply Cauchy's integral theorem and Cauchy's integral formula. (BL-3)
10. Understand singularities of complex functions. (BL-3)
11. Evaluate improper integrals of complex functions using Residue theorem. (BL-5)

MODULE-4 Solution of Algebraic, Transcendental Equations & Interpolation Hours:10

Introduction-Bisection method, Regula-falsi method, Newton Raphson method, Finite differences-Newton's forward and backward interpolation formulae – Lagrange's formulae.

At the end of the Module 4, students will be able to:

1. Solve an algebraic or transcendental equation using an appropriate numerical method. (BL-3)
2. Understand the use of different operators in interpolation. (BL-2)
3. Find interpolating polynomials using Newton's forward and backward formulae. (BL-2)
4. Understand the theoretical and practical aspects of the use of numerical methods. (BL-2)

MODULE-5 Numerical integration & Solution of ordinary differential equations Hours:10

Numerical Integration: Trapezoidal rule – Simpson's 1/3 Rule – Simpson's 3/8 Rule Numerical solution of Ordinary Differential equations: Solution by Taylor's series-Picard's Method of successive Approximations-Modified Euler's Method- Runge-KuttaMethod.

At the end of the Module 5, students will be able to:

1. Apply numerical differentiation and integration techniques to various engineering problems. (BL-3)
2. Understand the techniques of Trapezoidal rule, Simpson's 1/3 Rule, Simpson's 3/8 Rule and its applications (BL-2)
3. Work out numerical differentiation whenever and wherever routine methods are not (BL-1)
4. Apply Runge-kutta method in engineering problems (BL-3)

Total hours 48

NARAYANA ENGINEERING COLLEGE:GUDUR

20ES1010 DATA STRUCTURES								R20
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
III	2	0	0	32	2	40	60	100

Pre-requisite: Knowledge of Mathematics, Computer Programming, Analytical & Logical Skills

Course Objectives:

1. To explain efficient storage mechanisms of data for an easy access.
2. To design and implementation of various basic and advanced data structures.
3. To introduce various techniques for representation of the data in the real world.
4. To develop applications using data structures.
5. To pertain knowledge on improving the efficiency of algorithm by using suitable data structure.

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

- CO 1** Classify the Data Structures concepts in real time applications. (BL-2).
- CO 2** Demonstrate the concepts of stacks and queues for organizing data. (BL-3).
- CO 3** Demonstrate the concepts of Linked Lists in Linear Data Structures. (BL-3).
- CO 4** Interpret different ways of handling Trees and Graphs as non-linear Data Structures (BL-3).
- CO 5** Analyze different searching and sorting techniques for organizing data (BL-4).

Text Book(s):

1. B.S. Grewal, “Higher Engineering Mathematics”, 44th edition ,Khanna Publishers,2017.
2. 2 Ramana B.V., “Higher Engineering Mathematics”, McGraw Hill Publishers,2017..
3. 3. S.S. SASTRY, Introductory Methods of Numerical Analysis, 5/e, PHI learning private limited, 2012.

Reference Book(s):

1. Erwin Kreyszig, “Advanced Engineering Mathematics”, John Wiley.
2. Veerarajan T., “Engineering Mathematics”, Tata McGraw-Hill.
3. Michael Greenberg, Advanced Engineering Mathematics, 2/e, Pearson, 2018
4. R.K.Jain and S.R.K.Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002.

CO-PO Mapping														
CO	PO												PSO	
	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO 2
CO 1	3	2	2										2	
CO 2	1	3	3										2	
CO 3	1	3	3	1									1	
CO 4	1	3	2	1									1	
CO 5	2	3	3	1									2	

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1 Introduction to Data Structures 6H

Introduction: Overview of Data Structures, Implementation of Data Structures, Algorithm Specifications, Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off.

Arrays: One-Dimensional, Multi-Dimensional, Pointer Arrays.

At the end of the Module 1, students will be able to:

1. Understand the linear and non-linear data structures. (BL - 2)
2. Understand the time and space complexities of an algorithm. (BL - 2)
3. Illustrate representation of data using Arrays. (BL - 2)

MODULE -2 Stacks and Queues 7H

Stacks: Introduction, Representation of a Stack, Stack Operations, Applications of Stacks.

Queues: Introduction, Representation of a Queue, Queue Operations, Circular Queue, Applications of Queues.

At the end of the Module 2, students will be able to:

4. Explain stack ADT and its operations. (BL - 2)
5. Understand the expression evaluation using stacks. (BL - 2)
6. Implement various queue structures. (BL - 3)

MODULE-3 Linked Lists 6H

Introduction, Singly linked lists, Doubly Linked Lists, Circular Linked Lists, Linked Stacks and Queues, Applications of Linked Lists.

At the end of the Module 3, students will be able to:

1. Understand basics concepts of linked lists. (BL - 2)
2. Illustrate various structures of linked lists. (BL - 2)
3. Understand the concept of dynamic memory management. (BL - 2)

MODULE-4 Trees & Graphs 6H

Trees: Introduction, Basic Terminologies, Definition and Concepts, Representation of Binary Tree, Operations on a Binary Tree, Binary Search Tree, Height Balanced Binary Tree.

Graphs: Introduction, Graph Terminologies, Representation of Graphs, Graph Operations, Shortest Paths – Warshall's, Floyd's and Dijkstra's algorithms, Topological Sorting.

At the end of the Module 4, students will be able to:

1. Understand the concept of trees. (BL - 2)
2. Compare different tree structures. (BL - 2)
3. Explain the importance of Graphs for solving problems. (BL - 2)
4. Understand graph traversal methods. (BL - 2)
5. Implement algorithms to identify shortest path. (BL - 3)

MODULE-5 Sorting, Searching and Hash Tables 7H

Sorting: Introduction, Bubble Sort, Selection Sort, Quick Sort.

Searching: Introduction, Basic Terminology, Linear Search and Binary Search Techniques

Hash Table: Hashing Techniques, Collision Resolution Techniques, Closed Hashing, Open Hashing.

At the end of the Module 6, students will be able to:

1. Implement the sorting algorithms (BL - 3)
2. Select the appropriate sorting algorithm for a given application (BL - 3)
3. Understand the concept of Hash Table (BL - 2)
4. Explain searching techniques. (BL - 2)

Total hours: 32 hours

Text Book(s):

3. D. Samanta, "Classic Data Structures", 2nd Edition, Prentice-Hall of India, Pvt. Ltd., India, 2012.
4. Ellis Horowitz and Sartaj Sahni, "Fundamentals of Data Structures in C", 2nd Edition, Universities Press , 2008.

Reference Books:

1. NarasimhaKarumanchi, Data Structures and Algorithms Made Easy, Careermonk Publications, 2016
2. Peter Bras, "Advanced Data Structures", Cambridge University Press, 2014.
3. RS Salaria, Data Structures, 3rd Edition, Khanna Publishing House, 2017.
4. YashwantKanetkar, Data Structures through C,3rd Edition, BPB Publications, 2019.
5. RB Patel, Expert Data Structures with C, Khanna Publications, 2019.
6. Richard F. Gilberg, Behrouz A. Forouzan, Data Structures A Pseudo code Approach with C, Second Edition, Cengage Learning.
7. Ananda Rao Akepogu, Radhika Raju Palagiri,Data Structures and Algorithms Using C++ ,

Special Semiconductor Devices: Principle of operation and Characteristics of Varactor diode, Tunnel Diode, Photo diode, LED, SCR

At the end of the Module 1, student will be able to:

1. Define PN junction diode (BL-1)
2. Explain the operation of PN junction diode for both forward and reverse bias. (BL-2)
3. Explain the energy band diagram of PN junction diode (BL-2)
4. Interpret the effect of temperature on V-I characteristics of PN junction diode (BL-2)
5. Derive the expression for transition and diffusion capacitance (BL-2)
6. Explain V-I Characteristics of various special diodes. (BL-2)
7. Describe the principle of operation of thyristors. (BL-2)

MODULE -2

RECTIFIERS & FILTERS

10 Hrs

Diode applications: P-N junction diode as a rectifier - Half Wave Rectifier, Full Wave Rectifier, Bridge Rectifier, rectifier parameters, Harmonic components in Rectifier Circuits. Clippers and Clampers (Qualitative Treatment only)

Filters: Inductor Filters, Capacitor Filters, L- section Filters, π - section Filters, bleeder resistor.

At the end of the Module 2, students will be able to:

1. Explain the operation of a bridge rectifier. (BL-2)
2. Analyze the performance of rectifiers with and without filters. (BL-4)
3. Design half wave and full wave rectifier circuits. (BL-4)
4. Differentiate various rectifier circuits in terms of their parameter metrics. (BL-2)
5. Explain the importance of bleeder resistor (BL-2)

MODULE-3

BIPOLAR JUNCTION TRANSISTOR

9 Hrs

Bipolar junction Transistor : Construction, Principle of Operation, transistor current components, transistor configurations, Transistor h-parameter model, calculation of h-parameters from characteristics, transistor as a switch, transistor as an amplifier.

At the end of the Module 3, students will be able to:

1. Discuss the current components and their relationships in BJT (BL-2)
2. Explain principle, operation and applications of BJT (BL-2)
3. Describe input and output Characteristics of BJT (BL-2)
4. Differentiate BJT configurations (CB, CC, CE) (BL-2)

MODULE-4

TRANSISTOR BIASING

10 Hrs

Transistor Biasing: Need for biasing, operating point, load line analysis, Stabilization against variations in I_{CO} , V_{BE} and β , biasing and stabilization techniques: fixed bias, collector to base bias, voltage divider bias, bias compensation techniques, thermal runaway, heat sink and thermal stability.

At the end of the Module 4, students will be able to:

1. Explain principle, operation and applications of MOSFET (BL-2)
2. Describe the operation and characteristics of Depletion MOSFET. (BL-2)
3. Explain the operation and characteristics of Enhancement MOSFET. (BL-2)
4. Differentiate enhancement and depletion mode MOSFET. (BL-2)

MODULE-5 METAL OXIDE SEMICONDUCTOR FIELD-EFFECT TRANSISTOR 9 Hrs

MOSFET: Construction of depletion mode and enhancement mode of NMOS and PMOS, Drain characteristics of MOSFET, Transfer Characteristics of MOSFET, MOSFET as a Switch, CMOS Inverter and its Characteristics.

At the end of the Module 5, students will be able to:

1. Define biasing and stabilization (BL-1)
2. Explain the importance of thermal stability (BL-2)
3. Analyze the stabilization techniques. (BL-4)
4. Differentiate compensation techniques. (BL-2)

Total hours: 48 Hours

Text Book(s):

1. J. Milliman and C Halkias, "Integrated electronics", 2nd Edition, Tata McGraw Hill, 1991.
2. L. Boylestad and Louis Nashelsky (2006), Electronic Devices and Circuits, 9th Edition, Pearson/Prentice Hall
3. Electronic Devices and Circuits by Lal Kishore, BS Publications.

Reference Book(s):

1. Behzad Razavi, "Microelectronics", Second edition, Wiley, 2013.
2. S. Salivahanan, N. Suresh Kumar, A. Vallavaraj (2008), Electronic Devices and Circuits, 2nd edition, Tata McGraw Hill, New Delhi.
- 3.
4. Jimmie J Cathey, "Electronic Devices and Circuits," Schaum's outlines series, 3rd edition, McGraw-Hill (India), 2010.

NARAYANA ENGINEERING COLLEGE:GUDUR

20EC2001	DIGITAL LOGIC DESIGN							R2020
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
III	3	0	0	48	3	40	60	100

Pre-requisite: Basic knowledge on number system and algebra.

Course Objectives:

- To study the basic concepts of number systems and binary codes.
 - To minimize Boolean expressions using map and Q-M method.
 - To design combinational and sequential circuits.
 - To familiarize Registers & counters using Flip-Flops.
5. To understand the concept of memory organization

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

CO 1 Use number systems, binary codes and Boolean algebra to implement digital circuits **(BL-3)**

CO 2 Apply minimization techniques on Boolean expressions. **(BL-3)**

CO 3 Design combinational circuits using logic gates. **(BL-3)**

CO 4 Analyze synchronous sequential circuits. **(BL-4)**

CO 5 Classify the memories and programmable logic devices. **(BL-2)**

CO-PO Mapping														
CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	1										1	
CO2	3	3	3	1									1	
CO3	3	3	3	1									1	1
CO4	3	1	2	1									2	1
CO5	2	2											1	1

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1 **NUMBER SYSTEMS & BOOLEAN ALGEBRA** **10 h**

Number Systems: Introduction, Number Systems, Number base conversions, 1's and 2's Complements, BCD code, Excess -3 codes, Gray code, ASCII code, Error Detection and Correction Codes. Boolean Algebra: Basic definition, Basic theorems and properties, Boolean Functions, Canonical & Standard forms, Logic gates, implementation of Boolean functions using logic gates

At the end of the Module 1, students will be able to:

- List number systems. (BL-1)
- Illustrate different code conversions. (BL-2)
- List Theorem's and properties of Boolean algebra (BL-1)
- Explain the functionality of logic gates(BL-2)

MODULE -2 **SIMPLIFICATION OF BOOLEAN FUNCTIONS** **10 h**

Introduction, Karnaugh map simplification, Don't care conditions, Prime Implicants, Quine-McCluskey method Simplification, NAND & NOR Implementations, Two Level Implementations.

At the end of the Module 2, students will be able to:

- Apply basic laws and De Morgan's theorems to simplify Boolean expressions(BL-3)
- Explain map and Q-M method to minimize Boolean expressions. (BL-2)
- Implement Boolean expression using universal gates. (BL-3)
- Implement Boolean expression using two level methods. (BL-3)

MODULE-3 **COMBINATIONAL CIRCUITS** **9 h**

Introduction, Design Procedure, Adders, Sub tractor, Binary Adder-Sub tractor, BCD Adder, Binary Multiplier, Magnitude Comparator, Multiplexers, De-multiplexers, Decoders, Encoders and Code Converters.

At the end of the Module 3, students will be able to:

1. Design combinational logic circuits. (BL-3)
2. Implement Boolean expression using multiplexer. (BL-3)
3. Implement higher order MUX using lower order MUX.(BL-3)
4. Design code converters using gates. (BL-3)

MODULE-4

SEQUENTIAL CIRCUITS

10 h

Introduction, Latches, Flip-flops, Master-slave flip flops, Edge-triggered flip-flops, Flip-Flop conversions, Design of Synchronous Sequential Circuits: State Equations, State Table, State reduction, State assignment, State diagram, Mealy and Moore machine models, Registers, Shift Registers, Counters: Synchronous counters, Asynchronous counters & other counters.

At the end of the Module 4, students will be able to:

2. Describe behavior of latches & flip flops. (BL-2)
3. Analyze the flip-flop conversions(BL-3)
4. Analyze synchronous sequential circuits. (BL-3)
5. Explain the design procedure of sequential circuits(BL-2)
6. Design synchronous sequential circuits using state reduction & assignment process. (BL-3)

MODULE-5

MEMORY &PROGRAMMABLE LOGIC DEVICES

9 h

Introduction, Random Access Memory, Types of RAM, Memory decoding, Read Only Memory, Types of ROM, Flash memory, Programmable Logic Devices (PLDs): Basic concepts, Programmable Read Only Memory (PROM), Programmable Array Logic (PAL) and Programmable Logic Array(PLA).

At the end of the Module 6, students will be able to:

5. Explain PROM, PAL and PLA. (BL-2)
6. Compare digital logic families. (BL-2)
7. Illustrate the characteristics of digital IC's . (BL-2)

Total hours: 48 hours

Text Book(s):

1. M. Morris Mano, M.D. Ciletti, "Digital Design", 5th edition, Pearson, 2018.
2. John F Wakely Digital Design Principles And Practices, Pearson Publication, Fourth edition
3. Anil K. Maini, "Digital Electronics: Principles, Devices and Applications", Willey, 2007

Reference Book(s):

1. Anand Kumar, Switching Theory and Logic Design, PHI,2008
2. John. M Yarbrough, "Digital Logic Applications and Design", Thomson Learning, 2006.
3. R. P. Jain, "Modern Digital Electronics", 4th edition, McGraw Hill Education (India Private Limited), 2012.

NARAYANA ENGINEERING COLLEGE:GUDUR

20EC2002	NETWORK THEORY							R2020
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
III	3	0	0	45	3	40	60	100

Pre-requisite: Fundamental of Basic Electrical circuits

Course Objectives:

7. To understand frequency response in electrical circuits
 8. The capability to analyze the Low and High Pass filter.
 9. Evaluate the behaviour of networks for transient analysis of first order and second order.
 10. Analyze and synthesize networks using Laplace transforms.
11. Different types of two-port network analysis using network parameters, with different types of connections.

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

- CO 1** Describe the Series resonance ,parallel resonance and analyze the locus diagrams of R,L,C(BL-2)
- CO 2** Analyze the DC transients of R,L,C (BL-4)
- CO 3** Analyze the AC transients of R,L,C (BL-4)
- CO 4** Derive Two port network parameters of Electrical circuits(BL-3)
- CO 5** Analyze the Filters and Network functions(BL-4)

CO-PO Mapping														
CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2	1									1	1
CO2	3	2	2	2									1	1
CO3	3	2	2	2									1	1
CO4	3	3	2	2									1	1
CO5	3	3	2	2									1	1

COURSE CONTENT

MODULE – 1

RESONANCE

9hrs

Introduction, Definition of quality factor **Q** of inductor and capacitor, Series resonance, Bandwidth of the series resonant circuits, Parallel resonance (or anti-resonance), Locus diagram for Series R-L, R-C, R-L-C and Parallel Combination with Variation of Parameters.

At the end of the Module 1, students will be able to:

1. Explain the series and parallel resonance.(BL-2)
2. Understand the effect of resonance on series and parallel resonance circuits.(BL-2)
3. Understand the concept of locus diagrams. (BL-2)

MODULE -2

DC TRANSIENT ANALYSIS

9hrs

Transient Response of R-L, R-C, R-L-C Series and Parallel Circuits for D.C Excitation-Initial Conditions-Solution Method Using Differential Equations and Laplace Transforms, Response of R-L & R-C Networks to Pulse Excitation.

At the end of the Module 3, students will be able to:

4. Explain the transient phenomenon in DC excitations. (BL-2)
5. Explain Application of Laplace transform for solution of D.C transient circuits. (BL-2)
6. Compare the classical method and Laplace transform approach in sinusoidal excitations. (BL-2)

MODULE -3

AC TRANSIENT ANALYSIS

9hrs

Transient Response of R-L, R-C, R-L-C Series and Parallel Circuits for Sinusoidal Excitations-Initial Conditions-Solution Method Using Differential Equations and Laplace Transforms.

At the end of the Module 4, students will be able to:

12. Explain the transient phenomenon in AC excitations. (BL-2)
13. Understand AC transient analysis in electrical circuits to know the power system stability. (BL-2)
14. Develop knowledge on R-L, R-C and R-L-C circuit analysis in A.C. (BL-3)

MODULE -4

TWO PORT NETWORKS

9Hrs

Two Port Network Parameters: Impedance, Admittance, Transmission and Hybrid Parameters and their Relations, Reciprocity and Symmetry conditions, Concept of Transformed Network, Two Port Network Parameters Using Transformed Variables.

At the end of the Module 5, students will be able to:

4. Understand the concept of two port network theory. (BL-2)
5. Verify the Reciprocity and Symmetry conditions for the given two port network. (BL-1)
6. Understand the concept of Transformed Network (BL-2)

MODULE-5

FILTERS & NETWORK FUNCTIONS

9HRS

Filters – Low Pass – High Pass and Band Pass – RC, RL filters– derived filters and composite filters design – Attenuators – Network functions for one port and two port networks, pole-zeros of network functions and network stability

At the end of the Module 6, students will be able to:

1. Explain the types of filters. (BL-2)
2. Explain the parameters for the design of various filters. (BL-2)
3. Explain the poles and zeros of a given transfer function. (BL-2)

Total hours:45 hours

Text Book(s):

1. A Sudhakar and Shyam Mohan SP, "Circuits and Networks: Analysis and Synthesis", TMH, 5th Edition, New Delhi, 2015.
2. Ravish R., Network Analysis and Synthesis, 2/e, McGraw-Hill, 2015

Reference Book(s):

1. S.Sivanagaraju, G.Kishor&C.Srinivasa Rao, "Electrical Circuit Analysis", Cengage Learning, 1st Edition, 2010.
2. A. Chakrabarti : Circuit Theory (Analysis and Synthesis), Dhanpat Rai &Co
3. Joseph A. Edminister and Mahmood Nahvi, "Electric Circuits Schaum"s Outline Series", 6th Edition, Tata McGraw-Hill, 2014, New Delhi.

NARAYANA ENGINEERING COLLEGE:GUDUR

20ES1515 **ELECTRONIC DEVICES LAB**

R2020

Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P			C	CIE	SEE
III	0	0	2	36	1	40	60	100

Pre-requisite:Basic knowledge on semiconductor physics.

Course Objectives:

1. To Gain Knowledge on basic electronic devices.
2. To Observe the characteristics of various electronic devices.
3. To prepare students for designing various biasing circuits

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

- CO 1** Demonstrate the basic characteristics and applications of basic electronic devices. **(BL-02)**
- CO 2** Draw the characteristics of electronic devices by plotting graphs**(BL-02)**
- CO 3** Analyze the Characteristics of UJT, BJT, FET, and SCR **(BL-04).**
- CO 4** Design FET based amplifier circuits/BJT based amplifiers for the given specifications.**(BL-03)**

CO-PO Mapping														
CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	1	2						3	2		2	2	2
CO2	3	1	2						3	2		2	2	2
CO3	3	1	1						3	2		2	2	2
CO4	3	2	2						3	2		2	2	2

1: Low, 2-Medium, 3- High

COURSE CONTENT

Task-1: PN Junction Diode

CO

Objective: To Verify the Volt- Ampere characteristics of a PN junction diode and find static, dynamic and reverse resistances of the diode from the graphs.

CO1

Task-2: ZENER DIODE

Objective: To design a Zener diode based voltage regulator against variations of supply and load.

CO 2

Task-3: Half Wave Rectifier

Objective: To design a half wave rectifier for the given specifications with and without filters and verify experimentally and draw suitable graphs.

CO 3

Task-4: FULL WAVE RECTIFIER

Objective: To design a full wave rectifier for the given specifications with and without filters, and verify the given specifications experimentally. Vary the load and find ripple factor. And draw suitable graphs.

CO 3

Task-5: COMMON EMITTER CONFIGURATION

Objective: To Verify the input and output characteristics of BJT in Common Emitter configuration experimentally and find the required h – parameters from the graphs

CO 3

Task-6: Common Emitter Configuration

Objective: To Verify the input and output characteristics of BJT Common Emitter configuration experimentally and find h – parameters from the graph

CO3

Task-7: Common Collector configuration

Objective: To Verify the input and output characteristics of BJT Common Collector configuration experimentally and find h – parameters from the graph

CO3

Task-8: MOSFET Characteristics

Objective: To Study and draw the Volt Ampere characteristics of MOSFET

CO 4

Task-9: MOSFET As Switch

Objective: To Study the Switching characteristics.

CO 4

Task-10: LED Characteristics

Objective: To Study the characteristics of LED

CO4

Additional Experiments

Task-11: VOLTAGE- DIVIDER BIAS CIRCUIT USING BJT.

Objective: To Design and analyse the voltage- divider bias/self bias circuit using BJT

CO 1

Task-12: CLIPPERS AND CLAMPER CIRCUITS

Objective: To Verify clipping and clamper circuits using PN junction diode and draw the suitable graphs

CO 1

Text Book(s):

1. Fundamentals of Electronic Devices and Circuits Lab Manual By David Bell
2. Electronics Lab Manual By Navas K. A
3. Fundamentals of Electronic Circuit Design, Getting Started: MultiSim Textbook Edition by David J. Comer, Donald T. Comer.

Reference Book(s):

1. A Guide to Circuit Simulation and Analysis Using PSPICE by Paul W. Tuinenga
2. Ben G. Streetman, Sanjay Banerjee, Solid State Electronic Devices, Pearson Prentice Hall, 2006.
3. Robert T. Paynter, "Introductory Electronic Devices and Circuits", Pearson Education, 7th Edition

NARAYANA ENGINEERING COLLEGE:GUDUR

20EC2501 Digital Logic Design Lab

R2020

Semester	Hours / Week			Total hrs	Credit	Max Marks		TOTAL
	L	T	P			CIE	SEE	
III	0	0	2	33	1	40	60	100

Pre-requisite: Electronic Circuits, Basic Electronics

Course Objectives:

1. Students will learn and understand the Basics of digital electronics
 2. Students are able to design basic logic circuits,
 3. Able to design combinational circuits.
- i. Able to design sequential circuits.

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

CO 1 Demonstrate the truth table of various expressions and combinational circuits using logic gates. **(BL-2)**

CO 2 Develop various combinational circuits such as adders, sub-tractors, comparators, multiplexers and de-multiplexers. **(BL-3)**

CO 3 Construct flips-flops, counters and shift registers. **(BL-3)**

CO 4 Simulate full adder and up/down counters. **(BL-3)**

4. Sedra A.S. and K.C. Smith, "Micro Electronic Circuits", Oxford University Press, 5th Edition.

CO-PO Mapping														
CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	3						2	2		2	2	3
CO2	2		3						3	2		2	2	2
CO3	3	3	3						2	2		2	2	3
CO4	3	2	3						3	2		2	2	2

1: Low, 2-Medium, 3- High

COURSE CONTENT

Task-1 : STUDY OF LOGIC GATES

Objective: To verify the Truth Table verification of AND, OR, NOT, NAND, NOR, EX-OR & EX-NOR gates.

CO1

Task-2 : FULL ADDER &SUBTRACTOR

Objective:To realize the Full Adder and Sub-tractor circuits using basic logic gates and to verify their truth tables.

CO 2

Task-3: 4-BIT PARALLEL ADDER/SUBTRACTOR USING IC 7483

Objective: To perform the addition and subtraction of two 4-bit binary numbers.

CO 2

Task-4: 4:1 MULTIPLEXER USING GATES

Objective :To realize the 4 to 1 Multiplexer using gates. CO 2

Task-5 : REALIZATION OF 1:8 DEMUX USING IC 74138

Objective: To study the function of de-multiplexer using IC 74138. CO 2

Task-6 : REALIZATION OF CLOCKED SR &JK FLIP FLOP

Objective: 1. To verify the Truth Table of clocked SR Flip Flop
2. To verify the Truth Table of JK Flip Flop CO 3

Task-7 :REALIZATION OF SHIFT REGISTERS USING IC7474

Objective : To implement different types of shift registers like Serial In Serial Out [SISO], Serial In Parallel Out [SIPO], Parallel In Parallel Out [PIPO] and Parallel In Serial Out [PISO] using D-flip flops and to verify their observation table. CO 3

Task-8: RING COUNTER AND JOHNSON (TWISTED RING) COUNTER

Objective :To design and set up four bit Johnson and ring counter using JK Flip-Flops. CO 4

Task-9: REALIZATION OF MOD – N COUNTER USING 7490

Objective :To realize a Modulo N-counter using 7490 and verify the expected truth table and display the output waveform for a square wave input of given frequency. (N–to be specified, N= 9). CO 4

Task-10: MAGNITUDE COMPARATOR

Objective : To Design & Verify the 4-bit Magnitude Comparator using two 2-bitt magnitude comparators.CO 4

Additional Experiments

Task-1: DESIGN AND IMPLEMENTATION OF SEQUENCE GENERATOR

Objective : Design and testing of sequence generator using D flip flop CO 2

Task-2: INTERFACING 7-SEGMENT DISPLAY SYSTEM WITH IC 7447 TO DISPLAY 0-9

Objective : To interface 7-segment display with IC 7447 to display the decimal digits from 0 to 9. CO 2

Text Book(s):

1. M. Morris Mano, M.D. Ciletti, “Digital Design”, 5th edition, Pearson, 2018.
2. R. P. Jain, “Modern Digital Electronics”, 4th edition, McGraw Hill Education (India Private Limited), 2012.
3. Anand Kumar, Switching Theory and Logic Design, PHI,2008

Reference Book(s):

1. Digital Fundamentals, Thomas L. Floyd, Pearson Education, ISBN:9788131734483
2. Digital Principles and Applications, Malvino and Leach, TMH

NARAYANA ENGINEERING COLLEGE:GUDUR

20EC2502	Network theory lab							NECR-20
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
III	0	0	3	36	1.5	40	60	100
Pre-requisite: Basic concepts of electrical circuits								

Course Objectives:

- A. To understand the Series Resonance ,ParallelResonance,
 - B. To understand Locus Of RLC Circuits.
 - C. To learn to compute and to analyze the DC Transients,AC Transients for RLC series parallel circuits
 - D. To learn and apply the concept of Two port networks to the RLC networks
3. To analyse the types of filters and design the filters for required conditions for a given system.

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

CO 1Demonstrate the concept of **resonance and locus diagrams** of R,L,C.(**BL-2**)

CO 2Analyze the **transient response** of AC and DC circuits.(**BL-3**)

CO 3Determine experimentally the **two port network parameters and filters** and verify their result.(**BL-2**)

CO-PO Mapping														
CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3		2					2	2			1	1
CO2	3	3		2					1	2			1	1
CO3	3	3	2	2	2				2	2			3	3
1: Low, 2-Medium, 3- High														

COURSE CONTENT

TASK-1 Transient response of RL and RC circuit

Objective:

To verify the Transient response of RL circuit and to find the time constant of RL and RC network.

TASK-2 Transient response of RLC series circuit

Objective:

To verify the Transient response of RLC series circuit

TASK -3 Transient response of RLC parallel circuit

Objective:

To verify the Transient response of RLC parallel circuit

TASK-4 Locus Diagrams of RL and RC Series Circuits

Objective:

To Plot the current locus diagrams for RL and RC circuits.

TASK-5 Frequency response of series resonance circuit with analysis and design

Objective:

To determine resonant frequency, band width and Q-factor for series RLC circuits.

TASK-6 Frequency response of parallel resonance circuit with analysis and design.

Objective:

To determine resonant frequency, bandwidth and Q-factor for parallel RLC circuits

TASK-7 Z and Y Parameters

Objective:

To calculate and verify 'Z' parameters and Y parameters of two-port network.

TASK-8 Transmission and Hybrid Parameters

Objective:

To calculate and verify 'ABCD' parameters and „h“ parameters of two-port network

TASK -9 Design and frequency response of constant 'k' low pass & high pass filters

Objective:

To plot the frequency response of Low pass filter and High pass filter.

TASK-10 Design and frequency response of Band pass filter

Objective:

To study frequency response of Band pass filter

ADDITIONAL EXPERIMENTS (PSpICE SIMULATION)

TASK-11 Simulation of AC Circuits

Objective:

To simulate a simple AC circuits using PSpice

TASK-12 DC Transient Response

Objective:

To simulate a simple DC circuits using PSpice

Text Book(s):

1. A Sudhakar, Shyamamohan S Palli,“ Circuits & Networks”, Tata Mc Graw- Hill,4thEdition,2010
2. A Chakrabarthy,“ElectricCircuits”,DhanpatRai&Sons,6thEdition,2010.

Reference Book(s):

1. WillamHayt, Jack E.Kemmerly, Steven M. Durbin,“ Engineering Circuit Analysis ”, Tata Mc Graw-Hill, 8th Edition 2012
2. Rudra ratap,“ Getting Started with MATLAB: A Quick Introduction for Scientists and Engineers”, Oxford University Press,1st Edition,1999.

SEMESTER IV

Subject Code	Category	Course Title	Contact Periods per week				Credits	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total Marks
20EC2003	PC	Analog Electronics	3	0	0	3	3	40	60	100
20EC2004	PC	Control Systems	2	0	0	2	2	40	60	100
20EC2005	PC	Electromagnetic Theory and Transmission Lines	3	0	0	3	3	40	60	100
20EC2006	PC	Probability and Random Processes	3	0	0	3	3	40	60	100
20EC2007	PC	Signals and Systems	3	0	0	3	3	40	60	100
	OE	Open Elective I	3	0	0	3	3	40	60	100
20EC2503	PC	Analog Electronics Lab	0	0	3	3	1.5	40	60	100
20EC2504	PC	MATLAB and Simulink Lab	0	0	2	2	1	40	60	100
20CD6002	SC	Career Competency Development II	0	0	2	2	1	40	60	100
20CC6002	SC	Value Added Course/ Certificate Course II	0	0	0	0	1	40	60	100
		Counselling/Mentoring	0	0	1	1	0	--	--	--
		Sports/Hobby Clubs/Activities	0	0	2	2	0	--	--	--
		Activity Point Programme	During the Semester					20 Points		
		Total	17	0	10	27	21.5	400	600	1000

NARAYANA ENGINEERING COLLEGE:GUDUR

20EC2003	ANALOG ELECTRONICS							R2021
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
IV	3	0	0	48	3	40	60	100

Pre-requisite: Basic knowledge on concepts of electronic devices.

Course Objectives:

1. To study the effect of negative feedback on amplifier characteristics.
2. To design RC & LC oscillator circuits.
3. To analyze amplifier frequency response at low and high frequencies.
4. To study coupling schemes and multi stage amplifiers.
5. To analyze the large signal amplifiers and tuned amplifiers.

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

CO 1 Analyze the small signal amplifiers at low frequencies and high frequencies.(BL-4)

CO 2 Illustrate the concepts of negative feedback amplifiers. (BL-2)

CO 3 Illustrate the working principle of oscillators. (BL-2)

CO 4 Analyze the parameters of multi stage amplifiers.(BL-4)

CO 5 Interpret the concepts of Power amplifiers and Tuned amplifiers(BL-2)

CO-PO Mapping														
CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	2										2	
CO2	3	3	2										2	
CO3	3	3	1										1	
CO4	3	3	2	2									1	2
CO5	3	2	1	2									2	3

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1 SMALL SIGNAL LOW FREQUENCY & HIGH FREQUENCY ANALYSIS **11 Hrs**

Low Frequency Analysis:

Transistor hybrid model, determination of h-parameters, conversion of h-parameters, Analysis of CB, CE and CC amplifiers using exact and approximate analysis.

High Frequency Analysis:

Hybrid- π Common Emitter transistor model, Hybrid π conductance's, Hybrid π capacitances, Validity of hybrid π model, determination of high-frequency parameters in terms of low-frequency parameters, CE short circuit current gain, Current gain with resistive load.

At the end of the Module 1, students will be able to:

1. Define Transistor hybrid model.(BL-1)
2. Compare different transistor amplifiers. (BL-2)
3. Explain the effect of coupling and emitter bypass capacitors. (BL-2)
4. Explain the gain bandwidth product of amplifiers.(BL-2)
5. Analyze the Emitter follower frequency response at high frequencies.(BL-4)
6. Analyze the hybrid π CE transistor model. (BL-4)

MODULE -2**FEEDBACK AMPLIFIERS****9 Hrs**

Feedback concept, types of feedback, classification, feedback topologies, Characteristics of negative feedback amplifiers, Generalized analysis of feedback amplifiers, Determination of input & output impedance of different feedback amplifier, Method of Analysis of Feedback Amplifiers.

At the end of the Module 2, students will be able to:

1. Define negative and positive feedback in amplifiers.(BL-1)
2. Explain the effect of negative feedback on amplifier characteristics.(BL-2)
3. Compare different feedback topologies. (BL-2)

MODULE-3**OSCILLATORS****9 Hrs**

Oscillator principle, condition for oscillations, types of oscillators, Generalized analysis of LC Oscillators, Hartley oscillator & Colpitt's oscillator using BJT and FET with relevant analysis, Crystal oscillators, RC-phase shift oscillator & Wein bridge oscillator using BJT with relevant analysis, Frequency & amplitude stability of oscillators.

At the end of the Module 3, students will be able to:

1. Explain condition for oscillations and types of oscillators.(BL-2)
2. Illustrate the operation of RC oscillators.(BL-2)
3. Explain the operation of LC oscillators.(BL-2)
4. Demonstrate the frequency and amplitude stability of oscillators(BL-2)

MODULE-4**MULTISTAGE AMPLIFIERS****10 Hrs**

Classification of amplifiers, Methods of coupling, Generalized analysis of Cascaded amplifier, Analysis of two stage RC coupled amplifier with frequency response, Cascode amplifier, Emitter follower, Darlington pair amplifier, Differential amplifier using BJT.

At the end of the Module 4, students will be able to:

8. Explain the concept of cascading and coupling schemes(BL-2)
9. Analyze two stage RC coupled amplifier (BL-4)
10. Summarize the darlington amplifier parameters.(BL-2)
8. Explain differential amplifier with BJT. (BL-2)

MODULE-5**POWER AMPLIFIERS & TUNED AMPLIFIERS****9 Hrs**

Power Amplifiers: Classification, Class A Power Amplifier, Distortion, Second harmonic Distortion, Class B Amplifier, Push- pull amplifier, Complementary Symmetry Class AB Amplifier, Class C Amplifier, Thermal stability and Heat sink.

Tuned Amplifiers: Tuned Circuit, Q-Factor, Single tuned capacitive coupled amplifier, Effect of Cascading Single tuned amplifiers on Band width, Stability.

At the end of the Module 5, students will be able to:

1. List types of power amplifiers & compare the voltage and power amplifier.(BL-2)
2. Discuss heat sinks, thermal stability and distortions.(BL-1)
3. Explain the concept of tuned circuits. (BL-02)
4. Compare different tuned amplifiers. (BL-02)
5. Derive the expression for gain and bandwidth of a single tuned amplifier. (BL-02)
6. Describe the effect of cascading on bandwidth of tuned amplifiers. (BL-02)

Total hours: 48 Hours**Text Book(s):**

1. J. Millman and C.C. Halkias, "Integrated Electronics", McGraw-Hill, 1972.
2. Donald A. Neaman, "Electronic Circuit Analysis and Design", McGraw Hill.

NARAYANA ENGINEERING COLLEGE:GUDUR

20EC2004	CONTROL SYSTEMS							R2020
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
IV	2	0	0	32	2	40	60	100

Pre-requisite: Basics concepts of Electrical Circuits & Basics of Laplace transform

Course Objectives:

- 1 To understand the merits and demerits of open and closed loop control systems
- 2 To understand the step response of second order control systems
- 3 To plot Root locus for the given system transfer function
- 4 To understand the stability analysis from Bode plot, polar plots
- 5 To understand the merits of state space analysis over time domain analysis

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

CO1 Analyze the differential equations for mechanical and electrical systems and obtain the transfer function from block diagrams, servo motors and signal flow graphs (BL - 3)

CO 2 Analyze the time domain specifications, steady state errors and to learn time response analysis of first and second order systems(BL - 3)

CO 3 Summarize the concepts Routh's stability and Root locus to find the stability of the system (BL - 2)

CO 4 Summarize the frequency domain specifications from Bode, Polar, Nyquist plots and evaluate the frequency domain specifications(BL - 2)

CO 5 Summarize the concept of state space analysis, controllability and Observability and to obtain the transfer function. (BL - 2)

3. Electronic Circuit Analysis 4th Edition – by K. Lal Kishore , BS Publications.

Reference Book(s):

1. Robert T. Paynter, "Introductory Electronic Devices and Circuits", Pearson Education, 7th Edition
2. Robert L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuits Theory" Pearson/Prentice Hall, 9th Edition, 2006.
3. Sedra A.S. and K.C. Smith, "Micro Electronic Circuits", Oxford University Press, 5th Edition.
4. Salivahanan, N.Suressh Kumar, A. Vallavaraj, "Electronic Devices and Circuits", Tata McGraw Hill, Second Edition

CO-PO Mapping														
CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	3											3
CO2	3	3	1											3
CO3	1	2	2										3	
CO4	1	1	3	1										3
CO5	1	3	3											3

1- Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1	INTRODUCTION TO CONTROL SYSTEMS	8 hrs
<p>Examples & Classification of control systems, merits and demerits of Open Loop and closed loop control systems, Effects of positive and negative feedback</p> <p>Mathematical modelling and transfer function of Electrical and Mechanical systems, Analogous systems. Control System Components: DC Servo motor, AC Servo motor , Synchro Transmitter & Receiver (2h)</p> <p>Block diagrams: Block diagram representation of control systems, Block Diagram Reduction Rules .(4h)</p> <p>Signal flow graph: Definitions, Reduction using Mason's gain formula.(3h)</p> <p>At the end of the Module 1, students will be able to:</p> <ol style="list-style-type: none">1. Identify the difference between open loop and closed loop systems (BL=3)2. Understand the effect of feedback on system performance (BL=2)3. Apply the block diagram reduction to simplify the given system (BL=3)		
MODULE-2	TIME RESPONSE ANALYSIS	7 hrs
<p>Standard test signals, Time response of first order and second order un damped, under damped, critically damped and over damped systems, Time domain specifications. (6h)</p> <p>Error Analysis: Steady state Error, static error coefficient of type 0,1, 2 systems (3h)</p> <p>At the end of the Module 3, students will be able to:</p> <ol style="list-style-type: none">15. Understand the importance of basic test signals .(BL=2)16. Understand the Time response of second order system with different dampings.(BL=2)17. Find steady state error for the given system for any input signal. .(BL=1)		
MODULE-3	STABILITY ANALYSIS	6 hrs
<p>Stability: The concept of stability, Routh’s stability criterion, limitations of Routh’s stability.(4h)</p> <p>Root locus plot: The root locus concept, construction of root loci, effects of adding poles and zeros to $G(s)H(s)$ on the root loci. (5h)</p> <p>At the end of the Module 4, students will be able to:</p> <ol style="list-style-type: none">7. Understand various stability issues (BL=2)8. Apply Routh's stability criteria to given system for stability assessment (BL=3)9. construct the Root locus plot for the given system (BL=3)		
MODULE-4	FREQUENCY RESPONSE ANALYSIS	6 hrs
<p>Introduction, Frequency domain specifications, Bode plot, polar plot, Transfer function from the Bode Diagram, Stability Analysis from Bode Plots. Polar Plots, Nyquist Plots. (8h)</p> <p>Compensation Techniques: Lag, Lead, Lag-Lead Compensators.(3h)</p> <p>At the end of the Module 5, students will be able to:</p> <ol style="list-style-type: none">7. Understand various frequency domain specifications. (BL=2)8. Explain the Bode plot for the given system. (BL=2)9. Find the stability of given system from Bode plot and polar plot. (BL=1)		
MODULE-5	STATE SPACE ANALYSIS	5 hrs
<p>Introduction: Concepts of state, state variables and state model, derivation of state models from differential equations, Diagonalization. (5h)</p>		

Solution of state equation: Solving the Time invariant state Equations, State Transition Matrix and it's Properties. (2h)

The concepts of controllability and observability. (2h)

At the end of the Module 6, students will be able to:

9. Understand the importance of state space analysis (**BL=2**)
10. Find the state model for the given transfer function through various techniques. (**BL=1**)
11. Examine the controllability and observability of the given state model. (**BL=1**)

Total hours:32 hours

Text Book(s):

1. "Control Systems Engineering, I. J. Nagrath and M. Gopal, New Age International Publishers, 5th edition, 2007, Reprint 2012.
2. Control Systems by [A. Anand Kumar](#), PHI Learning pvt. Ltd., second edition

Reference Book(s):

1. Norman S. Nise, "Control Systems Engineering", John Wiley & Sons PTE Ltd, 2013
2. Modern Control Engineering, Katsuhiko Ogata, PEARSON, 1st Impression 2015.
3. Automatic Control Systems, Farid Golnaraghi and Benjamin. C. Kuo, WILEY, 9th Edition, 2010.
4. N C Jagan, "Control Systems", BS Publications, 1st Edition, 2007.
5. S Palani, "Control Systems Engineering", Tata McGraw-Hill Publications, 1st Edition, 2001.
6. N K Sinha, "Control Systems", New Age International Publishers, 1st Edition, 2002.

NARAYANA ENGINEERING COLLEGE :: GUDUR

20EC2005	ELECTROMAGNETIC WAVES AND TRANSMISSION LINES							R2020
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
IV	3	0	0	48	3	40	60	100

Pre-requisite: Vector Calculus, Knowledge of Integration and differentiation.

Course Objectives:

1. To study different coordinate systems, Physical significance of Divergence, Curl and Gradient.
2. To acquire knowledge on electric and magnetic fields in both static and dynamic domains.
3. To understand wave concept with the help of Maxwell's equations.
4. To Analyze reflection and refraction of EM waves and Electromagnetic wave propagation in different media.
5. To introduce concepts of polarization and fundamental theory of electromagnetic waves in transmission lines and their practical applications.

Course Outcomes: After successful completion of the course, the student will able to:

- CO 1** Apply the Coulomb's law and Gauss law to different charge distributions.(BL-3)
- CO 2** Make use of Biot-Savart Law, Ampere's Circuit law to static current distributions.(BL-3)
- CO 3** Analyze the electric and magnetic fields.(BL-4)
- CO 4** Interpret the characteristics of EM Wave.(BL-2)
- CO 5** Illustrate the concepts of transmission lines.(BL-2)

CO-PO Mapping														
CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2		2									1	
CO2	3	3		2									1	
CO3	3	2	2										2	
CO4	3	1	1										2	2
CO5	3	2	2										2	2

1- Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1

Electrostatics

13 Hrs

Coulomb's Law, Electric Field Intensity – Fields due to Different Charge Distributions, Electric Flux Density, Gauss Law and Applications, Electric Potential, Relations Between E and V, Maxwell's Two Equations for Electrostatic Fields, Electric dipole, Energy Density, Convection and Conduction Currents, Dielectric Constant, Isotropic and Homogeneous Dielectrics, Continuity Equation, Relaxation Time, Poisson's and Laplace's Equations, Capacitance – Parallel Plate, Coaxial, Spherical Capacitors, Illustrative Problems.

At the end of the Module 1, students will be able to:

- 1 Summarize basic laws of static electric field. (BL-2)
- 2 Derive the Maxwell's equations for electrostatic fields. (BL-3)
- 3 Solve problems applying laws of electrostatics. (BL-3)
- 4 Explain electric energy and potential (BL-2)
- 5 Define currents of conductors and dielectrics (BL-1)
- 6 Illustrate Poisson's and Laplace's Equations (BL-2)
- 7 Summarize types of capacitors (BL-2)

MODULE -2

Magneto statics

9 Hrs

Biot-Savart's Law, Ampere's Circuital Law and Applications, Magnetic Flux Density, Maxwell's Two Equations for Magneto static Fields, Magnetic Scalar and Vector Potentials, Forces due to Magnetic Fields, Magnetic torque and moment, Magnetic dipole, Inductances and Magnetic Energy, Illustrative Problems.

At the end of the Module 2, students will be able to:

18. Summarize basic laws of static magnetic field. (BL-2)
19. Derive the Maxwell's equations for magnetic fields. (BL-3)
20. Solve problems applying laws of magneto statics. (BL-3)
- 21.

MODULE-3

Maxwell's Equations for Time Varying Fields

6 Hrs

Faraday's Law and Transformer e.m.f, Inconsistency of Ampere's Law and Displacement Current Density, Maxwell's Equations in Different Forms and Word Statements. Boundary Conditions of Electromagnetic fields: Dielectric-Dielectric and Dielectric-Conductor Interfaces, Illustrative Problems.

At the end of the Module 3, students will be able to:

5. Derive Maxwell's equations for time varying electromagnetic fields. (BL-3)
6. Apply the boundary conditions of EM fields at the interface of different media.(BL-3)
7. Solve problems on time varying maxwell's equations of electromagnetic fields. (BL-3)
- 8.

MODULE-4

EM Wave Characteristics

12 Hrs

Wave Equations ,Uniform Plane Waves – Definition, All Relations between E & H, Sinusoidal Variations, Wave Propagation in Lossless and Conducting Media, Conductors & Dielectrics – Characterization, Wave Propagation, Polarization, Reflection and Refraction of Plane Waves – Normal and Oblique Incidences, for both Perfect Conductor and Perfect Dielectrics, Brewster Angle, Surface Impedance, Poynting Vector, and Poynting Theorem – Applications, Power Loss in a Plane Conductor, Illustrative Problems.

At the end of the Module 4, students will be able to:

5. Derive wave equations for different media. (BL-3)
6. Explain concept of polarization of electromagnetic waves. (BL-2)
7. Solve problems using wave characteristics equations (BL-3)
8. Explain principles of reflections and refraction for different incidences. (BL-2)
9. Explain concept of power flow using Pointing vector. (BL-2)
10. Solve problems on Brewster angle, power flow and surface impedance. (BL-3)

MODULE-5

Transmission Lines

8 Hrs

Introduction, Transmission line parameters (Primary and Secondary), Transmission line equations, Input impedance, Standing wave ratio & power, Smith chart & its applications, Applications of transmission lines of various lengths, Micro-strip transmission lines – input impedance, Illustrative Problems.

At the end of the Module 6, students will be able to:

- 1.Study the principles of transmission lines and concept of smith chart.(BL-2)
- 2.Derive the input impedance of transmission line.(BL-3)
3. Calculate the line parameters through problem solving.(BL-3)
- 4.Study the applications of different lengths of transmission lines.(BL-2)

Total Hours: 48 Hours

NARAYANA ENGINEERING COLLEGE: GUDUR

20EC2006 Semester	PROBABILITY THEORY AND RANDOM PROCESS			Total hrs	Credit	Max Marks		R2020 TOTAL
	L	T	P			CIE	SEE	
IV	3	0	0	48	3	40	60	100

Pre-requisite:

- Set theory
- Integrations, differentiations, partial differentiations formulas

• Terms involved in Electronics & Communications

Course Objectives:

1. To understand the basic probability concepts and to find the probability.
2. To acquire skills in handling situations involving more than one random variable and functions of random variables.
3. To analyze the concept of statistical averages.
4. To understand types of random processes, Auto-correlation, Cross Correlation and power spectral density and cross power spectral density
5. To understand the principles of random process relate to system concepts

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

CO 1 Interpret the concepts of sample spaces and set theory to calculate probabilities (BL-2)

CO 2 Apply the concept of random variables with probability density and distribution functions to compute probabilities for complex problems. (BL-3)

CO 3 Compute the statistical averages for multiple random variables using joint probability density and distribution functions. (BL-2)

CO 4 Interpret the concept of Power Spectrum Density & Cross Power Spectrum density related to temporal characteristics and spectral characteristics (BL-4)

CO 5 Apply the principles of a random process for solving system related problems. (BL-3)

Text Book(s):

1. Matthew N.O. Sadiku, S.V.Kulkami, "Elements of Electromagnetics", Oxford Univ. Press, 6th ed., 2015.
2. William H. Hayt Jr. and John A. Buck, "Engineering Electromagnetics", TMH, 7th ed., 2006.

Reference Book(s):

1. E.C. Jordan and K.G. Balmain, "Electromagnetic Waves and Radiating Systems", 2nd Edition, PHI, 2000
2. John D. Krauss, "Electromagnetics", 4th Edition, McGraw- Hill publication 1999.

CO-PO Mapping														
CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO 2
CO1	3	2	2											
CO2	2	2	2											
CO3	2	3	2	3										
CO4	3	3	3	3									2	
CO5	3	2	2	3									2	
1: Low, 2-Medium, 3- High														

MODULE – 1**PROBABILITY****9 Hrs**

Probability introduced through Sets and Relative Frequency; Probability space & Axioms; Mathematical Model of Experiments, Joint probability, Conditional probability, Total probability and Baye's theorem

At the end of the Module 1, students will be able to:

1. Understand the fundamental concepts of probability (BL-2)
2. Find the probability for real time examples (BL-1)
3. Find total probability (BL-1)
4. Apply Baye's theorem for different real time applications (BL-3)

MODULE -2**DISCRETE & CONTINUOUS RANDOM VARIABLES****9 Hrs**

Probability mass function, probability distribution function, example random variables and distributions and density functions; Joint distributions, functions of one and two random variables, moments of random variables; Conditional distribution, densities and moments; Characteristic functions of a random Variables; Central limit theorem (without+ proof)

At the end of the Module 2, students will be able to:

1. Understand probability distribution and density functions (BL-2)
2. Outline the importance of the central limit theorem (BL-2)
3. Solve the moments to the sum of random variables (BL-3)
4. Apply different probability distribution and density functions on random variables.(BL-3)

MODULE-3**OPERATIONS ON MULTIPLE RANDOM VARIABLES****9 Hrs**

Expected value of a function of random variables, joint moments about the origin, joint central moments Transformations of Multiple Random Variables, Linear Transformations of Gaussian Random Variables. Markov, Chebyshev and Chernoff bounds.

At the end of the Module 3, students will be able to:

- 1 Understand the moments for multiple random variables. (BL-2)
- 2 Understand the concepts of linear transformation of Gaussian random variables. (BL-2)
- 3 Apply the different operations to multiple random variables. (BL-3)

MODULE-4 RANDOM PROCESSES: TEMPORAL CHARACTERISTICS & SPECTRAL CHARACTERISTICS**12 Hrs**

The random process concept, classification of processes, concept of stationary and statistical independence. Correlation function.

Power spectrum Properties, Relationship between power spectrum and autocorrelation function, properties of power spectral density, relation between cross – power density spectrum and cross correlation, properties of cross power spectral density; problems.

At the end of the Module 4, students will be able to:

1. Define continuous and discrete-time random processes. (BL-1)
2. Explain various Stationary Processes. (BL-2)
3. Apply the concepts and its properties of auto correlation. (BL-3)
4. Apply the concepts and its properties cross correlation functions. (BL-3)
5. Understand the concepts of power spectral density & cross power spectral density (BL-2)
6. Apply PSD & CPSD properties on random process. (BL-3)
7. Apply CPSD properties on random process. (BL-3)

MODULE-5**RANDOM SIGNAL RESPONSE OF LINEAR SYSTEMS****9 Hrs**

System Response – Convolution, Mean and Mean squared Value of System Response, autocorrelation Function of Response, Cross Correlation Functions of Input and Output, Spectral Characteristics of System Response: Power Density Spectrum of Response, Cross-Power Density Spectrums of Input and Output, Band pass, Band Limited and Narrowband Processes, Properties.

Noise Definitions: White Noise, Ideal low pass filtered white noise, RC filtered white noise.

At the end of the Module 6, students will be able to:

- 1 Relate the theory of stochastic processes to analyze linear systems. (BL-2)
- 2 Understand the concepts of low pass and band pass noise models for random processes. (BL-2)
- 3 Apply the statistical characteristics to response of linear systems. (BL-3)
- 4 Analyse the output characteristics of a system when input is an WSS process. (BL-4)

Reference Book(s):

1. R.P. Singh and S.D. Sapre, "Communication Systems Analog & Digital", TMH, 1995.
2. Henry Stark and John W. Woods, "Probability and Random Processes with Application to Signal Processing", Pearson Education, 3rd Edition.
3. George R. Cooper, Clave D. MC Gillem, "Probability Methods of Signal and System Analysis", Oxford, 3rd Edition, 1999.
4. S.P. Eugene Xavier, "Statistical Theory of Communication", New Age Publications, 2003.
5. B.P. Lathi, "Signals, Systems & Communications", B.S. Publications, 2003
6. keiser, gerd, "probability theory and stochastic processes", TMH publications, 4th Edition.

NARAYANA ENGINEERING COLLEGE: GUDUR

20EC2007	Signals and Systems							R2020
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
IV	3	0	0	48	3	40	60	100

Pre-requisite:

- knowledge on Integration, Differentiations and Transforms

Course Objectives:

- To understand the mathematical description and representation of continuous and discrete-time signals and systems.
- To study the frequency representation of periodic signals.
- To characterize signals and systems using frequency domain methods.
- To study sampling theorem and to convert continuous-time signals to discrete-time signals with different techniques and vice-versa.
- To analyze continuous and discrete-time signals and systems using Laplace & Z- Transform mathematical tool.

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

- CO 1 Interpret** the concept of various signals and linear Time invariant Systems. (BL-2)
- CO 2 Interpret** the concept of Fourier series for Continuous time signals.(BL-2)
- CO 3 Apply** continuous timeFourier Transform for Continuous time signals .(BL-3)
- CO 4 Apply** Sampling Theorem for Continuous time signals.(BL-3)
- CO 5 Analyze** Laplace and Z-transform for continuous and discrete time systems.(BL-4)

CO-PO Mapping														
CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2										1	
CO2	3	3	3	2									3	2
CO3	3	3	2	2									2	1
CO4	3	2	3										2	
CO5	2	3	3	1									2	2

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1 INTRODUCTION TO SIGNALS AND SYSTEMS 9 Hrs

SIGNALS AND SYSTEMS:Basic definitions and classification of Signals, Basic operations on signals, Classification of Continuous-Time and Discrete-Time Systems, Basic System Properties, Linear Time-Invariant Systems - Discrete-Time LTI Systems, Convolution Sum, Continuous-Time LTI Systems Convolution Integral, Properties of Linear Time-Invariant Systems.

At the end of the Module 1, students will be able to:

- Understand classifications of the signals and systems. (BL-2)

2. Explain continuous and discrete time signals. **(BL-2)**
3. Understand the concept of convolution. **(BL-2)**

MODULE -2

FOURIER SERIES

8 Hrs

Representation of Fourier series, Continuous time periodic signals, Dirichlet's conditions, Properties of CT Fourier Series, Trigonometric Fourier Series and Exponential Fourier Series with examples, Complex Fourier spectrum, Fourier series representation of a periodic signals.

At the end of the Module 2, students will be able to:

1. Apply Fourier series for the periodic signals. **(BL-3)**
2. Solve problems by using Fourier series properties. **(BL-3)**
3. Sketch the complex Fourier spectrum. **(BL-3)**

MODULE-3

FOURIER TRANSFORMS

10 Hrs

Deriving Fourier Transform from Fourier series, Fourier Transform of standard signals, Fourier Transform of Periodic Signals, Properties of CT Fourier Transform, Systems characterized by Linear constant coefficient differential equations. The Magnitude-Phase Representation of the Fourier Transform, The Magnitude-Phase Representation of the Frequency Response of LTI Systems. Definition, Computation and properties of DTFT for different types of signals and systems.

At the end of the Module 3, students will be able to:

- 5 Analyze the periodic and aperiodic signals by applying Fourier transforms. **(BL-4)**
- 6 Interpret the Magnitude-Phase Representation of F.T & LTI Systems. **(BL-2)**
- 7 Solve problems by using F.T properties. **(BL-3)**
- 8 Analyze the spectral characteristics of signals using Fourier transform. **(BL-4)**
- 9 Analyze of DTFT for different types of signals and systems. **(BL-4)**

MODULE-4

SAMPLING

7 Hrs

Representation of a Continuous Time Signal by its Samples - Sampling Theorem, Reconstruction of a Signal from its Samples Using Interpolation, types of sampling-natural sampling, flat- top sampling and impulse sampling, Effect of under sampling -Aliasing.

At the end of the Module 4, students will be able to:

1. Illustrate the representation of a Continuous Time Signal by sampling. **(BL-2)**
2. Understand the reconstruction of a sampled signal using Interpolation. **(BL-2)**
3. Compare different sampling techniques. **(BL-2)**
4. Solve problems for nyquist interval and nyquist rate. **(BL-3)**

MODULE-5

LAPLACE TRANSFORMS & Z-TRANSFORMS

14 Hrs

Definition, Region of Convergence, Properties, Inverse Laplace Transform, Relationship between Fourier and Laplace Transforms, Laplace Transform Pairs, Analysis and Characterization of LTI Systems Using the Laplace Transform .

Definition, Region of Convergence, Properties of the z-Transform, Inverse z-Transform, Relation between Fourier and Z Transforms, Common z- Transform Pairs, Analysis and Characterization of LTI Systems Using z-Transforms.

At the end of the Module 4, students will be able to:

1. Understand the properties of Laplace transform. **(BL-2)**
2. Analyze the continuous-time and discrete-time signals and systems using Laplace transform. **(BL-4)**
3. Find the stability of the systems using ROC. **(BL-1)**
4. Understand the properties of Z - transform. **(BL-02)**
5. Analyze the discrete-time signals and systems using Z - transforms. **(BL-04)**
6. Interpret therelationship between Fourier and Z - Transforms. **(BL-02)**
7. Find the stability of the systems using ROC. **(BL-01)**

Total hours:48 Hours

Text Book(s):

1. A.V. Oppenheim, A.S.Willsky and S.H. Nawab, "Signals and Systems", 2ndEdition, PHI, 2009.

2. Simon Haykin and Van Veen, "Signals & Systems", 2nd Edition, Wiley, 2005.

3. Signals and Systems, J. Nagrath, S. N. Sharan, R. Ranjan, S. Kumar, TMH

Reference Book(s):

1. Simon Haykin and B. Van Veen, Signals & Systems, John Wiley, 2nd Edition, 2010.

2. A. Anand Kumar, Signals & Systems, PHI, 2011.

3. B.P. Lathi, Principles of Linear Systems and Signals, Oxford University Press, 2nd Edition, 2013.

NARAYANA ENGINEERING COLLEGE:GUDUR

20EC2503 ANALOG ELECTRONICS LAB

R2020

Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P			CIE	SEE	TOTAL
IV	0	0	2	42	1	40	60	100

Pre-requisite: Basic knowledge on amplifiers and oscillators.

Course Objectives:

1. Analyze amplifiers for frequency response
2. Analyze feedback circuits, amplifier circuits and oscillator circuits
3. Design and construct simple electronic circuits to accomplish a specific function, e.g., designing amplifiers

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

CO 1 Measure various parameters of analog circuits and compare experimental results in the laboratory with theoretical analysis. **(BL-3)**

CO 2 Analyze negative feedback amplifier circuits, oscillators, Power amplifiers, Tuned amplifiers. **(BL-4)**

CO 3 Design analog electronic circuits using discrete components **(BL-3)**

CO 4 Design RC and LC oscillators, Feedback amplifier for specified gain and multistage amplifiers for Low, Mid and high frequencies. **(BL-3)**

CO-PO Mapping														
CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1				1					2	2				
CO2	3	2			2				2	2				2
CO3	3	2	2	2	2				2	2			2	2
CO4			2		2				2	2			2	2

1: Low, 2-Medium, 3- High

COURSE CONTENT

Task-1 : COMMON EMITTER AMPLIFIER

Objective: Design voltage divider based Common Emitter amplifier with discrete components and calculate the bandwidth of amplifier from its frequency response.

Task-2: RC COUPLED AMPLIFIER

Objective: Design two stage RC coupled amplifier for given specifications. Determine Gain and Bandwidth from its frequency response curve.

Task-3: DARLINGTON AMPLIFIER

Objective: Design Darlington amplifier and determine gain and bandwidth from frequency response.

Task-4: CASCODE AMPLIFIER

Objective: Design cascode amplifier and determine gain and bandwidth from frequency response

Task-5: VOLTAGE SERIES FEEDBACK AMPLIFIER

Objective: Design voltage series feedback amplifier for the given specifications. Determine the effect of feedback on the frequency response of a voltage series feedback amplifier.

Task-6 : CURRENT SHUNT FEEDBACK AMPLIFIER

Objective: Design and simulate current shunt feedback using PSPICE/Multisim and determine the effect of feedback on the frequency response

Task-9: RC PHASE SHIFT OSCILLATOR

Objective: Design and simulate RC Phase shift oscillator for the given specification using PSPICE /Multisim. Determine the frequency of oscillation using simulation tool.

Task-10 :HARTLEY OSCILLATOR

Objective: Design and simulate Hartley oscillator using PSPICE /Multisim and determine the frequency of oscillations..

Task-9: COLPITTS OSCILLATOR

Objective: Design and simulate Colpitts oscillator using PSPICE /Multisim and determine the frequency of oscillations.

Task-11: CLASS-A POWER AMPLIFIER

Objective: Design and simulate class A power amplifier using PSPICE /Multisim,find out the efficiency and Plot the output waveforms.

Task-12: CLASS-B PUSH PULL AMPLIFIER

Objective: Design and simulate class B push-pull amplifier using PSPICE /Multisim, find out the efficiency and Plot the output waveforms.

Task-12: SINGLE TUNED AMPLIFIER

Objective: Design and simulate single tuned voltage amplifier using PSPICE /Multisim and determine the resonant frequency and bandwidth.

Additional Experiments:

Task-13: WEIN BRIDGE OSCILLATOR

Objective: Design Wien bridge oscillator for the given specification. Determine the frequency of oscillation.

Task-14 :CLASS C AMPLIFIER

Objective: Design and simulate class C power amplifier using PSPICE /Multisim and find the efficiency and plot the output waveforms.

Text Book(s):

2. Introduction to PSPICE Using OrCAD for Circuits and Electronics by Rashid Muhammad H
3. PSPICE and MATLAB for electronics: An integrated approach by John o. Attia
4. Fundamentals of Electronic Circuit Design, Getting Started: MultiSim Textbook Edition by David J. Comer, Donald T. Comer.

Reference Book(s):

- 1 A Guide to Circuit Simulation and Analysis Using PSPICE by Paul W. Tuinenga
- 2 Robert L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuits Theory" Pearson/Prentice Hall, 9th Edition, 2006.
- 3 Sedra A.S. and K.C. Smith, "Micro Electronic Circuits", Oxford University Press, 5th Edition.

SEMESTER V

Subject Code	Category	Course Title	Contact Periods per week				Credits	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total Marks
20EC2008	PC	Analog and Digital Communications	3	0	0	3	3	40	60	100
20EC2009	PC	Linear IC Applications	3	0	0	3	3	40	60	100
20EC2010	PC	Microprocessors and Microcontrollers	3	0	0	3	3	40	60	100
	OE	Open elective II	3	0	0	3	3	40	60	100
20EC4001-06	PE	Professional Elective I	3	0	0	3	3	40	60	100
20EC2505	PC	Analog and Digital Communications Lab	0	0	3	3	1.5	40	60	100
20EC2506	PC	Microprocessors and Microcontrollers Lab	0	0	3	3	1.5	40	60	100
20CD6003	SC	Career Competency Development III	0	0	2	2	1	40	60	100
20CC6003	SC	Value Added Course/ Certificate Course III	0	0	0	0	1	40	60	100
20EC7501	PR	Internship I/on job training/Com Ser Project	0	0	0	0	1.5	00	100	100
20MC8002-12	MC	Mandatory Course III	2	0	0	2	0	00	00	00
		Counselling/Mentoring	0	0	1	1	0	--	--	--
		Sports/Hobby Clubs/Activities	0	0	2	2	0	--	--	--
		Activity Point Programme	During the Semester					20 Points		
		Total	17	0	10	28	21.5	360	640	1000

NARAYANA ENGINEERING COLLEGE:GUDUR

20EC2008	ANALOG AND DIGITAL COMMUNICATION SYSTEMS							R2020
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
V	3	0	0	48	3	40	60	100

Pre-requisites:

- ✓ Electronic Devices
- ✓ Signals and Systems
- ✓ Probability and Random Processes

Course Objectives:

1. To familiarize various modulation and demodulation techniques of analog communication systems.
2. To acquire knowledge on angle modulation and demodulation techniques.
3. To learn the function of various stages of AM, FM transmitters.
4. To summarize various baseband and carrier modulation techniques
5. To understand the concept of information theory and channel coding.

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

- CO 1** Define the need of modulation for communication systems. (BL:1)
- CO 2** Verify the effect of noise on the performance of communication system BL2
- CO 3** Analyze the various Digital modulation techniques BL4
- CO 4** Calculate the bit error rate for different digital modulation schemes BL4
- CO 5** Make use of the different error control codes for efficient transmission BL3

CO-PO Mapping														
CO	PO												PSO	
	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	2										2	
CO2	3	3	3										1	
CO3	3	3	3										2	
CO4	3	3	2										1	
CO5	3	2	2										2	

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1

CONTINUOUS WAVE MODULATION

Hours:10

Introduction to communication systems, Need for modulation, Amplitude Modulation (AM): AM and its modifications – DSB, SSB, VSB, Frequency translation, Frequency Division Multiplexing (FDM).

Angle Modulation: Frequency Modulation (FM), Phase modulation, Nonlinear Effects in FM, Super heterodyne receiver.

At the end of the Module 1, students will be able to:

1. Explain the benefits and applications of modulation.(BL:2)
2. Describe the generation and detection of amplitude modulated signals.(BL:2)
3. Compare AM, DSB-SC, SSB-SC and VSB. (BL:2)

MODULE -2

NOISE AND PULSE MODULATION

Hours:08

Introduction to noise: Types of noise, Receiver model, Noise in AM, DSB, SSB, and FM Receivers, Pre-emphasis and De-emphasis in FM.

Introduction to pulse modulation: Sampling process, PAM, PWM and PPM-generation and detection.

At the end of the Module 2, students will be able to:

1. List the types of noise. (BL:1)
2. Define noise temperature, noise bandwidth and noise figure.(BL:2)
3. List the types of pulse modulation schemes.(BL:2)
4. Analyze time and frequency domain representation of narrowband noise.(BL:4)
5. Compare PAM, PWM, PPM. (BL:2)

MODULE-3

SOURCE CODING SYSTEMS

Hours:10

Comparison of analog and digital communication systems, Elements of digital communication system, Sampler, Quantization-types and Encoder, PCM, Differential PCM, Delta Modulation (DM), Adaptive DM, Time Division Multiplexing (TDM), Comparison of the above systems.

At the end of the Module 3, students will be able to:

1. Describe the elements of digital communications system. (BL:2)
2. Explain types of quantization techniques. (BL:2)
3. Differentiate PCM and DPCM. (BL:2)
4. Explain how different noises are eliminated in ADM?(BL:2)
5. Explain Time Division Multiplexing (TDM). (BL:4)

MODULE-4

BAND-PASS DATA TRANSMISSION

Hours:10

Introduction, Need for carrier modulation techniques, Binary shift keying: ASK, FSK, PSK, DPSK generation, Coherent and non coherent detection, Band width, Signal space diagram, Probability error calculation, M-ary shift keying: ASK, FSK, PSK, Quadrature Amplitude Modulation (QAM), Minimum Shift Keying (MSK).

At the end of the Module 3, students will be able to:

1. Explain the need for carrier modulation techniques. (BL:2)
2. Differentiate coherent and non-coherent detection. (BL:2)
3. Analyze carrier modulation techniques. (BL:4)
4. Explain Quadrature Amplitude Modulation. (BL:2)

MODULE-5

INFORMATION THEORY & CHANNEL CODING

Hours:10

Information theory: Message, Information, Entropy, Mutual information & its properties, Channel capacity, Shannon Hartley Theorem, Shannon Fano & Huff man coding and Illustrative problems.

Channel Coding: Error detection & correction - Repetition & Parity check codes, Interleaving, Code vectors and Hamming distance, FEC and ARQ systems, Linear block codes – Matrix representation of block Codes, Convolutional codes, Viterbi decoding.

At the end of the Module 5, students will be able to:

1. Define information. (BL:1)
2. Explain the types of entropies and its properties. (BL:2)
3. Discuss source coding theorem.(BL:2)Explain the concept of frequency interleaving. (BL:2)
4. Analyze channel coding techniques. (BL:4)

Text Book(s):

1. Simon Haykin, "Communication Systems", JohnWiley& Sons, 4th Edition, 2004.
2. B. P. Lathi, Zhi Ding " Modern Digital and Analog Communication Systems", Oxford press, 2011

Reference Book(s):

1. Sam Shanmugam, "Digital and Analog Communication Systems",JohnWiley& Sons, 1999.
2. Bernard Sklar, F. J. harris"Digial Communications: Fundamentals and Applications", Pearson Publications, 2020.
3. Taub and Schilling, "Principles of Communication Systems", Tata McGraw Hill, 2007

NARAYANA ENGINEERING COLLEGE:GUDUR

20EC2009	Linear IC Applications(20EC2009)							R2020
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
V	3		0	48	3	40	60	100

Pre-requisite: Basic knowledge of Electronic Devices, EDC and Digital Logic Design.

Course Objectives:

1. Explain the differential amplifier and its electrical parameters.
2. To introduce the basic building blocks of operational Amplifier.
3. To study and design various applications of OPAMPs.
4. To know the design of oscillators and Active filters using op amps.
5. To Study the concepts of the waveform generation, converters and introduce some special function Ics (i.e., IC 555 Timer, IC 565 PLL).

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

- CO 1** Analyzethe various characteristics of **Differential amplifier**.**(BL: 4)**.
- CO 2** **Interpret** the characteristics and configurations of Op-amp **(BL: 2)**.
- CO 3** **Analyzethe** linear and nonlinear **applications** of an Op-amp **(BL:2)**
- CO 4** **Design** the Oscillators and active filters using Op-amp **(BL: 4)**.
- CO 5** **Study** the applications ofthe special purpose integrated circuits and Data Convertors. **(BL: 2)**.

CO-PO Mapping														
CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	P O 7	PO 8	P O 9	PO 10	P O 11	P O 12	PSO1	PSO 2
CO1	3	3	3											
CO2	3	3	2											
CO3	3	3	3		1								1	1
CO4	3	3	2		2								2	2
CO5	3	3	2		2								2	1

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE-1 Integrated Circuits and Differential Amplifier 10hours

Introduction to IC, Classification of IC's, Differential amplifier, Differential Amplifier Circuits Configurations, DC and AC analysis of Dual input balanced/unbalanced and single input balanced/unbalanced output configurations, Properties of the differential Amplifier circuit configurations, Methods of improving CMRR - Constant Current Bias and Current mirror, Level Translator. (10 hrs)

At the end of the Module 1, students will be able to:

1. Infer the Dc and AC Analysis of BJT Differential AmplifierConfigurations.(BL2)
2. Choose the Different methods to improve CMRR in Differential amplifier.(BL2)
- 3.Illustrate the use of level translator in differential amplifier.(BL2)

MODULE – 2**Operational amplifiers & OP-AMP Configurations****9hours**

Introduction, Basic information of Op-Amp, Block diagram of an Op-Amp, Ideal and Practical Op-Amp Characteristic's, Ideal Equivalent Circuit of an Op-Amp, Ideal and Practical Voltage Transfer curve, DC and AC characteristics of Op-Amp.(5hrs).

Introduction, feedback configurations, voltage series feedback, voltage shunt feedback and differential amplifiers, Frequency response, High frequency Op-Amp equivalent circuit, open loop gain Vs frequency, circuit stability, slew rate. (5hrs).

At the end of the Module 2, students will be able to:

1. Demonstrate the Op-Amp with negative and positive feedback.(BL2)
2. Outline the Gain Bandwidth Concept and the frequency response of the amplifiers. (BL2)
3. Illustrate various stages of operational amplifier(BL2)
4. Infer how to draw the ideal and practical Op-Amp Voltage Transfer Curve.(BL2)
5. Illustrate the DC and AC characteristics of an Op-Amp.(BL2)

MODULE -3OP-AMP APPLICATIONS**10hours**

DC and AC amplifiers, Summing Amplifiers, instrumentation amplifier, voltage to current converter, current to voltage converter, Integrator, Differentiator, Comparator, zero crossing detector, Schmitt Trigger, Square wave generator, triangular wave and Saw-tooth wave form generators.(10 hrs)

At the end of the Module 3, students will be able to:

1. Design Circuits using Operational Amplifiers for various applications.(BL3)
2. Illustrate the various types of Wave forms as sine wave, square, triangular and Saw-tooth wave forms.(BL2)
3. Summarize the linear IC applications help in IC Based Electronic Projects Design.(BL2)

MODULE-4OSCILLATORS& ACTIVE FILTERS**9hours**

RC Phase shift and Weinbridge oscillators, Active filters: Classification of Filters, 1st and 2nd order LPF & HPF filters, Band pass, Band reject and All pass filters.(9 hrs)

At the end of the Module 4, students will be able to

1. Demonstrate the basic operating principles of oscillator.(BL2)
2. Illustrate the various types of Filters. (BL2)
3. Explain First order Low Pass filter with Circuit diagram.(BL2)

MODULE-5SPECIALIZED APPLICATIONS**10hours**

555 timer IC (Mono-stable & Astable operation) & its applications, PLL, operating principles, Monolithic PLL, applications.(5 hrs)

Introduction, Basic DAC techniques, Binary Weighted Resistor DAC, R-2R Ladder DAC, Inverted R-2R DAC, D/A Specifications, A/D Converters - Flash type, Successive Approximation type, Dual Slope type, A/D Specifications.(5 hrs)

At the end of the Module 5, students will be able to:

1. Demonstrate the operating principles of IC 555 timer, IC PLL and applications.(BL2)
2. Explain the operating principle of PLL with block diagram(BL2)
3. Summarize the Performance of the D to A and A to D converters.(BL2)
4. Demonstrate the Switches for D/A converters. (BL2)
5. Choose appropriate A/D and D/A converters for signal processing applications.(BL2)

NARAYANA ENGINEERING COLLEGE: GUDUR

20EC2010	MICROPROCESSORS AND MICROCONTROLLERS							R2020
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
V	2	0	2	48	3	40	60	100

Pre-requisite: Knowledge on switching theory and logic design, basics of computer organisation, architecture and basic programming techniques.

Course Objectives:

- To study the internal architecture, interrupts & memory organization of 8086 microprocessor.
- To understand the programming concepts using 8086.
- To impart the basics of the MSP 430 and its variants.
- To understand programming techniques using interrupts, instruction set & addressing modes
- To provide the knowledge on low power modes of MSP 430.

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

- CO 1** Demonstrate the internal architecture, memory organisation and interrupt structure of 8086 microprocessor.(BL-2)
- CO 2** Construction of a maintainable assembly language program for an algorithm. (BL-3)
- CO 3** Interpret the concepts of low power modes of MSP 430.(BL-2)
- CO 4** Develop programs using software interrupts and addressing modes of MSP430.(BL-3)
- CO 5** Compare various on chip peripherals of MAP 430.(BL-3)

Text Book(s):

- Ramakanth A. Gayakwad, “Op-Amps & Linear ICs”, 4th Edition, PHI, 2002
- Choudhary D. Roy, Shail B. Jain, Linear Integrated Circuits, New Age International (p) Ltd, (2018-19 Session), 5th Edition (Paperback)

Reference Book(s):

- Analog Electronics, L.K.Maheshwari, Laxmi Publications, PHI, 2005
- D.A. Bell, Operational Amplifiers and Linear ICs. Oxford University Press, 3rd edition.
- R.F.Coughlin & Fredrick Driscoll “Op-Amps & Linear Integrated Circuits” 6th Edition, PHI.
- F. Sergio, Design with Op Amps & Analog Integrated Circuits. Mcgraw Hill, 1997
- D. William, Operational Amplifiers with Linear Integrated Circuits. Prentice Hall, 2004

CO-PO Mapping														
CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3													
CO2	2	1	3										1	1
CO3	3		2		2								2	1
CO4	2		2		1								1	1
CO5	2	1	2										1	1

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 18086 MICROPROCESSOR 10 h

Introduction, Microprocessor Evolution, Intel 8086 Microprocessor: Features block diagram, Register Organization, Memory organization, Interrupts and Interrupt Vector Table.

At the end of the Module 1, students will be able to:

- List the features of 8086 microprocessor.(BL-1)
- Explain the architecture of 8086 microprocessor.(BL-2)
- Describe the memory organization of 8086 microprocessor.(BL-1)

4. Explain the concept of interrupt handling of 8086.(BL-2)

MODULE 2 PROGRAMMING WITH 8086 10 h

Instruction Formats -Addressing Modes-Instruction Set of 8086, Assembler Directives, Macros and Procedures. Simple ALP's.

At the end of the Module 2, students will be able to:

- 1.Explain the different addressing modes in 8086. (BL-2)
- 2.Explain different instruction set of 8086 (BL-2)
3. Implement ALPs using 8086 (BL-3)

MODULE-3 LOW POWER RISC MSP430

10 h

Low power RISC MSP430 block diagram, features and architecture, Variants of the MSP430 family viz. MSP430x2x, MSP430x4x, MSP430x5x and their targeted applications, Register set.

At the end of the Module 3, students will be able to:

1. List the features of MSP 430 microcontroller.(BL-1)
2. Explain the architecture of MSP 430 microcontroller.(BL-2)
3. Compare variants of MSP 430. (BL-2)

MODULE-4 ADDRESSING MODES & INTERRUPTS OF MSP430

8 h

Addressing modes, Instruction set, Memory address space; I/O ports pull up/down resistors concepts, Interrupts and interrupt programming.

At the end of the Module 4, students will be able to:

1. Apply data in MSP 430 programming using addressing modes. (BL-3)
2. Explain the instruction set of MSP 430. (BL-2)
3. Do programming using interrupts.(BL-3)

4.Lists interrupt types supported by MSP430. (BL-2)

MODULE-5 ON-CHIP PERIPHERALS OF MSP 430

10 h

On-chip peripherals (Analog & Digital), ADC, Comparator and data transfer using DMA controller, Watchdog timer, System clocks, Timers &Real Time Clock (RTC), Low power modes. Serial Communication Protocols: UART, USB, I2C & SPI and implementation using MSP430.

At the end of the Module 5, students will be able to:

- 1 List the on chip peripherals of MSP 430 microcontroller.(BL-1)
- 2 Discuss MSP430 clock system. (BL-2)
- 3 Explain the operation of watchdog timer.(BL-2)
- 4.Explain the concept of Real Time Clock (RTC). (BL-2)
- 5.List the features of UART, USB, SPI, and I2C. (BL-1)
- 6.Explain the UART, I2C, SPI interface using MSP430. (BL-2)

Total hours:48 Hours

Text Book(s):

- 1 "Microprocessor and Microcontrollers", N. Senthil Kumar, M. Saravanan, S. Jeevanathan, Oxford Publishers. Second Edition, 2016
- 2 MSP430 microcontroller basics. John H. Davies, Newnes Publication, I st Edition, 2008
- 3 "The X86 Microprocessors , Architecture, Programming and Inerfacing", Lyla B.Das ,Pearson Publications,2010

Reference Book(s):

NARAYANA ENGINEERING COLLEGE:GUDUR

20EC2505	ANALOG AND DIGITAL COMMUNICATIONS LAB							R2020
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
V	0	0	2	36	1	40	60	100

Pre-requisite: A course on Analog and Digital Communications.

Course Objectives:

1. To design and test communication circuits for analog modulation and demodulation schemes.
2. To familiarize the concept of antenna parameters and their measurement process.
3. To design and test digital modulation and demodulation techniques.
4. To write and execute programs in MATLAB to implement various modulation techniques.

5. To understand channel coding and equalization technique

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

CO 1 Demonstrate analog & pulse modulation and demodulation schemes. [BL:3]

CO 2 Analyze the behaviour of digital modulation and demodulation techniques. [BL:4]

CO 3 Execute programs in MATLAB to implement various digital carrier keying techniques.[BL:3]

CO 4 Simulate channel coding and equalization techniques using MATLAB [BL:2]

1. “Advanced microprocessors & microcontrollers”, K M Burchandi & A K Ray, 3rd edition, 2013
2. “Microprocessor and Interfacing: Programming and Hardware”, Douglas V.Hall, McGrawHill
3. “8086 microprocessor: Programming and Interfacing the PC”, Kenneth Ayala Cengage Learning.

CO-PO Mapping														
CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	2						2	2		2	3	3
CO2	3	3							2	2		2	3	3
CO3	3	3	2						2	2		2	3	3
CO4	3	3	2						2	2		2	2	2

1: Low, 2-Medium, 3- High

COURSE CONTENT

CO

Task-1: AMPLITUDE MODULATION AND DEMODULATION

Objective:

To study the function of Amplitude Modulation & Demodulation (under modulation, perfect modulation & over modulation) and also to calculate the modulation index. CO 1

Task-2: FREQUENCY MODULATION AND DEMODULATION

Objective:

To study the functioning of Frequency Modulation & Demodulation and to calculate the modulation index. CO 1

Task-3: PULSE AMPLITUDE MODULATION & DEMODULATION

Objective:

To Perform Pulse amplitude Modulation and Demodulation and to draw the observed waveforms. CO 2

TASK-4: PULSE WIDTH AND POSITION MODULATION & DEMODULATION

Objective:

To implement the Pulse Width and Position Modulation & Demodulation circuits and to draw the observed waveforms.

	CO 2
Task-5: PRE-EMPHASIS AND DE-EMPHASIS	
Objective:	
To study the functioning of Pre-Emphasis and De-Emphasis circuits.	CO 1
Task-6: PULSE CODE MODULATION AND DEMODULATION	
Objective:	
To Study & Understand the operation of the Pulse code modulation & Demodulation.	CO 2
Task-7: DIFFERENTIAL PULSE CODE MODULATION AND DEMODULATION	
Objective:	
To generate the differential Pulse code modulation & Demodulation using MATLAB	CO 2
Task-8: DELTA MODULATION AND DEMODULATION	
Objective:	
To transmit an analog message signal in its digital form and again reconstruct back the original analog message signal at receiver by using Delta modulator.	CO 2
Task-9: HUFFMAN CODING	
Objective:	
To generate Huffman coding using Matlab.	CO 3
Task -10: FSK MODULATION AND DEMODULATION	
Objective:	
To generate and demodulate frequency shift keyed (FSK) signal using MATLAB.	CO 3
Task-11: PSK MODULATION AND DEMODULATION	
Objective:	
To generate and demodulate phase shift keyed (PSK) signal using MATLAB	CO 3
Task-12: GENERATION OF QPSK USING MATLAB	
Objective:	
To generate and demodulate Quadrature phase shift keyed (QPSK) signal using MATLAB.	CO 3

Additional Experiments:

Task-13: FREQUENCY DIVISION MULTIPLEXING USING MATLAB	
Objective:	
To study and simulate Frequency division multiplexing and draw its waveforms.	CO 4
TASK-14: CHANNEL EQUALIZATION ALGORITHM USING MATLAB	
Objective:	
To simulate the Zero Forcing Equalizer.	CO 4

Text Book(s):

1. B. P. Lathi, "Modern Digital and Analog Communication Systems," 3rd Edition, Oxford Univ. press, 2006.
2. John Wiley & Sons Simon Haykin, "Communication Systems," 3rd Edition, 2010.
3. Sham Shanmugam, "Digital and Analog Communication Systems", Wiley-India edition, 2006.(edition)
4. R.P. Singh and S. Sapre, "Communication Systems: Analog and Digital", 3rd edition, Tata McGraw-Hill, 2017.
5. J.S. Chitode, "Digital Communication:, Technical Publications, Pune.

Reference Book(s):

1. Bruce Carlson, & Paul B. Crilly, "Communication Systems – An Introduction to Signals & Noise in Electrical Communication", 5th Edition, McGraw-Hill International Edition, 2010.

NARAYANA ENGINEERING COLLEGE:GUDUR

20EC2506	MICROPROCESSORS & MICROCONTROLLERS LAB						R2020
Semester	Hours / Week			Total hrs	Credit	Max Marks	
	L	T	P		C	CIE	SEE
V	0	0	2	36	1	40	60
							TOTAL
							100

Pre-requisite: A course on Microprocessor and Microcontroller.

Course Objectives:

- 1 To acquire knowledge on CC studio & Launch pad.
- 2 To acquire knowledge on MSP430 microcontroller instruction set.
- 3 To synthesize embedded C programs using MSP430 microcontroller.

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

- CO 1** Understand the installation process of CC studio & launch pad. **(BL-2)**
CO 2 Synthesize operations on MSP430 microcontroller using Code Composer Studio. **(BL-3)**
CO 3 Examine power consumption of microcontroller using low power modes. **(BL-3)**

2. Herbert Taub & Donald L Schilling, "Principles of Communication Systems", 3rd Edition, Tata McGraw-Hill, 2009.
3. George Kennedy and Bernard Davis, "Electronics & Communication System", TMH, 2004.(edition).
4. Digital communications, 5/e,2008,J G Proakis, McGraw Hill, New delhi.
5. Digital communications, 2/e, 2007, Bernard Sklar,Pearson edition, New delhi.

CO-PO Mapping														
CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	1	1	1		1						1	1	1	
CO 2		2	2		2							2		1
CO 3				2	2									1

1: Low, 2-Medium, 3- High

COURSE CONTENT

CO

TASK 1: INTRODUCTION TO CODE COMPOSER STUDIO TOOL

Objective: Introduce the code composer studio to perform any task using Mixed signal Processor. **CO1**

Task-2 : ARITHMETIC OPERATIONS

Objective: Use Embedded C programming to perform arithmetic operations such as addition, subtraction.

CO 2

Task-3: LOGICAL OPERATIONS

Objective: Use Embedded C programming to perform logical operations such as AND, OR, XOR operations.

CO 2

Task-4: DEMO ON MSP430 LAUNCH PAD

Objective: Introduce the MSP430 launch pad to perform operations and interface devices. **CO 1**

Task-5 :BLINKING LED USING GPIO

Objective: ToInterface and programme GPIO ports in C using MSP430

1. Blinking LEDs(Red& Green)

Push buttons

CO 2

Task-6: USAGE OF LOW POWER MODES

Objective: Usage of Low Power Modes: Use MSPEXP430FR5969 as hardware platform and demonstrate the low power modes and measure the active mode and standby mode current.

CO 3

Task-7: INTERRUPT PROGRAMMING THROUGH GPIOs

Objective: To verify Interrupt programming of MSP 430 through GPIOs. CO 3

Task-8: PWM GENERATION USING TIMER ON MSP430 GPIO

Objective: To Generate Pulse Width Modulated signal using Timer on MSP430 GPIO. CO 3

Task-9 :INTERFACING POTENTIOMETER WITH MSP430

Objective: To Interface potentiometer with MSP430 to control the brightness of LED. CO 3

Task-10: PWM BASED SPEED CONTROL OF DC MOTOR

Objective: To control the speed of a DC motor by potentiometer connected to MSP430 GPIO CO 3

Additional Experiments

Task-1: Wi-Fi EMAIL APPLICATION

Objective: To write an embedded C program for verifying the Wi-Fi e-mail application of MSP430 microcontroller by interfacing it with CC3100 Booster pack.

CO 2

Task-2: MASTER SLAVE CHARACTERISTICS

Objective: To write an embedded C program for verifying the Master-slave characteristics of MSP430 microcontroller.

CO 3

Text Book(s):

- 1 “Microprocessor and Microcontrollers”, N. Senthil Kumar, M. Saravanan, S. Jeevanathan, Oxford Publishers. Second Edition, 2016
- 2 MSP430 microcontroller basics. John H. Davies, Newnes Publication, 1st Edition, 2008
- 3 “The X86 Microprocessors , Architecture, Programming and Interfacing” , Lyla B.Das ,Pearson Publications,2010

Reference Book(s):

- 1 “Advanced microprocessors & microcontrollers”, K M Burchandi & A K Ray, 3rd edition, 2013
- 2 “Microprocessor and Interfacing: Programming and Hardware”, Douglas V.Hall, McGrawHill
- 3 “8086 microprocessor: Programming and Interfacing the PC”, Kenneth Ayala Cengage Learning.

SEMESTER VI

Subject Code	Category	Course Title	Contact Periods per week				Credits	Scheme of Examination Max. Marks			
			L	T	P	Total		Int. Marks	Ext. Marks	Total Marks	
20EC2011	PC	Digital Design using HDL	3	0	0	3	3	40	60	100	
20EC2012	PC	Digital Signal Processing	3	0	0	3	3	40	60	100	
20EC2013	PC	VLSI Design	3	0	0	3	3	40	60	100	
	OE	Open Elective III	3	0	0	3	3	40	60	100	
20EC4007-12	PE	Professional Elective II	3	0	0	3	3	40	60	100	
20EC2507	PC	Digital Signal Processing Lab	0	0	3	3	1.5	40	60	100	
20EC2508	PC	Integrated Circuits Lab	0	0	3	3	1.5	40	60	100	
20EC2509	PC	VLSI Design Lab	0	0	3	3	1.5	40	60	100	
20CD6004	SC	Career Competency Development IV	0	0	2	2	1	40	60	100	
20CC6004	SC	Value Added Course/ Certificate Course IV	0	0	0	0	1	40	60	100	
		Counselling/ Mentoring	0	0	1	1	0	--	--	--	
		Sports/ Hobby Clubs/Activities	0	0	2	2	0	--	--	--	
		Activity Point Programme	During the Semester						20 Points		
		Total	150	12	29		21.5	400	600	1000	

NARAYANA ENGINEERING COLLEGE:GUDUR

20EC2011	Digital Design using HDL							R2020
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
VI	3	0	0	48	3	40	60	100

Pre-requisite: Concepts of Switching Theory and Logic Design.

Course Objectives:

- 1 To describe, design, and simulate digital circuits using the Verilog Hardware description language.
- 2 To understand behavioural and RTL modelling of digital circuits
- 3 To verify timing constraints of digital circuits, through the Verilog HDL
- 4 To synthesize, digital circuits designs on a development board
- 5 To Implement digital circuits on a development board

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

- CO 1** Interpret digital design flow used in chip design Flow. (BL-2)
- CO 2** Model simple digital circuits using Verilog HDL. (BL-3)
- CO 3** Simulate digital circuits using Verilog HDL.(BL-3)
- CO 4** Analyze simulation techniques in behavioral and Switch level models of digital circuits. (BL-3)
- CO 5** Model digital circuits using Verilog tasks and directives.(BL-3)

CO-PO Mapping														
CO	COURSE CONTENT												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	2		3								2	2
CO2	3	3	1		3								2	1
CO3	3	3	1		3								2	2
CO4	3	3	1		3								3	1
CO5	3	3	3		3								3	3

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE -1 Introduction to digital design

10hrs

INTRODUCTION TO DIGITAL DESIGN. Introduction to hardware descriptive language (HDL). Difference between computer programming languages and HDLs Examples and HDL based digital design flow based on FPGA and CPL

Verilog as HDL, Levels of Design Description, Concurrency, Simulation and Synthesis using EDA tools

At the end of the Module 1, students will be able to:

1. What is importance of HDL (Hardware Descriptive Language) (BL-2)
2. Describe difference between concurrent and sequential programming (BL-2)
3. Explain Digital design and implementation flow (BL-2)

MODULE -2

Introduction To Verilog

9hrs

Language Constructs And Conventions: Introduction, Keywords, Identifiers, White Space Characters, Comments, Numbers, Strings, Logic Values, Strengths, Data Types, Scalars and Vectors, Parameters, Operators.

Gate Level Modeling: Introduction, AND Gate Primitive, Module Structure, Other Gate Primitives, Illustrative Examples, Tri-State Gates, Array of Instances of Primitives, Additional Examples, Design of Flipflops with Gate Primitives, Delays, Strengths and Contention Resolution, Net Types, Design of Basic Circuits.

At the end of the Module 2, students will be able to:

1. Explain simulation and synthesis models of Digital circuits (BL-2)
2. Describe simulation techniques (BL-2)
3. Explain How to create test bench (BL-2)
4. Model digital circuits in Gate level using Verilog (BL-3)
5. Explain Gate Primitives used in Verilog (BL-2)

MODULE-3 Verilog Modeling -1

10hrs

Data Flow Level Modeling: Introduction, Continuous Assignment Structures, Delays and Continuous Assignments, Assignment to Vectors, Operators.

Behavioral Modeling: Introduction, Operations and Assignments, Functional Bifurcation, Initial Construct, Always Construct, Examples, Assignments with Delays, Wait construct, Multiple Always Blocks, Designs at Behavioral Level, Blocking and Non-blocking Assignments, The case statement, Simulation Flow. *if* and *if-else* constructs, *assign-deassign* construct, *repeat* construct, *for* loop, the *disable* construct, *while* loop, *forever* loop, *parallel* blocks, *force-release* construct, Event.

At the end of the Module 3, students will be able to:

1. Model digital circuits in data flow style (BL-3)
2. Explain High level abstraction of digital systems with behavioral modeling of systems (BL-2)
3. Apply concepts behavioral constructs like 'always', 'initial', 'if', 'if-else', 'case'..etc to describe a digital system (BL-3)

MODULE-4 Verilog Modeling -2

8hrs

Switch Level Modeling: Introduction, Basic Transistor Switches, CMOS Switch, Bi-directional Gates, Time Delays with Switch Primitives, Instantiations with Strengths and Delays, Strength Contention with Tri-reg Nets.

Functions, Tasks, And User-Defined Primitives: Introduction, Function, Tasks, User- Defined Primitives (UDP), FSM Design (Moore and Mealy Machines). (4h)

At the end of the Module 4, students will be able to:

1. Describe low level abstraction of digital systems with switch modeling of systems (BL-2)
2. Explain Switch level primitives (BL-2)
3. Describe the importance of tasks and functions (BL-2)
4. model digital systems using User- Defined Primitives (UDP) (BL-3)

MODULE-5 Tasks and Functions

11hrs

System Tasks, Functions And Compiler Directives: Introduction, Parameters, Path Delays, Module Parameters, System Tasks and Functions, File-Based Tasks and Functions, Compiler Directives, Hierarchical Access, Verilog models for memories and buses: Static RAM memory, UART Design

At the end of the Module 5, students will be able to:

- 1 Explain the concept of FSM (BL-2)
- 2 Learn compiler directives. (BL-2)
- 3 Describe the usage of functions and tasks in packages (BL-2)

Total hours:48 hours

Text Book(s):

1. T.R. Padmanabhan and B. Bala Tripura Sundari, "Design through Verilog HDL", WSE, IEEE Press 2008.
2. J. Bhaskar, "A Verilog Primer", BSP, 2nd edition 2003.
3. Samir Palnitkar, "Verilog HDL", Pearson Education, 2nd Edition, 2003.

NARAYANA ENGINEERING COLLEGE::GUDUR

20EC2012	Digital Signal Processing							R2020
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
VI	3	0	0	48	3	40	60	100

Pre-requisite: Signal and systems

Course Objectives:

- To illustrate the concepts of digital signal processing techniques.
 - To analyze discrete time signals by FFT Algorithms.
 - To design infinite impulse response filters for filtering undesired signals.
 - To design finite impulse response filters for filtering undesired signals.
- To summarize the architectural features of programmable DSP Processor.

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

- **CO 1 Illustrate** the concepts of digital signal processing techniques. **(BL-02)**
- **CO 2 Analyze** time and frequency domains description of discrete time signals using FFT Algorithms**(BL-03)**
- **CO 3 Design** of IIR filters using different methods**(BL-04)**
- **CO 4 Design** of FIR filters using different methods **(BL-04)**
- **CO 5 Summarize** the architectural features of programmable DSP Processor. **(BL-02)**

Reference Book(s):

1. Thomas and Moorby, “The Verilog Hardware Description Language”, kluwer academic publishers, 5th edition, 2002.
2. Stephen Brown and Zvonko Vranesic, “Fundamentals of Logic Design with Verilog”, TMH publications, 2007.
3. Charles.H.Roth,Jr., Lizy Kurian John “Digital System Design using VHDL” , Thomson, 2nd Edition, 2008

CO-PO Mapping														
CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	3	1									2
CO2	3	3	3	3	2									3
CO3	3	3	3	3										
CO4	3	3	3	3	2									3
CO5	3	3	2	2	2								2	2

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1 INTRODUCTION TO DSP AND DFT 11 Hrs

INTRODUCTION TO DIGITAL SIGNAL PROCESSING:Elementary discrete time signals, Representation of discrete time signals, classification of discrete time signals and systems **(4 Hr's)**

DISCRETE FOURIER TRANSFORMS (DFT): Introduction, Properties of DFT, DFT as a linear transformation, DFT relationship with other transforms, multiplication of two DFTs- the circular convolution, Linear filtering methods based on DFT-overlap-save and overlap-add methods. **(7 Hr's)**

At the end of the Module 1, students will be able to:

1. Classify Discrete-time signals and systems. **(BL-02)**

2. Understand the representation of discrete time signals. **(BL-02)**
3. Find the DFT for the given sequence. **(BL-01)**
4. Compare overlap-save and overlap-add methods. **(BL-02)**

MODULE -2 FAST FOURIER TRANSFORM

08 Hrs

Efficient computation of DFT algorithms - Radix 2-Decimation-in-Time & Decimation-in-Frequency algorithms, Inverse FFT, Illustration with an example **(8 Hr's)**

At the end of the Module 2, students will be able to:

1. Understand FFT algorithms. **(BL-02)**
 2. Find the DFT of a sequence using DIT-FFT. **(BL-01)**
 3. Find the DFT of a sequence using DIF-FFT. **(BL-01)**
4. Compare the similarities and dissimilarities between DIT & DIF FFT algorithms. **(BL-02)**

MODULE-3 DESIGN OF IIR FILTERS

11 Hrs

DESIGN OF IIR FILTERS: Design of IIR filters from analog filters (Butterworth and Chebyshev)

IIR filter design by approximation of derivatives, by Impulse invariance, and by bilinear transformation methods, Frequency transformation in digital domains, Illustration with an example.

REALIZATION OF IIR FILTERS: Structures for IIR systems - Direct form, Cascade form, Parallel form and Transposed structures. **(3 Hr's)**

At the end of the Module 4, students will be able to:

1. Construct IIR filters using different structures. **(BL-03)**
 2. Design IIR filters using Butterworth and Chebyshev filters. **(BL-04)**
 3. Design IIR filters using Impulse invariance and bilinear transformation methods. **(BL-04)**
1. Translate IIR filters in digital domain. **(BL-02)**

MODULE-4 DESIGN OF FIR FILTERS

10 Hrs

DESIGN OF FIR FILTERS: Introduction to FIR filters, Linear phase FIR filters, design of FIR filters using Rectangular, Hanning, Hamming, Bartlet and Blackman windows, Illustrative problems.

REALIZATION OF FIR FILTERS: Structures for FIR systems- Direct form and Cascade form, Comparison of FIR and IIR filters.

At the end of the Module 3, students will be able to:

2. Construct FIR filters using different structures. **(BL-03)**
 3. Design FIR filters using windowing techniques. **(BL-04)**
4. Design linear phase FIR filters using various techniques. **(BL-04)**

MODULE-5 ARCHITECTURES FOR PROGRAMMABLE DSP DEVICES

08 Hrs

Basic Architectural features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation Unit.

At the end of the Module 6, students will be able to:

1. List the architectural features of Programmable DSPs. **(BL-01)**
 2. Explain the addressing modes of PDSPs. **(BL-02)**
3. Summarize the speed issues of programmable DSPs. **(BL-02)**

Total hours:48 hours

Text Book(s):

1. John G. Proakis, Dimitris G. Manolakis, "Digital signal processing, principles, Algorithms and applications," Pearson Education/PHI, 4 th ed., 2007.
2. Avtar Singh and S. Srinivasan, "Digital Signal Processing," Thomson Publications, 2004.
3. S.Salivahanan, A.Vallavaraj, C.Gnanapriya, "Digital signal processing", Tata McGraw Hill, 2 nd edition, 2011

Reference Book(s):

1. Sanjit K Mitra, "Digital signal processing, A computer base approach," Tata McGraw Hill, 3 rd edition, 2009
2. B. P. Lathi, "Principles of Signal Processing and Linear Systems," Oxford Univ. Press, 2011.
3. A. V. Oppenheim and R.W. Schaffer, & J R Buck, "Discrete Time Signal Processing," 2nd, Pearson Education, 2012.

NARAYANA ENGINEERING COLLEGE:GUDUR

20EC2013 **VLSI DESIGN**

R2020

Semester	Hours / Week			Total hrs	Credit	Max Marks		TOTAL
	L	T	P			C	CIE	
VI	3	0	-	48	3	40	60	100

Pre-requisite: Basics of semiconductor devices, Electronics circuits, Digital logic Design, Physics.

Course Objectives:

1. To understand the fabrication process of MOS, CMOS, Bi-CMOS Transistors, the electrical properties of MOS circuits
2. To Know the design rules, layout diagrams, stick diagrams and will also acquaint with knowledge on electrical constraint while designing
3. To know the design of various complex logic gates using CMOS and other forms of logic.
4. Subsystem design is used in VLSI integrated circuits for adders, multipliers, shifters, ALUs and Array Subsystems used in sequential circuit designs i.e. SRAM, DRAM.
5. To know the architectural details of FPGAs, CPLDs and procedural steps to develop semiconductor ICs like Full-Custom, Semi-Custom & programmable ICs.

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

- CO 1** Analyze the MOS Device Equations & CMOS basic inverter characteristics. (BL-4).
- CO 2** Apply the concepts of stick diagrams and layout design rules for CMOS Circuits. (BL-3).
- CO 3** Design the digital complex logic gate design of various types using CMOS and other forms of logic. (BL-3).
- CO 4** Develop various Data Path subsystems, parity generators, and array of memories to compensate trade-off area, speed and power requirements. (BL-3).
- CO 5** Implement digital logic circuits using PLAs, FPGAs and CPLDs. (BL-4).

CO-PO Mapping														
CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3		2								2	1
CO 2	3	3	3										3	3
CO 3	3	3	3	3	1									3
CO 4	3	3	3	1	1								3	1
CO5	3	2	2	1	3								3	2

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE-1 Introduction to MOS Technologies

12 hours

Introduction to integrated circuit technologies, Basic of MOS transistors, enhancement mode MOS transistor, depletion mode MOS transistor, NMOS and CMOS fabrication, BICMOS.

ELECTRICAL PROPERTIES : I_{ds} - V_{ds} relationships, Threshold Voltage, Body effect, Channel length modulation, g_m , g_{ds} , figure of merit ω_0 , Pass transistor, NMOS Inverter, CMOS Inverter analysis and design, Latch-up in CMOS circuits

At the end of the Module 1, students will be able to:

1. Illustrate the evolution of Integrated Circuits and MOS Technologies. (BL-2).
2. Compare Bipolar, NMOS, CMOS, BICMOS and GaAs technologies. (BL-2).
3. Explain PMOS Fabrication Process. (BL-2).
4. Interpret the fundamentals of MOS devices and its V-I characteristics.(BL- 4)
5. Compare the relative merits of the three different forms of pull-up for an inverter circuit.(BL-2).

MODULE-2 VLSI CIRCUIT DESIGN PROCESS

9 hours

VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layout, $2\mu\text{m}$ CMOS Design rules for wires, Contacts and Transistors Layout Diagrams for NMOS, CMOS Inverters and Gates, Scaling of MOS Circuits: Scaling models, Scaling factors for device parameters, Limitations of Scaling.

At the end of the Module 3, students will be able to:

1. Develop the Layout of simple MOS circuits using Lambda based **design** rules. (BL-3).
2. Demonstrate how the NMOS, CMOS transistors layouts are built using $2\mu\text{m}$ CMOS Design rules.
3. Illustrate the scaling models and scaling factors for NMOS,PMOS and CMOS Devices.(BL-2)
4. Infer the limitations of scaling.

MODULE-3 GATE LEVEL DESIGN

9 hours

Logic gates and other complex gates, Switch logic, Other Forms of CMOS Logic: Pseudo-nMOS logic, Dynamic CMOS logic, Clocked CMOS (C^2 MOS) logic, CMOS Domino Logic, n-p CMOS logic.

At the end of the Module 4, students will be able to:

1. Demonstrate any logic function into Gate level design. (BL-2)
2. Illustrate various logic circuits with different design styles. (BL-2)
3. Explain CMOS domino logic and give its advantages and disadvantages. (BL-2)
4. Compare the other forms of CMOS Logic. (BL-2)

MODULE-4 DATA PATH SUBSYSTEMS

9 hours

Shifters, Design of an ALU Subsystem, Adders, Multipliers, Parity generators, SRAM, DRAM, ROM, Serial Access Memories, and Content Addressable Memory.

At the end of the Module 5, students will be able to:

1. Interpret the different architectures for adders.(BL-2)
2. Identify the speed and area trade off Adders, Multipliers and shifters.(BL-3)

3. Demonstrate the working principle and operation of different Memories. (BL-2).
4. Illustrate the read and write operations in static RAM with neat diagram. (BL-2)

MODULE-5 IMPLEMENTATION STRATEGIES

9hours

Full custom, Standard Cell, Gate Array based ASICs, PLA, PAL, PLD, and CPLD & FPGA Architecture. Programmable Array Logic, Design Approach.

At the end of the Module 6, students will be able to:

1. Illustrate the techniques of chip design using programmable devices. (BL-2).
2. Demonstrate the architecture and routing procedures of CPLD & FPGA. (BL-2).

Total hours:**48 hours**

Text Books:

1. Kamran Eshraghian, Douglas A. Pucknell and Sholeh Eshraghian, *Essentials of VLSI Circuits and Systems*, PHI, 2005.
2. P.P. Sahu, VLSI Design, TMH, 1st edition 2013.
3. K.Lal Kishore and V.S.V. Prabhakar, "VLSI DESIGN", IK Publishers, 1st edition 2009

Reference Books:

1. John P Uyemura, Introduction to VLSI Circuits and Systems, Wiley India, 2006
2. Jhon F. Wakerly, "Digital Design Principles & Practices", Pearson Education Asia, 3rd Edition, 2005.
3. John M. Rabaey, Digital Integrated Circuits: A Design Perspective, PHI, 2nd Edition, 1997.
4. Wayne Wolf, "Modern VLSI Design", Pearson Education, 3rd Edition, 2008.
5. Sebastian Smith, "Application Specific Integrated Circuits", Addison Wesley Publishing Company Incorporated, 2008
6. Principles of CMOS VLSI Design- Weste and Eshraghian, Pearson Education, 1999

NARAYANA ENGINEERING COLLEGE:GUDUR

20EC2507 DIGITAL SIGNAL PROCESSING LAB

R2020

Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P			C	CIE	SEE
VI	0	0	3	36	3	40	60	100

Pre-requisite: Knowledge on Signals and Systems and Matlab.

Course Objectives:

1. To analyze various continuous and discrete time signals using matlab functions.
2. To demonstrate the use of DFT to efficiently process discrete time signals in the frequency domain.
3. To design aspects of FIR and IIR filters for given specifications.

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

- CO 1** Analyze discrete time signals & systems using MATLAB
- CO 2** Design & implement IIR & FIR filters for different specifications
- CO 3** Design DSP based real time processing systems to meet desired needs of the society

CO-PO Mapping														
CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3							2	2		2	2	3
CO2	2	2	2		2				2	2		2	2	2
CO3	2	3							2	2		2	2	3

1: Low, 2-Medium, 3- High

COURSE CONTENT

CO

PART-A: Software Experiments using MATLAB software

(Minimum of 5 experiments are to be conducted)

Task-1: GENERATION OF DISCRETE TIME SIGNALS

Objective: To generate various continuous and discrete time signals using MATLAB software. CO 1

Task-2: ENERGY AND POWER OF A SIGNAL

Objective: To find the energy and power of a given discrete time signal using MATLAB software. CO 1

Task-3: DFT

Objective: To find the DFT of a given sequence using MATLAB software. CO 2

Task-4: BUTTERWORTH IIR FILTER

Objective: To design and implement IIR Butterworth (LP/HP) filter using MATLAB software. CO 3

Task-5: FIR LOW PASS FILTER

Objective: To design and implement FIR Low pass filters using any three windows in MATLAB software. CO 3

Task-6: FIR HIGH PASS FILTER

Objective: To design and implement FIR high pass filters using any three windows in MATLAB software. CO 3

Task-7: FIR BAND-PASS FILTER

Objective: To design and implement FIR band-pass filter using any three windows in MATLAB software.

CO 3

PART-B: Using DSP Processor kits (Floating point) and Code Composer Studio (CCS)

Task-8: GENERATION OF DISCRETE TIME SIGNALS

Objective: To generate various continuous and discrete time signals using DSP Processor and CC studio.

CO 1

Task-9: ENERGY AND POWER OF A SIGNAL

Objective: To find energy and power of a given discrete time signal using CC studio.

CO 1

Task-10: DFT

Objective: To find the DFT of a given sequence using CC studio.

CO 2

Task-11: FIR FILTER

Objective: To design and implement FIR filters using CC Studio.

CO 3

Task-12: IIR FILTER

Objective: To design and implement IIR filters using CC Studio.

CO 3

Additional Experiments:

Task-13: CIRCULAR CONVOLUTION

Objective: To find circular convolution of given two discrete time signals using MATLAB software. CO 1

TASK-14: N-POINT DIF-FFT ALGORITHM

Objective: To find the DFT of a given sequence using DIF FFT algorithm in MATLAB software. CO 2

Text Book(s):

- 1 John G. Proakis, Dimitris G. Manolakis, "Digital signal processing, principles, Algorithms and applications," Pearson Education/PHI, 4 th ed., 2007.
- 2 Sanjit K Mitra, "Digital signal processing, A computer base approach," Tata McGraw Hill, 3 rd edition, 2009
- 3 S.Salivahanan, A.Vallavaraj, C.Gnanapriya, "Digital signal processing", Tata McGraw Hill, 2 nd edition, 2011

Reference Book(s):

1. A.V.Oppenheim and R.W. Schaffer, & J R Buck, "Discrete Time Signal Processing," 2 nd ed., Pearson Education, 2012.
2. B. P. Lathi, "Principles of Signal Processing and Linear Systems," Oxford Univ. Press, 2011.
3. Li Tan, Jean Jiang, "Digital Signal Processing, Fundamentals and Applications," Academic Press, Second Edition, 2013
4. P. Ramesh Babu, "Digital Signal Processing", 4th edition, 2006, SCITECH publication, India.

NARAYANA ENGINEERING COLLEGE:GUDUR

20EC2508 IC Applications Laboratory

R2020

Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P			C	CIE	SEE
VI	0	0	2	42	1	40	60	100

Pre-requisite: Basic knowledge of Electronic Devices and circuits, Knowledge on dual power supply connections.

Course Objectives:

- 1.To understand the characteristics of operational amplifier
2. To Apply Operational Amplifiers in linear and non-linear applications.
3. To Design different types of active filters.
- 4.To Design and construct waveform generation circuits
5. To understand the designing industrial applications using 555 timer.

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

- CO 1** Illustrate the working of Op amp ICs & Application specific analog ICs.
- CO 2** Analyze operational amplifier based circuits for linear and non-linear applications.
- CO 3** Design Operational amplifiers for linear and nonlinear application, Multivibrator circuits using 555 & application specific ICs.
- CO 4** Simulate all linear and nonlinear application based Op amp Circuits and circuits based on application specific ICs.

CO-PO Mapping														
CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2							3	3		2	3	
CO2	2	2	2						3	3		2	3	
CO3	2	2	2						3	3		2	3	2
CO4	2	2	2						3	3		2	3	2
1: Low, 2-Medium, 3- High														

Note: List of Experiments (At least twelve experiments are to be done):

- | COURSE CONTENT | CO |
|---------------------------------------------------------------------------------------------------------------------------------------------|------|
| Task-1: Inverting, Non-Inverting & Unity Gain Amplifiers Using IC 741 Op-Amp | |
| Objective: To determine voltage gain and frequency response of inverting, non-inverting & unity Gain amplifiers using IC 741 Op-Amp. | CO 1 |
| Task-2: Measurement of Op-Amp Parameters | |
| Objective: To measure offset voltages, bias currents, CMRR, Slew Rate using IC-741 Op-Amp. | CO 1 |
| Task-3: Integrator & Differentiator Using IC 741 Op-Amps. | |
| Objective: To design, construct and verify the response of | |
| a) Integrator using Op-amp IC741 for sine and square wave inputs at 1 KHz frequency. | |

- b) Differentiator using Op-amp IC741 for sine and square wave inputs at 1 KHz frequency. CO 2

Task-4: Op-Amp Applications-Zero Crossing detector, Window Detector & Schmitt trigger. CO2

Objective: To study Zero Crossing detector, Window detector & Schmitt trigger using Op-Amp.

Task-5: Op-Amp Applications-Signal Converters.

Objective: To Construct suitable circuits for voltage to current converter and current to voltage converters using Op-Amp. CO 2

Task-6: Instrumentation Amplifier Using IC 741 Op-Amps.

Objective: To design an instrumentation amplifier and determine its voltage gain using IC-741 Op-Amp. CO 3

Task-7: Function Generator Using IC 741 Op-Amps.

Objective: To generate triangular and square wave forms and to determine the time period of the wave forms. CO 3

Task-8: RC PHASE SHIFT OSCILLATOR AND WEIN BRIDGE OSCILLATOR

Objective: To study the Operation of Wein – Bridge Oscillator and RC phase shift oscillator using IC 741 Op-Amp and to determine the frequency of Oscillations. CO 3

Task-9: DESIGN OF ACTIVE FILTERS (LPF, HPF)

Objective: To design, construct and plot the frequency response of
a) First order low pass filter with cut-off frequency of 5KHz
b) First order high pass filter with a cut-off frequency of 1KHz. CO3

Task-10: Astable Multivibrator Using IC 555 Timers.

Objective: To obtain a symmetric square wave output wave forms by maintaining certain duty cycle by using 555 timers.

Task-11: Monostable Multivibrator Using IC 555 Timers.

Objective: To design a Monostable Multivibrator using 555 timer to get 10msec pulse output. CO4

Task-12: Data converters using Op-amp

Objective: To obtain analog output voltages for the digital input data using 3-bit binary weighted resistor type DAC using Op-Amp. CO5

Additional Experiments:

Task-13: Low Drop Out Regulator Using IC 741 Op-Amps.

Objective: Design and test a low Dropout regulator using op-amps for a given voltage regulation characteristic Using IC 741 Op-Amp. CO5

Task-14: DC-DC Converter Using IC 741 Op-Amps.

Objective: Design of a switched mode power supply that can provide a regulated output voltage for a given input range using IC 741 Op-Amp. CO 5

Text Book(s):

1. Ramakanth A. Gayakwad, "Op-Amps & linear ICs", PHI, 3rd edition, 2003.
2. D. Roy Chowdhury, "Linear Integrated Circuits", New age international (p) Ltd, 2nd edition, 2003.
3. K.Lal Kishore, "Operational Amplifiers and Linear Integrated Circuits", Pearson 1st edition, 2008.

Reference Book(s): Salivahanan, "Linear Integrated Circuits and Applications", TMH, 1st edition, 2008.

1. S. Franco, Design with Operational Amplifiers and Analog Integrated Circuits, 3rd edition, TMH.
2. William D. Stanley, Operational Amplifiers with Linear Integrated Circuits, 4th edition, Pearson.
3. Roy Mancini, OP-AMPS for Everyone, 2nd edition.

NARAYANA ENGINEERING COLLEGE:GUDUR

20EC2509	VLSI DESIGN LAB							R2020
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
VI	0	0	2	42	1	40	60	100

Pre-requisite: A course on Microwave and optical communications.

Course Objectives:

- 1.To understand how to measure different performance parameters of the circuits.
2. To Create some innovative ideas for the students to design various circuits to satisfy the performance parameters of the design.
3. To design the layouts for logic circuits

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

CO 1 Develop Verilog HDL source code for the given problem/experiment, and simulate the given circuit with suitable simulator and verify the results.

CO 2 Analyze the obtained results of the given experiment/problem.

CO 3 Implement the experiments using FPGA/CPLD hardware tools.

CO-PO Mapping														
CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	2						2	3		2	2	3
CO2	3	2	2						2	3		2	2	3
CO3	3	3	2						2	3		2	2	3

1: Low, 2-Medium, 3- High

COURSE CONTENT

CO

Task-1: Realization of Logic gates

Objective: Develop VERILOG model for all basic gates and simulate to verify the functionality and synthesize to verify the RTL schematic. CO 1

Task-2: Design and Implementation of 4-Bit ripple carry and carry look ahead adder using Behavioral, Dataflow and Structural modeling.

Objective: Develop the VERILOG model for 4-bit ripple carry adder and simulate to verify the functionality and synthesize to verify the RTL schematic. CO 1

Task-3: Design and Implementation of 16 to 1 mux through 4 to 1 mux.

Objective: Develop the VERILOG model for 16:1 mux. through 4:1 mux. and simulate to verify the functionality and synthesize to verify the RTL schematic. CO 1

Task-4: Design and Implementation of 8 to 3 encoder.

Objective: Develop the VERILOG model for 8 to 3 encoder and simulate to verify the functionality and synthesize to verify the RTL schematic. CO 1

Task-5: Design and Implementation of 8-bit parity generator and checker.

Objective: Develop the VERILOG model for 8-bit parity generator and simulate to verify the functionality and synthesize to verify the RTL schematic. CO 1

Task-6: Design and Implementation of D-Flip-Flop.

Objective: Develop the VERILOG model for D-flip flop and simulate to verify the functionality and synthesize

to verify the RTL schematic.

CO 1

Task-7: Design and Implementation of 8 bit synchronous up-down counter.

Objective: Develop the VERILOG model for 8-bit synchronous up-down counter and simulate to verify the functionality and synthesize to verify the RTL schematic.

to verify the
CO 1

Task-8: Design and simulate a CMOS Inverter

Objective: To generate layout for inverter using Tanner/Micro wind tool or equivalent industry software and simulate to verify the functionality.

standard
CO 2

Task-9: Design and simulate CMOS NAND and NOR Gate.

Objective: (1) To generate layout for NAND gate using Tanner/Micro Wind tool or equivalent industry standard software and simulate to verify the functionality.

(2) To generate layout for NOR Gate using Tanner/Micro Wind Tool or Equivalent Industry Standard Software and simulate to verify the functionality.

CO 2

Task10: Design and simulate CMOS Full Adder.

Objective: To generate layout for FULL ADDER using Tanner/Micro wind tool or equivalent industry standard software and simulate to verify the functionality.

CO 2

Task-11: Design and simulate CMOS Full Subtractor.

Objective: To generate layout for Full Subtractor using Tanner/Micro Wind Tool or equivalent Industry Standard Software and simulate to verify the functionality.

CO3

Task-12: Design and simulate D-Latch using CMOS.

Objective: To generate layout for a D-Latch using Tanner/Micro wind tool or equivalent industry standard software and simulate to verify the functionality.

CO 3

Additional Experiments:

Task-13: Design and Implementation of 4-bit sequence detector through Mealy state machines.

Objective: Develop VHDL model for 4-bit sequence detector using Mealy state machines to simulate to verify the functionality and synthesize to verify the RTL schematic.

CO 3

Task-14: Design and simulate 2 to 4 Decoder using CMOS.

Objective: Develop VHDL model for 2 to 4 decoder using Tanner/Micro wind tool or equivalent industry standard software and simulate to verify the functionality.

CO 2

Text Book(s):

1. Kamran Eshraghian, Eshraghian Douglas and A. Pucknell, "Essentials of VLSI circuits and systems", PHI, 2013 edition.
2. K.Lal Kishore and V.S.V. Prabhakar, "VLSI Design", IK Publishers
3. Razavi, Design of Analog CMOS Integrated Circuits, Tata McGraw Hill Publications, 2002.

Reference Book(s):

1. J.M. Rabaey, A. Chandrakasan and B. Nikolic, Digital Integrated Circuits- A Design Perspective, 2nd edition, PHI, 2003.
2. Weste, CMOS VLSI Design: A Circuits And Systems Perspective, 3rd edition, Pearson Education India, 2007.

SEMESTER VII

Subject Code	Category	Course Title	Contact Periods per week				Credits	Scheme of Examination Max. Marks			
			L	T	P	Total		Int. Marks	Ext. Marks	Total Marks	
20HS5001 -8	HS	Humanities and Social Science Elective	2	0	0	2	2	40	60	100	
20EC2014	PC	Microwave and Optical Communications	3	0	0	3	3	40	60	100	
	OE	Open Elective IV	3	0	0	3	3	40	60	100	
20EC4013-18	PE	Professional Elective III	3	0	0	3	3	40	60	100	
20EC4019-24	PE	Professional Elective IV	3	0	0	3	3	40	60	100	
20EC4025-30	PE	Professional Elective V	3	0	0	3	3	40	60	100	
20EC2510	PC	Electronic Design Workshop	0	0	2	2	1	40	60	100	
20EC2511	PC	Microwave and Optical Communications Lab	0	0	3	3	1.5	40	60	100	
20CD6005	SC	Career Competency Development V	0	0	2	2	1	40	60	100	
20CC6501	SC	Skill Development Training	0	0	2	2	1	40	60	100	
20EC7502	PR	Internship II/on job training/Com Ser Project	0	0	0	0	1.5	00	100	100	
20MC8002-12	MC	Mandatory Course IV	2	0	0	2	0	00	00	00	
		Counselling/Mentoring	0	0	1	1	0	--	--	--	
		Sports/Hobby Clubs/Activities	0	0	2	2	0	--	--	--	
		Activity Point Programme	During the Semester						20 Points		
		Total	19	0	12	31	23	400	700	1100	

NARAYANA ENGINEERING COLLEGE:GUDUR

20EC2014	MICROWAVE & OPTICAL COMMUNICATIONS						R2020	
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
VII	3	0	0	48	3	40	60	100

Pre-requisite: EMTL, Engineering physics

Course Objectives:

- To apply Electromagnetic Theory for calculating waveguides and transmission lines
- To Summarize microwave system and components in terms of network theory(scattering Matrix)
- To illustrate microwave components such as ferrite devices
- To outline the basic elements of optical fiber transmission link, fiber modes configurations and structures
- To Summarize the various optical source materials, LED structures, quantum efficiency, Laser diodes and applications

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

- CO 1** Interpret the importance of waveguides
- CO 2** Illustrate the working of passive devices
- CO 3** Differentiate Linear beam tubes and crossed field tubes in terms of operation and performance
- CO 4** Analyze the signal propagation in optical fibers
- CO 5** Select appropriate optical sources and detectors for specific applications

CO-PO Mapping														
CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	1										1	
CO2	3	3	1	1									1	
CO3	3	3	1	1									3	
CO4	3	3	1	1									1	
CO5	3	3	1	1		1							3	

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1 WAVEGUIDES

9 Hrs

WAVEGUIDES AND COMPONENTS: Introduction, microwave spectrum and bands, applications of microwaves. Rectangular waveguides, circular waveguides, microwave cavities.

At the end of the Module 1, students will be able to:

1. Explain impedance matching network for any transmission line or system. **(BL-02)**
2. Understand various parameters of waveguide and use of component as per applications. **(BL-02)**
3. Find impedance by using smith chart. **(BL-01)**
4. Summarize various waveguide components. **(BL-02)**

MODULE-2 MICROWAVE PASSIVE COMPONENTS

9 Hrs

Microwave passive devices :Microwave hybrid circuits, directional couplers, circulators and isolators. Coaxial connectors, adapters, Phase shifters, Attenuators, Waveguide Tees.

Microwave Semiconductor Devices: Gunn Oscillator – Principle of operation, Characteristics, Two valley model, IMPATT, TRAPATT diodes.

At the end of the Module 3, students will be able to:

1. Explain different parameters of two port devices. **(BL-02)**
2. Find the S matrix of multiport networks. **(BL-01)**
3. Understand Symmetrical Z and Y parameters. **(BL-02)**
4. Summarize various Microwave passive devices. **(BL-01)**

MODULE-3 MICROWAVE TUBES AND MEASUREMENTS

10 Hrs

Microwave Tubes: (i) Linear Beam Tubes – Two cavity Klystron amplifier -velocity modulation, bunching process, output power, Reflex Klystron oscillator, power output and efficiency, Travelling Wave Tube (TWT).

(ii) **Crossed Field Tubes** – Magnetron oscillator, pi-mode operation, power output and efficiency, Hartree Condition, Mode jumping in Magnetron

Microwave measurements: microwave bench, errors and precautions, power, attenuation, frequency, standing wave, impedance measurements.

At the end of the Module 3, students will be able to:

1. Understand principle of operation of Microwave Tubes (BL-1)
3. Derive the expressions power output and efficiency of all microwave devices (BL3)
4. Differentiate Linear beam tubes and crossed field tubes in terms of operation and performance (BL5)

MODULE-4 INTRODUCTION TO OPTICAL FIBERS

10 Hrs

Evolution of fiber optic system-Elements of an Optical Fiber Transmission link-Ray Optics-Optical Fiber Modes and Configurations. Single Mode Fibers-Graded Index fibers Structure.

Signal Degradation Optical Fibers: Attenuation–Absorption losses, Scattering losses, Bending Losses, Core and Cladding losses, Signal Distortion in Optical Waveguides

At the end of the Module 4, students will be able to:

1. Understand the fundamental principles of optics and light wave. **(BL-02)**
2. Explain the transmission characteristics of optical fiber. **(BL-02)**
3. Explain various losses in optical fibers. **(BL-02)**
4. Illustrate the signal distortion in optical waveguides. **(BL-02)**
5. Explain different fibers structures. **(BL-02)**

MODULE-5 FIBER OPTICAL COMPONENTS AND APPLICATIONS

10 Hrs

Direct and indirect Band gap materials-LED structures–Light source materials–Quantum efficiency and LED power, Modulation of a LED, lasers Diodes: Modes and Threshold condition–Rate equations–External Quantum efficiency–Resonant frequencies, PIN and APD diodes.

Applications of optical communication: Telephony, Telemetry, video distribution, military applications.

At the end of the Module 5, students will be able to:

1. Explain optical fiber communication links using appropriate optical fibers light sources. **(BL-02)**
2. Outline the various LED structures. **(BL-02)**
3. Explain the terms quantum efficiency, LED power, Modulation of a LED. **(BL-02)**
4. Explain the operation of LASER PIN, APD diodes. **(BL-02)**
5. List various applications of Fiber optical receivers. **(BL-01)**

Total hours: 48hours

Text Book(s):

- 1 Microwave devices and Circuits-Samuel Y. Liao, Pearson, 3rd Edition, 2003.
- 2 Microwave principles-Herbert J.Reich,J.G.Skalmik, P.F.Ordung and H.L.Krauss, CBS publishers and distributors, New Delhi,2004
- 3 GerdKeiser,“OpticalFiberCommunication”McGraw–HillInternational,Singapore,3rded.,2000
- 4 J.Senior,“OpticalCommunication,PrinciplesandPractice”,PrenticeHallofIndia,1994

NARAYANA ENGINEERING COLLEGE:GUDUR

20EC2511	MICROWAVE AND OPTICAL COMMUNICATION LAB							R2020
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
VII	0	0	2	36	1	40	60	100

Pre-requisite: A course on Microwave and optical communications.

Course Objectives:

1. To study and analyze microwave components by measuring various parameters.
2. To verify the characteristics of optical sources.
3. To measure attenuation and distortions in optical fiber link.
4. To analyze radiation pattern of horn antenna

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

- CO 1** Analyze the waveguides in different modes of operation. (BL-4)
- CO 2** Interpret the limitations of conventional tubes at microwave frequencies and different microwave oscillators & amplifiers. (BL-3)
- CO 3** Analyse the optical fibre communications link. (BL-4)

Reference Book(s):

- 1 Foundations for microwave engineering-R.E.Collin, IEEE press, John Wiley, 2nd edition, 2002
- 2 Microwave circuits and passive devices-M.L.Sisodia and G.S.Raghuvanshi,Wiley Eastern Ltd.,New age International publishers Ltd., 1995.
- 3 Microwave engineering passive circuits-Peter A.Rizzi, PHI, 1999.
- 4 Electronic and Radio Engineering-F.E.Terman, McGraw-Hill, 4th Edition, 1995
- 5 Microwave Engineering – A. Das, TMH, 2nd ed., 2009
- 6 MaxMing-KangLiu,“Principles and Applications of Optical Communications” ,TMH,2010.2
- 7 .S.C.Gupta,“Textbook on optical fiber communication and its applications”,PHI,2005.
- 7 Satish Kumar,“Fundamentals of Optical Fiber communications”,PHI,2009

CO-PO Mapping														
CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3	2						2	3		2	2	2
CO2	2	2	2						2	3		2	2	2
CO3	2	3	2						2	3		2	2	2

1: Low, 2-Medium, 3- High

COURSE CONTENT

CO

Task-1: Characteristics of a Reflex Klystron And Electronic Tuning

Objective: Use microwave bench setup to Study the mode characteristics and electronic tuning range of reflex klystron.

CO 3

Task-2: V-I Characteristics of Gunn Oscillator

Objective:

Use microwave bench setup to study the V-I characteristics of GUNN diode and find the threshold voltage and current point.

CO 2

Task-3: To Determine the Attenuation of A Given Unknown Attenuator

Objective:

Use microwave bench setup to determine the attenuation of a given unknown attenuator. CO 3

Task-4: Multi-Hole Directional Coupler

Objective:

Use microwave bench setup to study the characteristics of directional coupler and determine the different parameters.

CO 2

Task-5: VSWR Measurement

Objective:

Use microwave bench setup to find VSWR and impedance of an unknown load that is connected at the end of the bench set up. Make use of VSWR meter for the measurement of VSWR of a given load. CO 3

Task 6: Frequency and Wavelength of Waveguide

Objective:

Use microwave bench setup to determine the frequency and wavelength of waveguide.

CO 1

Task-7: Characteristics of Magic Tee

Objective:

Use microwave bench setup to study the characteristics of magic tee and find the scattering parameters. CO 2

Task-8: Characteristics of Fiber Optic LED

Objective:

To study the characteristics of fiber optic LED and photo detector. CO 5

Task-9: VI Characteristics of Laser Diode

Objective:

To Measure the VI Characteristics of Laser Diode. CO 5

Task-10: Optical Fiber Digital Link

Objective:

To set up an optical fiber digital link and to study the relationship between the transmitted and received signal.

CO 4

Task-11: Numerical Aperture of an Optical Fiber

Objective:

To study the numerical aperture of an optical fiber. CO 4

Task-12: Optical Fiber Analog Link

Objective:

To set up an optical fiber analog link and to study the relationship between the transmitted and received signal.

CO 4

Additional Experiments:

Task-13: Impedance Measurement

Objective:

Use microwave bench-setup to measure the unknown impedance by using smith chart. CO 3

Task-14: Characteristics of E-Plane T, H-Plane T

Objective:

Use microwave bench setup to find the S - matrix Characterization of E-Plane T, H-Plane T

CO 2

Text Book(s):

1. Microwave devices and Circuits-Samuel Y. Liao, Pearson, 3rd Edition, 2003.
2. Microwave principles-Herbert J.Reich, J.G. Skalnik, P.F. Ordung and H.L. Krauss, CBS publishers and distributors, New Delhi,2004
3. GerdKeiser,“OpticalFiberCommunication”McGraw–HillInternational,Singapore, 3rded.,2000
4. J.Senior,“OpticalCommunication,PrinciplesandPractice”,PrenticeHallofIndia,1994

Reference Book(s):

1. Foundations for microwave engineering-R.E. Collin, IEEE press, John Wiley, 2ndedition, 2002
2. Microwave circuits and passive devices-M.L. Sisodia and G.S. Raghuvanshi,Wiley Eastern Ltd.,New age International publishers Ltd., 1995.
3. Microwave engineering passive circuits-Peter A. Rizzi, PHI, 1999.
4. Electronic and Radio Engineering-F.E. Terman, McGraw-Hill, 4th Edition, 1995
5. M. Ming-Kang Liu, “Principles and Applications of Optical Communications” ,TMH,2010.

ELECTIVE TRACK/GROUP	Professional Elective-1	Professional Elective-2	Professional Elective-3	Professional Elective-4	Professional Elective-5
Communications	An Introduction to coding theory	Antennas	Satellite communication	Wireless communication	Signal Processing for mm Wave Communication for 5G and Beyond
Micro Electronics	Industrial Electronics	Micro Electronics: Devices to Circuits	Introduction to MEMS	Fundamentals of Nano and Quantum Photonics	High Speed Electronics
Signal & Image Processing	MATLAB Programming For Numerical Computation	Adaptive Signal Processing	Introduction to Machine Learning	Digital Image Processing	Digital Speech Processing
VLSI	Fundamentals of Micro and Nano Fabrication	Mixed Signal Design	RF Integrated Circuits	Low Power VLSI Design	FPGA Architectures
Embedded System	Semiconductor Memories	Real Time Operating Systems	Introduction to Internet of things	Advanced Embedded Logic design	Embedded System Design with ARM
Automation	Programmable Logic Controllers	Electronic Measurements and Instrumentation	Biomedical Instrumentation	Virtual Instrumentation	Process Control and Instrumentation

NARAYANA ENGINEERING COLLEGE::GUDUR

20EC4001	AN INTRODUCTION TO CODING THEORY							R2020
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
V	3	0	0	48	3	40	60	100

Pre-requisite:

- probability, Statistical averages
- Integrations, differentiations, partial differentiations
- Analog & Digital Communications

Course Objectives:

1. To understand the concept of linear block codes.
2. To apply source encoding algorithms.
3. To analyze convolutional encoding algorithms.
4. To analyze convolutional decoding algorithms.
5. To analyze the turbo decode

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

- CO 1** Explain linear block codes **(BL-2)**
- CO 2** Apply source encoding algorithms. **(BL-3)**
- CO 3** Analyze convolutional encoding algorithms**(BL-4)**
- CO 4** Analyze the convolutional decoding algorithms **(BL-4)**
- CO 5** Analyze turbo decode**(BL-4)**

CO-PO Mapping														
CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	1	1	1	2							1	2	
CO2	1	2	2	1	1							1	2	
CO3	1	2	2	1	2							1	2	
CO4	2	2	2	1	2							1	2	
CO5	1	2	2	1	1							1	2	

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1 **LINEAR BLOCK CODE** **10Hr**

Introduction to error control coding - Introduction to linear block codes, generator matrix and parity check matrix, Properties of linear block codes: Syndrome, error detection, Decoding of linear block codes, Distance properties of linear block codes.

At the end of the Module 1, students will be able to:

- 1 Explain error control coding. (BL-1)
- 2 Write generator and parity matrix (BL-3)
- 3 Understand distance properties (BL-2)

MODULE -2 **HAMMING CODES** **9Hr**

Some simple linear block codes: Hamming codes, Repetition codes, Single parity check codes, Reed Muller codes, Bounds on size of codes: Hamming bound, Singleton bound, Plotkin bound, Gilbert-Varshamov bound.

At the end of the Module 2, students will be able to:

1. Apply the source encoding algorithms. (BL-3)
2. Understand various codes (BL-2)
3. Analyze various bound techniques. (BL-4)

MODULE-3 **CONVOLUTIONAL ENCODER** **10Hr**

Introduction to convolutional codes-I: Encoding, state diagram, trellis diagram, Introduction to convolutional codes-II: Classification, realization, distance properties.

At the end of the Module 3, students will be able to:

1. Understand the convolutional codes (BL-2)
2. Understand state and trellis diagram (BL-2)
3. Find distance properties. (BL-1)

MODULE-4 **CONVOLUTIONAL DECODER** **10Hr**

Decoding of convolutional codes-I: Viterbi algorithm and BCJR algorithm, Performance bounds for convolutional codes, Low density parity check codes, Decoding of low density parity check codes: Belief propagation algorithm on BSC and AWGN channels.

At the end of the Module 4, students will be able to:

1. Understand the decoding (BL-2)
2. Analyze the performance bounds for convolutional codes (BL-4)
3. Understand the propagation algorithms (BL-2)

MODULE-5 **TURBO CODER** **9Hr**

Turbo codes, Turbo decoding, Distance properties of turbo codes, Convergence of turbo codes, Automatic repeat request schemes, Applications of linear codes.

At the end of the Module 5, students will be able to:

1. Analyze turbo codes. (BL-4)
2. Understand distance properties of turbo codes. (BL-2)
3. Explain applications of linear codes (BL-2)

Total hours:48 hours

Text Book(s):

1. "Error Control Coding", by Shu Lin and Daniel J. Costello, Jr., second edition, Prentice Hall, 2004.
2. Todd K. Moon, "Error Correction Coding", 1st Edition, Wiley-Inter science, 2006.
3. F. J. Mac Williams, N. J. A. Sloane, "The Theory of Error-Correcting Codes", North-Holland, Amsterdam, 1977

Reference Book(s):

1. R. E. Blahut, "Algebraic Codes for Data Transmission", 1st Edition, Cambridge University Press 2003.
2. Cary W. Huffman, Vera Pless, "Fundamentals of Error-Correcting Codes", 1st Edition, Cambridge University Press, 2003.
3. Rolf Johannesson and Kamil Sh. Zigangirov, "Fundamentals of Convolutional Coding", IEEE Press, 1999.

NARAYANA ENGINEERING COLLEGE:GUDUR

20EC4002	INDUSTRIAL ELECTRONICS							R2020
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
V	3	0	0	48	3	40	60	100

Pre-requisite: Courses on Basic Engineering Physics, Basic Electronic Devices & Power electronics.

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

- CO 1** Explain the characteristics of Industrial electronic devices .(BL-02)
- CO 2** Explain the operation and applications of SCR.(BL-02)
- CO 3** Explain the operation and applications of Thyristor .(BL-02)
- CO 4** Explain the working principle and applications of power convertors .(BL-02)
- CO 5** Explain the working principle of timers, induction heating dielectric heating equipment .(BL-01)

CO-PO Mapping														
CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	1									1	2	
CO2	3	2	1									1	2	
CO3	2	3	2									1	2	
CO4	3	2	2	1								1	2	
CO5	3	2	2	1								1	2	
1: Low, 2-Medium, 3- High														

COURSE CONTENT

MODULE – 1 Industrial electronic devices

10hrs

Industrial electronics devices : SCR, DIAC, TRIAC, PUT, IGBT, Triggering methods of SCR, Commutation techniques of SCR, Opto electronic devices: Opto-Isolators, Opto-TRIAC, Opto-SCR, Opto-transistor.

MODULE -2 SCR & its applications

10hrs

SCR: Principles of operation and characteristics of SCR, Ratings of SCR.

Applications of SCR in Power Control: Static circuit breaker, Protection of SCR, Inverters - Classification, Single Phase inverters, Converters –single phase Half wave and Full wave. DIAC, TRIAC.

MODULE-3 Thyristor & its applications

8hrs

Thyristor: Triggering of Thyristors, Commutation Techniques of Thyristors - Classes A, B, C, D, E and F.

Thyristor Applications: Chopper circuits – Principle, methods and Configurations, DIAC AND TRIAC, TRIACS – Triggering modes, Firing Circuits, Commutation.

MODULE-4 Power Converters

9hrs

Single phase rectifiers and Polyphase rectifiers, Three-phase H.W. & Three-phase F.W. rectifiers, Inverters: Series, Parallel and bridge Inverters, Inverters: Series, Parallel and bridge Inverters, Chopper, UPS : online & offline SMPS.

MODULE-5 Industrial Applications

11 hrs

Industrial timers -Classification, types, Electronic Timers – Classification, RC and Digital timers, Time base Generators. Electric Welding Classification, types and methods of Resistance and ARC welding, High Frequency heating – principle, merits, applications, High frequency Source for Induction heating. Dielectric Heating – principle and Applications &Ultrasonics.

Total hours: 48 hours

Text Books:

1. G. K. Mithal, "Industrial Electronics", Khanna Publishers, Delhi, 2000.
2. J.Gnanavadivel, R.Dhanasekaran, P.Maruthupandi, "Industrial Electronics", Anuradha Publications, 2011.

Reference Books:

1. F. D. Petruzulla, "Industrial Electronics", McGraw Hill, Singapore, 1996.
2. M. H. Rashid, "power Electronics Circuits, Devices and Application", PHI, 3rd edition, 2004.
3. G. M. Chute and R. D. Chute, "Electronics in Industry", McGraw Hill Ltd, Tokyo, 1995.

NARAYANA ENGINEERING COLLEGE:GUDUR

20EC4003	MATLAB PROGRAMMING FOR NUMERICAL COMPUTATION							R2020
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
V	3	0	0	48	3	40	60	100

Pre-requisite: Basic Knowledge in Programming

Course Objectives:

1. To Understand the MATLAB programming environment
2. To recall numerical differentiation and integration
3. To understand linear algebra in MATLAB
4. To explain various regression and interpolation methods.
5. To Understand ODE

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

- CO 1** Understand MATLAB programming(BL-2)
- CO 2** Apply trapezoidal rule MATLAB functions(BL-3)
- CO 3** Understand linear and non linear equations (BL-2)
- CO 4** Explain interpolation in MATLAB(BL-2)
- CO 5** Analyze error methods.(BL-4)

CO-PO Mapping														
CO	COURSE CONTENT												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	1											1	1
CO2	3	3	2		1								2	1
CO3	3	3	2		1								2	1
CO4	3	2	2		1								2	1
CO5	3	2	2		1								2	1

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE -1 Introduction to MATLAB Programming

9hrs

Basics of MATLAB programming, Array operations in MATLAB, Loops and execution control Working with files: Scripts and Functions Plotting and program output.

Approximations and Errors: Defining errors and precision in numerical methods Truncation and round-off errors, Error propagation, Global and local truncation errors.

At the end of the Module 1, students will be able to:

1. Illustrate MATLAB Programming Environment (BL-2)
2. Explain array operations in Matlab(BL-2)
3. Describe global and local truncation errors(BL-2)

MODULE -2 Numerical differentiation and integration

9 hrs

Numerical Differentiation in single variable, Numerical differentiation: Higher derivatives, Differentiation in multiple variables, Newton-Cotes integration formulae, Multi-step application of Trapezoidal rule MATLAB functions for integration.

At the end of the Module 2, students will be able to:

1. Explain numerical differentiation(BL-2)
 2. Illustrate differentiation in multiple variables(BL-2)
3. Explain newton cotes integration formulae (BL-2)

MODULE-3 Linear equations and Non linear equations

10hrs

Linear algebra in MATLAB, Gauss Elimination LU decomposition and partial pivoting Iterative methods: Gauss-Siedel Special Matrices: Tri-diagonal matrix algorithm Nonlinear equations in single variable, MATLAB function zero in single variable, Fixed-point iteration in single variable, Newton-Raphson in single variable, MATLAB function solve in single and multiple variables Newton-Raphson in multiple variables.

At the end of the Module 3, students will be able to:

1. Explain linear algebra in MATLAB(BL-2)
 2. Describe LU decomposition and partial pivoting iterative methods (BL-2)
3. Describe Newton-Raphson in multiple variables (BL-2)

MODULE-4 Regression and Interpolation

10hrs

Introduction, linear least squares regression(including lsqcurvefit function), Functional and nonlinear regression (including lsqnonlin function), Interpolation in MATLAB using spline and p-chip.

At the end of the Module 4, students will be able to:

1. Explain linear least squares regression(BL-2)
2. Illustrate functional regressions(BL-2)
3. Describe interpolation method in MATLAB(BL-2)

MODULE-5 Ordinary differential equations(ODE)

10hrs

Introduction to ODEs; Implicit and explicit Euler's methods, Second-Order Runge-Kutta Methods, MATLAB ode45 algorithm in single variable, Higher order Runge-Kuttamethods , Error analysis of Runge-Kutta method.

At the end of the Module 4, students will be able to:

1. Explain ODE basics (BL-2)
 2. Illustrate ODE 45 algorithm in MATLAB (BL-2)
3. Illustrate higher order Runge- kuttamethods (BL-2)

Total hours:48 hours

Text Book(s):

1. Fausett L.V. (2007) Applied Numerical Analysis Using MATLAB, 2nd Ed., Pearson Education

References:

2. Chapra S.C. and Canale R.P. (2006) Numerical Methods for Engineers, 5th Ed., McGraw Hill

NARAYANA ENGINEERING COLLEGE:: GUDUR

20EC4004	Fundamentals of Micro and Nano Fabrication							R2020
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
V	3	0	0	48	3	40	60	100

Pre-requisite: Micro and nano systems

Course Objectives:

- 1.Explain various cleaning methods
2. Analyze various deposition methods
3. Learn optical lithography
4. Differentiate wet and dry etching
5. Describe tool and process

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

- CO 1 Describe various cleaning techniques (BL_4)
- CO 2 Explain various deposition methods(BL-2)
- CO 3 Understand optical lithography(BL-2)
- CO 4 Analyze wet and dry etching (BL-4)
- CO 5 Understand design for manufacturability (BL-2)

CO-PO Mapping														
CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO 2
CO1	3	1	2					1					1	1
CO2	3	1	2					1						
CO3	3	2	1				1						1	
CO4	3	1	2					2						
CO5	3	1	1		1			12						

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1 INTRODUCTION TO MICRO FABRICATION

10 Hrs

Substrate, Introduction to clean room, Additive Processing: Contamination and surface cleaning, Advanced cleaning techniques, Defects, Diffusion, Diffusion -Advanced Concepts, Ion Implantation.

At the end of the Module 1, students will be able to:

1. Understand micro fabrication basics (BL-2)
2. Explain contamination and surface cleaning(BL-2)
3. Analyze various cleaning techniques (BL-4)

MODULE -2 ADDITIVE PROCESSING

9 Hrs

Native films, Advanced Concepts, Defects at Si/SiO₂ interface, Chemical Vapor Deposition, Material deposition-ALD & Physical Vapor Deposition, Atomic Layer Deposition, Physical Vapor Deposition: Basics, Evaporation, and Sputtering.

At the end of the Module 2, students will be able to:

1. Identify defects at Si/SiO₂ interface (BL-1)
2. Explain various deposition methods (BL-2)

MODULE-3 METALLIZATION AND OPTICAL LITHOGRAPHY

10 Hrs

Metallization and Optical Lithography: Contact resistance, Electro-migration and Epilogue, Pattern Transfer Basics, Optical lithography basics: resist process, Contact and Proximity printing, Stepper and Scanner, Image formation basics, Image formation in photo resist, Surface Reflection.

At the end of the Module 3, students will be able to:

1. Understand metallization (BL-2)
2. Understand optical lithography (BL-2)
3. Explain contact and proximity printing (BL-2)

MODULE-4 WET & DRY ETCHING

10 Hrs

Etching ,Figures of Merit, Wet etching Basics, Wet Etching Recipes, Optical Lithography & E-Beam Lithography, Mask Technology, Dry etch: Plasma, Basics Plasma etching basics, Plasma tool configuration, Etch mechanism, Etch chemistry.

At the end of the Module 4, students will be able to:

5. Differentiate wet and dry etching (BL-4)
6. Recall optical lithography methods(BL-2)
7. Understand plasma etching basics(BL-2)

MODULE-5 CHEMICAL MECHANICAL POLISH AND DESIGN FOR MANUFACTURABILITY **9 Hrs**

Basics, Tool and process, Design for Manufacturability, Process integration, PV integration, CMOS integration.

At the end of the Module 5, students will be able to:

5. Describe tool and process (BL-2)
6. Understand design for manufacturability (BL-2)
7. Differentiate various integration methods (BL-4)

Total hours: 48 hours

Text Book(s):

1. Stephen A. Campbell (1996), The Science and Engineering of Microelectronic Fabrication, Oxford university Press.
2. Sorab K. Gandhi (1994), VLSI Fabrication Principles: Silicon and Gallium Arsenide, Wiley.
3. Richard C. Jaeger (2001), Introduction to Microelectronic Fabrication, Modular Series on Solid State Devices

Reference Book(s):

1. Milton Ohring (2002), Materials Science of Thin Films, Deposition and Structure
2. Marc J. Madou (2011) Fundamentals of Microfabrication and Nanotechnology, CRC Press.
3. Chris Mack (2007), Fundamental Principles of Optical Lithography, Wiley.

NARAYANA ENGINEERING COLLEGE:GUDUR

20EC4005	SEMICONDUCTOR MEMORIES							R2020
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
V	3	0	0	48	3	40	60	100

Pre-requisite: Basic knowledge on memories & CMOS technology.

Course Objectives:

- To understand the design and architecture of MOS memories.
- To understand the design and architecture of non volatile memories.
- To apply various testing methods on semiconductor memories.
- To illustrate the concept of reliability of semiconductors.

† To analyse Radiation Hardening Techniques of semiconductors.

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

- CO 1** Understand the design and architecture of MOS memories.(**BL-2**)
- CO 2** Explain the design and architecture of non volatile memories.(**BL-2**)
- CO 3** Apply various testing methods on semiconductor memories. (**BL-3**)
- CO 4** Explain the reliability of semiconductors & Radiation Hardening Techniques (**BL-2**)
- CO 5** Understand the architecture of advanced memory technologies.(**BL-2**)

CO-PO Mapping														
CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	1										1	
CO2	2		1										1	
CO3	2	2		2										1
CO4	2	1	2	2									1	
CO5	2	2	1											

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE -1SRAM AND DRAM MEMORIES

10 hrs

SRAM Cell Structures-MOS SRAM Architecture-MOS SRAM Cell and Peripheral Circuit Operation-Bipolar SRAM Technologies-Silicon On Insulator (SOI) Technology-Advanced SRAM Architectures and Technologies-Application Specific SRAMs. DRAM Technology Development-CMOS DRAMs - DRAMs Cell Theory and Advanced Cell Structures' - BiCMOS, DRAMs - Soft Error Failures in DRAMs - Advanced DRAM Designs and Architecture-Application Specific DRAMs.

At the end of the Module 1, students will be able to:

- 5. Understand the architecture of MOS SRAM cell. (**BL-2**)
- 6. Understand the architecture of MOS DRAM cell. (**BL-2**)
- 7. Compare architectural features of SRAM & DRAM cells. (**BL-2**)

MODULE -2 NON VOLATILE MEMORIES

10hrs

Masked Read-Only Memories (ROMs)-High Density ROMs-Programmable Read-Only Memories (PROMs)-BipolarPROMs-CMOS PROMs-Erasable (UV) - Programmable Road-Only Memories (EPROMs)-Floating-Gate EPROM Cell-One-Time Programmable (OTP) EPROMs Electrically Erasable PROMs (EEPROMs)-EEPROM Technology And Architecture-Nonvolatile SRAM-Flash Memories (EPROMs or EEPROM)-

Advanced Flash Memory Architecture.

At the end of the Module 2, students will be able to:

1. Understand the architecture of Masked Read-Only Memories. **(BL-2)**
2. Understand the architecture of bipolar PROMS. **(BL-2)**
3. Compare various non volatile memories. **(BL-2)**

MODULE-3 MEMORY FAULT MODELLING & TESTING

8 hrs

RAM Fault Modelling, Electrical Testing, Pseudo Random Testing-Megabit DRAM Testing, Non-volatile Memory Modelling and Testing-IDDQ Fault Modelling and Testing-Application Specific Memory Testing.

At the end of the Module 3, students will be able to:

5. Explain the concept of RAM Fault Modelling. **(BL-2)**
6. Understand the concept of Non-volatile Memory Modelling. **(BL-2)**
7. Apply various testing methods on semiconductor memories. **(BL-3)**

MODULE-4 MEMORY RELIABILITY AND RADIATION EFFECTS

11 hrs

General Reliability Issues-RAM Failure Modes and Mechanism-Non-volatile Memory Reliability-Reliability Modelling and Failure Rate Prediction-Design for Reliability-Reliability Test Structures-Reliability Screening and Qualification.

Single Event Phenomenon (SEP)-Radiation Hardening Techniques-Radiation Hardening Process and Design Issues-Radiation Hardened Memory Characteristics-Radiation Hardness Assurance and Testing - Radiation Dosimetry-Water Level Radiation Testing and Test Structures.

At the end of the Module 4, students will be able to:

1. Illustrate the concept of reliability of semiconductors. **(BL-2)**
2. Understand Reliability Test Structures of semiconductors. **(BL-2)**
3. Understand the Radiation Hardening Process for semiconductor memories. **(BL-2)**
4. Analyse Radiation Hardening Techniques of semiconductors. **(BL-4)**

MODULE-5 ADVANCED MEMORY TECHNOLOGIES

9 hrs

Ferroelectric Random Access Memories (FRAMs)-Gallium Arsenide (GaAs) FRAMs - Analog Memories-Magneto-resistive Random Access Memories (MRAMs)-Experimental Memory Devices. Memory Hybrids and MCMs (2D)-Memory Stacks and MCMs (3D)-Memory MCM Testing and Reliability Issues-Memory Cards-High Density Memory Packaging Future Directions.

At the end of the Module 6, students will be able to:

Understand the architecture of Gallium Arsenide (GaAs) FRAM. **(BL-2)**

Understand the architecture of Magneto-resistive Random Access Memories (MRAM). **(BL-2)**

Compare FRAM with MRAM. **(BL-2)**

Total hours:48 hours

Text Book(s):

- 1 Ashok K. Sharma, "Semiconductor Memories", Two-Volume Set, Wiley-IEEE Press, 2003.
- 2 Brent Keeth, R. Jacob Baker, Brian Johnson, Freng Lin, "DRAM Circuit Design : Fundamental and High Speed Topics", Wiley-IEEE Press, 2nd Edition, 2008.
- 3 Betty Prince, "High Performance Memories: New Architecture DRAMs and SRAMs - Evolution and Function", Wiley, Revised Edition, 1999.

Reference Book(s):

- 1 Luecke Mize Care, "Semiconductor Memory design & application", Mc-Graw Hill.

NARAYANA ENGINEERING COLLEGE:GUDUR

20EC4006	PROGRAMMABLE LOGIC CONTROLLERS							R2021
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
V	3	1	0	48	4	40	60	100

Pre-requisite: Electrical & Electronics, basics, Industrial controls

Course Objectives:

1. It is to provide and ensure a comprehensive understanding of using advanced controllers in measurement and control instrumentation.
2. To illustrate about data acquisition – process of collecting information from field instruments.
3. To analyse Programmable Logic Controller (PLC), IO Modules and internal features.
4. To Comprehend Programming in Ladder Logic, addressing of IO.
5. To understand the significance of PID in industrial applications.

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

CO 1 Explain main functional units in a PLC and their interaction.(BL-2)

CO 2 Construct basic Ladder logic diagrams for the circuits .(BL-3)

CO 3 Illustrate the working principles of Registers, timers and counters and their real time applications.(BL-2)

CO 4 Explain data handling functions of PLC.(BL-2)

CO 5 Demonstrate analog signal processing and PID operations.(BL-2)

Illustrate PLC applications.(BL-2)

2 Memory Technology design and testing 1999 IEEE International Workshop on: IEEE Computer Society Sponsor (S)

3 Belty Prince, “ Semiconductor Memory Design Handbook”

CO-PO Mapping														
CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2												2	
CO2	2	2	2									2	2	
CO3	2	2											2	
CO4	2												2	
CO5	2												2	

: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1

Introduction to PLC

8h

PLC Basics PLC system, I/O modules and interfacing CPU processor programming equipment programming formats, construction of PLC ladder diagrams, devices connected to I/O modules.

At the end of the Module 1, students will be able to:

- Explain fundamentals of PLC system. (BL-2)
- List the devices connected to PLC modules.(BL-1)

▪ Explain the I/O modules. (BL-2)

MODULE -2

PLC Programming

10h

PLC Programming input instructions, outputs, operational procedures, programming examples using contacts and coils. Digital logic gates programming in the Boolean algebra system, conversion examples Ladder diagrams for process control Ladder diagrams and sequence listings

At the end of the Module 2, students will be able to:

- Explain the basics of PLC programming.(BL-2)
- Model industrial applications using PLC. (BL-3)
- Solve boolean expressions using ladder logic.(BL-3)

MODULE-3

PLC Registers

10h

PLC Registers: Characteristics of Registers module addressing holding registers input registers, output registers. PLC Functions Timer functions and industrial applications counters counter function industrial applications, Number comparison functions, number conversion functions.

At the end of the Module 3, students will be able to:

- Explain PLC registers.(BL-2)
- Explain Timer functions and its industrial application.(BL-2)
- Explain counter functions and its industrial application. (BL-2)

MODULE-4

PLC Functions

10h

Arithmetic Functions, Data move functions,SKIP, Master control Relay Jump Move FIFO, FAL, ONS, CLR and Sweep functions and their applications. Bit Pattern and changing a bit shift register, sequence functions and applications, Matrix functions.

At the end of the Module 4, students will be able to:

- Explain arithmetic functions. (BL-2)
- List PLC functions. (BL-1)
- Explain sequencer functions. (BL-2)

MODULE-5

Analog PLC operation

10h

Analog PLC operation: Analog modules and systems Analog signal processing multi bit data processing , analog output application examples, PID principles position indicator with PID control, PID modules(5h)

Controlling of Robot using PLC, Continuous Bottle-filling system, Batch mixing system, 3-stage air conditioning system, Automatic frequency control of Induction heating.(5)

At the end of the Module 5, students will be able to:

- Explain Analog PLC operation. (BL-2)
- Explain PID functions. (BL-2)
- List the advantages of PID. (BL-1)
- Summarize the PLC applications. (BL-2)
- Explain industrial applications of PLC. (BL-2)
- Explain manufacturing applications of PLC. (BL-2)

Total hours:48 hours

Text Book(s):

- 1.Programmable Logic Controllers – Principle and Applications by John W. Webb & Ronald A. Reiss, Fifth Edition, PHI
2. Digital Design by Morris Mano, PHI, 3rd Edition 2006.
- 3.Programmable logic Controllers, Frank D. Petruzella, 4th Edition, McGraw Hill Publishers.

Reference Book(s):

- 1.Programmable Logic Controllers – Programming Method and Applications by JR. Hackworth & F.D Hackworth Jr. – Pearson, 2004.
- 2.Programmable logic controllers and their Engineering Applications, 2nd Edition, Alan J. Crispin.
- 3.Computer Control of Process,S.K.Singh

NARAYANA ENGINEERING COLLEGE:GUDUR

20EC4007	ANTENNAS							R2020
Semester	Hours / Week			Total hrs	Credit	Max Marks		
VI	L	T	P		C	CIE	SEE	TOTAL
	3	0	0	48	3	40	60	100

Pre-requisites:

- ✓ Knowledge of Mathematics is essential
 - ✓ Basics concepts of Electromagnetics
 - ✓ Basics of Vector Analysis
- ✓ Electromagnetic waves and transmission lines

Course Objectives:

- To introduce radiation mechanisms and basic characteristics of antennas.
- To derive mathematical expressions and their application for complete design of antennas.
- To explain measurement of antenna parameters
- To introduce design concepts of various types of antennas including micro strip antenna.
- To describe binomial arrays

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

- CO 1** Explain the construction & radiation pattern of antenna(BL:2)
- CO 2** Analyze the radiation resistance & patterns of Loop, Yagi-uda array, Folded Dipole, Helical & Horn antennas (BL:3)
- CO 3** Analyze the radiation resistance & patterns of Micro strip and reflector antennas.(BL:3)
- CO 4** Analyze the antenna arrays. (BL:3)
- CO 5** Discuss the techniques to measure the radiation pattern, directivity and gain of antennas.BL:2)

CO-PO Mapping														
CO	PO												PSO	
	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	2									2		
CO2	3	3	3	2								2	3	3
CO3	3	3	3	2								2	3	3
CO4	3	3	3	2								2	3	3
CO5	3	3	2									2	3	3

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1 ANTENNA BASICS

Hours:08

Antenna parameters: Radiation pattern, Radiation intensity, Beam area, Beam efficiency, Beam width, Antenna efficiency, Gain, Directivity, Effective area, Effective height, Polarization, Antenna temperature, Antenna impedance, Front to back ratio, Applicability of network theorems to antennas, Radiation from quarter wave monopole and Half wave dipole, Illustrative Problems.

At the end of the Module 1, students will be able to:

4. Explain the applications of reciprocity theorem for antennas.
 5. Describe various antenna parameters.
6. Explain different types of antennas.

MODULE -2 VHF,UHF& MICROWAVE ANTENNAS-I

Hours:10

Loop Antennas - Introduction, Small Loop, Comparison of far fields of small loop and short dipole, Radiation Resistances and Directives of small and large loops (Qualitative Treatment), Arrays with Parasitic Elements - Yagi - Uda Antennas, Folded Dipoles & their characteristics, Slot Antennas and their characteristics, Log-Periodic Antennas, Illustrative Problems.

At the end of the Module 2, students will be able to:

Explain the construction and working of Yagi-uda antenna.

Derive the radiation resistance of dipole antenna.

Derive the expression for the radiation resistance and directivity of a loop antenna.

MODULE-3 VHF,UHF& MICROWAVE ANTENNAS-II

Hours:10

Micro strip Antennas- Introduction, features, advantages and limitations, Rectangular patch antennas- Geometry and parameters, characteristics of Micro strip antennas, reflector antennas - Introduction, Flat sheet and corner reflectors, parabola reflectors- geometry, pattern characteristics, Feed Methods, Reflector Types - Related Features, Lens Antennas - Geometry of Non-metallic Dielectric Lenses, Zoning , Tolerances, Applications, Illustrative Problems.

At the end of the Module 3, students will be able to:

Explain the corner reflector antennas and its design considerations.

Differentiate active & passive corner reflectors.

Explain the basic principle of operation of lens antenna.

Explain the basic characteristics of microstrip antennas.

MODULE-4 HELICAL AND HORN ANTENNA

Hours:10

Helical Antennas- Helical Geometry, Helix modes, Practical Design considerations for Mono-filar Helical Antenna in Axial and Normal Modes. Horn Antennas- Types, Fermat's Principle, Optimum Horns, Design considerations of Pyramidal Horns, Illustrative Problems.

At the end of the Module 3, students will be able to:

Explain the modes of operation of helical antenna.

Explain the construction and characteristics of helical antenna.

Explain the construction and working of Horn antenna.

MODULE-5 ANTENNA ARRAYS AND MEASUREMENTS

Hours:10

Introduction, Arrays of two Isotropic point sources-different cases, Principle of pattern multiplication, N-element uniform linear array- Broadside and end fire cases, Properties of BSA & EFA, EFA with increased directivity, Binomial array, Illustrative Problems.

Antenna Measurements: Introduction, near and far fields, sources of errors, Gain measurement-Gain comparison and absolute gain methods, Radiation Pattern and Directivity measurement.

At the end of the Module 5, students will be able to:

1 Compare BSA and End fire array.

2 Explain Binomial arrays.

3 Analyze principle of pattern multiplication

Text Book(s):

1. John D. Kraus and Ronald J. Marhefka and Ahmad S.Khan, "Antennas and wave propagation," TMH, New Delhi, 4th Ed., (special Indian Edition), 2010.

2. E.C. Jordan and K.G. Balmain, "Electromagnetic Waves and Radiating Systems," PHI, 2ndEdn, 2000.

Reference Book(s):

1. C.A. Balanis, "Antenna Theory- Analysis and Design," John Wiley & Sons, 2ndEdn., 2001.
2. K.D. Prasad, SatyaPrakashan, "Antennas and Wave Propagation," Tech. India Publications, New Delhi, 2001.

NARAYANA ENGINEERING COLLEGE:GUDUR

20EC4008	MICRO ELECTRONICS :DEIVCES TO CIRCUITS							R2020
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
V	3	0	0	48	3	40	60	100

Pre-requisite: knowledge on semiconductor materials

Course Objectives:

- Be familiar with the MOSFET physical structure and operation, terminal characteristics, circuit models and basic circuit applications.
- Confront integrated device and/or circuit design problems, identify the design issues, and develop solutions.
- Analyze and design microelectronic circuits for linear amplifier and digital applications.
- Contrast the input/output and gain characteristics of single-transistor, differential and common two-transistor linear amplifier building block stages
- Provide solutions to overcome short channel effects.

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

- CO 1** Explain various characteristics MOSFETs.(BL-02)
CO 2 Analyze the frequency response of MOSFET amplifiers .(BL-02)
CO 3 Design Single stage amplifiers to meet stated operating specifications using MOS Transistors. (BL-0 3)
CO 4 Design Differential amplifiers to meet stated operating specifications.(BL-03)
CO 5 Explain Multistage amplifiers and their frequency responses.(BL-02)

CO-PO Mapping														
CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	1		2							1	1	
CO2	2	2	1		1							1	2	2
CO3	2	3	2		1							1	1	
CO4	2	2	2	1	1							1		1
CO5	2	2	2	1								1	1	
CO6	3	3	2	1	2							1		2

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE-1

MOSFET

8H

MOS Capacitors: Energy levels and flat band, Static and Biased band shapes, Accumulation, depletion and inversion, NMOS and PMOS, Quantitative solution, Fields and Potentials

MOS Transistor: Qualitative description, Triode regime, Pinch-off and saturations regime, Quantitative derivation, Threshold voltage, Square Law, MOSFET as an amplifier and as a switch,

At the end of the Module 1, students will be able to:

1. List the types of MOSFET. (BL-01)
2. Demonstrate the MOSFET device structure. (BL-02)
3. Explain the characteristics of MOSFET.(BL-02)
4. Understand the pinch off and saturation regime of MOS transistor .(BL-02)

MODULE-2 MOSFET Biasing**10H**

Biasing in MOS amplifier Circuits, Small Signal Operation and Models, Basic MOSFET amplifier, MOSFET internal capacitances, frequency response of CS amplifier.

At the end of the Module 3, students will be able to:

1. Define MOSFET biasing. (BL-01)
 2. Explain small signal operation of MOSFET. (BL-02)
 3. Explain internal capacitances of MOSFET.(BL-02)
4. Understand the frequency response of CS amplifier.(BL-02)

MODULE-3 Single Stage IC Amplifier**10H**

Comparison of MOSFET and BJT, Current sources, Current mirrors and Current steering circuits, high frequency response- general considerations, CS with active loads, high frequency response of CS, CG amplifiers with active loads, high frequency response of CG, Cascode amplifiers. CS with source degeneration.

At the end of the Module 4, students will be able to:

- Apply the knowledge of semiconductors to illustrate the functioning of BJT. (BL-02)
- Analyze the DC performance of single-stage analog amplifiers containing these circuit elements
- Analyze the Various configurations in terms of frequency response. (BL-04)
- Identify active, cut off and saturation regions of a transistor. (BL-01)
- Explain working of cascode amplifiers.(BL-02)

MODULE-4 Differential Amplifiers**10H**

The MOS differential pair, small signal operation of MOS differential pair, Differential amplifier with active loads, and frequency response of the differential amplifiers.

At the end of the Module 5, students will be able to:

- Understand the differential pair of MOSFET. (BL-03)
- Explain the operation of small signal differential amplifier pair. (BL-02)
- Understand the differential amplifier with active loads. (BL-02)

MODULE-5 Multistage Amplifiers**10H**

Configurations, Cascaded stages, DC equivalent, AC equivalent and small signal, Gain and I/O resistance. Scaling of MOSFETs: Short channel MOSFETs – short channel effects, velocity saturation, channel length modulation, DIBL, GIDL. Variability in MOSFETs. Reliability of MOSFETs high field effects, hot carrier degradation, negative bias temperature instability, MOSFET breakdown, high k dielectrics.

At the end of the Module 5, students will be able to:

1. Define various configurations of multistage amplifiers.(BL-01)
 2. Explain the DC performance of multistage amplifiers.(BL-02)
3. Understand the AC equivalent performance of multistage amplifiers.(BL-02)

Text Book(s):

1. Howe, R. T., and C. G. Sodini. Microelectronics: An Integrated Approach. Upper Saddle River, NJ: Prentice Hall, 1996. ISBN: 0135885183
2. Jaeger & Blalock, Microelectronic Circuit Design (5th edition), McGraw Hill, 2015. ISBN 9780073529608 (required)
3. Microelectronic Circuits, Adel Sedra and K.C. Smith, 6th Edition, Oxford University Press, International Version, 2009
4. Taur and T.H. Ning, —Fundamentals of Modern VLSI Devices, Cambridge University Press, Cambridge, United Kingdom, 1998.

Reference Book(s):

1. Fonstad, C. G. Microelectronic Devices and Circuits. New York, NY: McGraw-Hill, 1994. ISBN: 0070214964.
2. Pierret, R. F. Semiconductor Device Fundamentals. Upper Saddle River, NJ: Prentice Hall, 1995. ISBN: 0201543931.

NARAYANA ENGINEERING COLLEGE:: GUDUR

20EC4009	ADAPTIVE SIGNAL PROCESSING							R2020
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
VI	3	0	0	48	3	40	60	100

Pre-requisite: Signals and Systems, Analog and digital communication, Antenna

Course Objectives:

1. To understand linear optimum filtering
2. To estimate phase shift between two narrow band signals
3. To search the performance surface
4. to understand adaptive beam forming
5. To examine target tracking
6. To define Kalman filtering problem

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

CO 1 **Explain** adaptive linear combiner (BL-1)

CO 2 **Calculate** minimum mean square error (BL-4)

CO 3 **Compare** leaving curves (BL-2)

CO 4 **Retrieve** LMS adaptation algorithm (BL-1)

CO 5 **Estimate** state using the innovation process (BL-2)

3. Microelectronics – Analysis and Design, Sundaram Natarajan, Tata McGraw-Hill, 2007

4. A.B.Bhattacharyya,—CompactMOSFETModelsforVLSIDesign,JohnWiley&SonsInc.,2009.

CO-PO Mapping														
CO	PO											PSO		
	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO1	PSO 2
CO1	3	3	2										2	
CO2	3	3											2	
CO3	3	3											2	
CO4	3	3	2										2	
CO5	3	3	2										2	

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1 INTRODUCTION TO ADAPTIVE SYSTEMS

10 Hrs

Definitions, Characteristics, Applications, Example of an Adaptive System. The Adaptive Linear Combiner – Description, Weight Vectors, Desired Response Performance function – Gradient & Mean Square Error.

At the end of the Module 1, students will be able to:

Explain characteristics of an adaptive system(BL-2)

Describe adaptive linear combiner (BL-1)

Calculate mean square error (BL-4)

MODULE -2 DEVELOPMENT OF ADAPTIVE FILTER THEORY

9 Hrs

Introduction to Filtering – Smoothing and Prediction – Linear Optimum Filtering, Problem statement, Principle of Orthogonally – Minimum Mean Square Error, Wiener- Hopf equations, Error Performance – Minimum Mean Square Error, Estimation of phase shift between two narrow band signals using Orthogonal Decomposer.

At the end of the Module 2, students will be able to:

Explain smoothing and prediction (BL-2)

Understand linear optimum filtering (BL-2)

Calculate minimum mean square error (BL-4)

Estimate phase shift between narrow band signals (BL-2)

MODULE-3 STEEPEST DESCENT ALGORITHMS

10 Hrs

Searching the performance surface – Methods & Ideas of Gradient Search methods – Gradient Searching Algorithm & its Solution – Stability & Rate of convergence – Learning Curves Gradient Search by Newton’s Method, Method of Steepest Descent, Comparison of Learning Curves.

At the end of the Module 3, students will be able to:

1. Search the performance surface (BL-1)
2. Explain gradient searching algorithm (BL-2)
3. Compare learning curves (BL-2)

MODULE-4 LMS ALGORITHM & APPLICATIONS

10 Hrs

Overview – LMS Adaptation algorithms, Stability & Performance analysis of LMS Algorithms – LMS Gradient & Stochastic algorithms – Convergence of LMS algorithm. Applications: Adaptive BFSK, BPSK, ASK demodulators and delay estimation. Adaptive Beam forming, concept of IQ channels, Adaptive filter implementation of Hilbert Transform. Introduction to MUSIC

At the end of the Module 4, students will be able to:

- Retrieve LMS adaptation algorithms (BL-1)
- Analyze the performance of LMS algorithms (BL-4)
- Understand adaptive beam forming (BL-2)
- Implement adaptive filter of Hilbert transform (BL-3)

MODULE-5 STATE ESTIMATORS

9Hrs

Introduction to RLS Algorithm, Statement of Kalman filtering problem, The Innovation Process, Estimation of State using the Innovation Process- Expression of Kalman Gain, Filtering Example estimation of state from observations of noisy observed narrow band signals. Target tracking using only DOA.

At the end of the Module 5, students will be able to:

- Define Kalman filtering problem (BL-1)
- Estimate state using the innovation process (BL-2)
- Examine target tracking using only DOA (BL-3)

Total hours: 48 hours

Text Books:

1. Bernard Widrow, Samuel D. Stearns, “Adaptive Signal Processing”, 2005, PE.
2. Simon Haykin, “Adaptive Filter Theory”, 4th Edition. 2002, PE Asia.

Reference Book(s):

1. Sophocles. J. Orfamadis, “Optimum signal processing: An introduction”, 2nd Edition, 1988, Mc Graw-Hill, Newyork
2. S. Thomas Alexander, “Adaptive signal processing-Theory and Applications”, 1986, Springer.

NARAYANA ENGINEERING COLLEGE:GUDUR

20EC4010	Mixed Signal Design						R2020
Semester	Hours / Week			Total hrs	Credit	Max Marks	
	L	T	P		C	CIE	SEE
V	3	0	1	48	4	40	60
							TOTAL
							100

Pre-requisite: Linear IC Applications, VLSI Design

Course Objectives:

1. To Understand the concepts of Switched capacitors Circuits.
2. To Extend the concept of phase locked loop for designing PLL application with minimum jitter by considering non ideal effects.
3. To study concepts of Data Converter Fundamentals, Nyquist Rate A/D Converters.
4. To Understand the concepts of Nyquist Rate A/D Converters, and applications.
5. To study and to analyze the Oversampling Converters.
- 6.To Understand the of Continuous-Time Filters, CMOS Trans-conductors Using Triode, Active Transistors and MOSFET-C Filters.

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

- CO 1** Demonstrate in-depth knowledge in Switched Capacitor Circuits.(BL2)
- CO 2** Apply the basic principles of PLL for different types of applications.(BL3)
- CO 3** Illustrate the fundamentals of Data converter.(BL2)
- CO 4** Demonstrate Nyquist Rate A/D Converters.(BL2)
- CO 5** Develop high speed modulators, interpolating & decimating filters for analog and digital communications. (BL3)

CO-PO Mapping															
CO	PO												PSO		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	1	-						2	1			1		
CO2	3	2	1						2	1			2		
CO3	3	2	1						2	1		1	2		
CO4	3	2	1						2	1		1	2		
CO5	3	2	1						2	1		1	2		

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE-1 Switched Capacitor Circuits 10hours

Introduction to Switched Capacitor circuits-basic building blocks, Operation and Analysis, Non-ideal effects in switched capacitor circuits, Switched capacitor integrator first order filters, Switch sharing, bi-quad filters. At the end of the Module 1, students will be able to:

6. Demonstrate first order filter with least interference.(BL2)
7. Illustrate the non-ideal characteristics of a switched capacitor integrator. (BL2)
8. Explain the two switched capacitor bi-quad realizations .(BL2)

MODULE-2 Phased Lock Loop (PLL)**9hours**

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.

At the end of the Module 2, students will be able to:

1. Explain the block diagram of Phase Locked Loop (BL2).
2. Demonstrate the basic charge pump PLL and non-ideal effects in PLLs.(BL2).
3. Explain the Jitter in PLLs and delay locked loops.(BL2).

MODULE-3 Data Converter Fundamentals**10hours**

DC and dynamic specifications, Quantization noise, Nyquist rate D/A converters- Decoder based converters, Binary-Scaled converters, Thermometer-code converters, Hybrid converters.

At the end of the Module 3, students will be able to:

1. Illustrate the block diagram of a D-A converter in signal processing applications. (BL2)
2. Explain deterministic approach and statistic approach of quantization noise in data converters.(BL2)
3. Demonstrate a thermometer code charge redistribution D/A converter. (BL2)

MODULE-4 Nyquist Rate A/D Converters**9hours**

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.

At the end of the Module 4, students will be able to:

1. Illustrate Successive-Approximation type ADC (BL2)
2. Explain the function of a 3 bit flash ADC. (BL2)
3. Demonstrate the operation of a multiple-bit pipeline ADC. (BL2)

MODULE-5 Oversampling Converters**10 hours**

Oversampling without noise shaping, oversampling with noise shaping, Noise shaping modulators, Decimating filters and interpolating filters, Higher order modulators, Delta sigma modulators with multi-bit quantizers, Delta sigma D/A.

At the end of the Module 5, students will be able to:

1. Demonstrate noise shaping modulators.(BL2)
2. Explain oversampled data converters with noise shaping(BL2)
3. Design and analyze delta sigma D/A converter.(BL3).
4. Explain the block diagram of second order Delta-Sigma modulator(BL2)

Total hours:**48hours**

Text Books:

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

Reference Books:

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

NARAYANA ENGINEERING COLLEGE:GUDUR

20EC4011	REAL TIME OPERATING SYSTEMS							R2020
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
V	3	0	0	48	3	40	60	100

Pre-requisite: Basic knowledge on Embedded systems and operating systems.

Course Objectives:

- To understand the basic real time concepts & reference model of real time systems.
- To compare various scheduling techniques in real time operating systems.
- To acquire knowledge on various synchronization mechanisms.
- To illustrate various programming tools for real time operating systems.
- To apply various protocols for communication in real time operating systems.

† To apply programming tools to study real time operating systems.

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

- CO 1** Understand the the basic real time concepts & reference model of real time systems.(**BL-2**)
- CO 2** Compare various scheduling techniques in real time operating systems. (**BL-4**)
- CO 3** Analyse various synchroniztion mechanisms for real time systems. (**BL-4**)
- CO 4** Illustrate various programming tools for real time operating systems.(**BL-2**)
- CO 5** Apply various protocols for communication in real time operating systems. (**BL-3**)

CO-PO Mapping														
CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	1	1							1	1		
CO2	1		1											2
CO3	2	2		1	2						1			1
CO4	2	1	2	2	2							2	1	
CO5		1												

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE -1INTRODUCTION

9 hrs

Introduction - Basics of task scheduling - Cyclic executives - Cyclic scheduler - Cyclic scheduler

At the end of the Module 1, students will be able to:

- Understand the basic real time concepts of real time operating systems. (**BL-2**)
- Understand various scheduling techniques in real time operating systems. (**BL-2**)
- Compare different scheduling techniques in real time systems. (**BL-2**)

MODULE -2 Characteristics of real time systems

9 hrs

Exercises on frame size selection - Event-driven schedulers - Rate monotonic algorithm - RMA task schedulability - Rate monotonic analysis.

At the end of the Module 2, students will be able to:

Understand various scheduling techniques in real time operating systems. **(BL-2)**

Analyze monolithic algorithms **(BL-4)**

Compare various schedulability techniques in real time operating systems. **(BL-4)**

MODULE-3 MODELING TIME CONSTRAINTS 10 hrs

RMA generalizations - Further RMA generalizations - Resource sharing among real-time tasks - Solution to priority inversion problem - Highest locker protocol

At the end of the Module 3, students will be able to:

Explain the concept of RMA in real time systems. **(BL-2)**

Understand the concept of resource sharing with examples. **(BL-2)**

Analyze various protocol mechanisms for real time systems. **(BL-4)**

MODULE-4 BASIC CONCEPTS REAL TIME OPERATING SYSTEMS 10hrs

Priority ceiling protocol - PCP priority inversions - Analysis of PCP priority inversions - Some basic issues in real-time operating systems - Unix as a real-time operating system.

At the end of the Module 4, students will be able to:

1. Illustrate various concepts operating system services. **(BL-2)**

2. Acquire knowledge on protocols in RTOS Environment. **(BL-2)**

3. understand the issues in operating systems. **(BL-1)**

MODULE-5 REAL TIME COMMUNICATION 10hrs

CASE STUDIES: Case study Linux POSIX system, RT-Linux / RTAI, Windows system, Vx-works, uitrn
Kernel design issues: structure, Process states, Data structures, Inter-task communication mechanism.

At the end of the Module 5, students will be able to:

Acquire the practical knowledge in real time operating systems. **(BL-2)**

Understand the LINUX operating system multicomputer system. **(BL-2)**

Apply various inter task mechanisms in real time operating systems. **(BL-3)**

Total hours:48 hours

Text Book(s):

1. J. J. Labrosse, "MicroC/OS-II: The Real -Time Kernel", Newnes, 2002.

2. Jane W. S. Liu, "Real-time systems", Prentice Hall, 2000

Reference Book(s):

1. W. Richard Stevens, "Advanced Programming in the UNIX® Environment", 2nd edition, Pearson Education India, 2011.

2. Philips A. Laplante, "Real-Time System Design and Analysis", 3rd edition, John Wley& Sons, 2004.

3. Doug Abbott, "Linux for Embedded and Real-Time Applications", Newnes, 2nd edition, 2011.

NARAYANA ENGINEERING COLLEGE:GUDUR

20EC4012 **ELECTRONIC MEASUREMENTS & INSTRUMENTATION** R2021

Semester	Hours / Week			Total hrs	Credit	Max Marks		TOTAL
	L	T	P			CIE	SEE	
V	3	0	0	48	3	40	60	100

pre-requisite:Engineering physics,Basic Principles of Electrical Engineering (Circuit Theory), Basic Digital and Analog Electronics

Course Objectives:

1. To understand the measuring methods and instruments of electrical quantities.
2. To understand, design aspects and performance criterion of measuring instruments.
3. To understand the working principle of various transducers.
4. To aware the students about the different types of bridges
5. To understand about transducers.

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

CO 1 Explain the characteristics and operation of different instruments.(BL:2)

CO2 Examine the operation of CRO.(BL:4)

CO 3 Apply the knowledge of signal generators to test the circuits.(BL:3)

Explain the operation of signal Analysers. (BL:2)

CO 4 Construct AC and DC bridges.(BL:3)

CO 5 Explain transducers operation. (BL:2)

CO-PO Mapping														
C O	P O												PS O	
	P O 1	P O 2	P O 3	P O 4	P O 5	P O 6	P O 7	P O 8	P O 9	P O 10	P O 11	P O 12	PS O 1	PS O 2
CO1	2		2									1	2	
CO2	2	1											1	
CO3	2	1											1	
CO4	2	1	2										1	
CO5	2	2	2										2	
CO6	2	1	2									2	2	
1: Low, 2-Medium, 3-High														

COURSE CONTENT

MODULE-1

Performance characteristics of instruments: 9h

Performance characteristics of instruments: Static characteristics, accuracy, resolution, precision, expected value, error and sensitivity. Errors in measurement and dynamic characteristics: speed of response, fidelity, lag and dynamic error.(6h)

Voltmeters: Multirange, range extension, solid state and differential voltmeters.

Ammeters: Shunt and thermocouple type ammeter.

Ohmmeters: Series type, shunt type, multimeter for voltage, current and resistance measurements.

Digital multimeters: Block diagram and specifications.(3h)

At the end of the Module 1, students will be able to:

- Explain the characteristics of instrument.(BL:2)
- Illustrate the use of different measuring instruments.(BL:2)
- Demonstrate working principles of voltmeters, ammeters, ohmmeters and multimeters.

(BL:2)

MODULE-2**Cathode Ray Oscilloscopes****10h**

Cathode Ray Oscilloscopes: CRT features, vertical amplifiers, horizontal deflection system, sweep, trigger pulse, delay line, sync selector circuits, simple CRO, triggered sweep CRO, dual beam CRO, measurement of amplitude and frequency. Dual trace oscilloscope, sampling oscilloscope, storage oscilloscope, digital storage oscilloscope, Lissajous method of frequency measurement, standard specifications of CRO, probes for CRO (active and passive), attenuator type (10h)

At the end of the Module 2, students will be able to:

- Explain the operation of CRO. (BL:2)
- Demonstrate various measurements made with CRO. (BL:2)

Compare different CRO's. (BL:2)

At the end of the Module 4, students will be able to:

- Explain the operation of CRO. (BL:2)
- Demonstrate various measurements made with CRO. (BL:2)

Compare different CRO's. (BL:2)

MODULE-3**Signal Generators & Signal Analyzers****10h**

Signal Generators: Fixed and variable, AF oscillators, standard and AF sine and square wave signal generators, function Generators, square pulse, random noise and sweep. (5h)

Signal Analyzers: AF, HF Wave Analyzers. Harmonic Distortion, Heterodyne wave Analyzers, Spectrum Analyzers, Power Analyzers, digital Fourier analyzers, Capacitance-Voltage Meters, Oscillators. (5h)

At the end of the Module 3, students will be able to:

- Explain the importance of signal generators. (BL:2)
- Explain different types of signal generators. (BL:2)
- Compare various signal generators. (BL:2)
- Explain the operation of signal analyzers. (BL:2)
- Illustrate the use of analyzers in industrial applications. (BL:2)

- Compare various analysers. (BL:2)

MODULE-4**Bridges****10h**

AC Bridges: Measurement of inductance: Maxwell's bridge, Anderson bridge. Measurement of capacitance: Schering bridge. Kelvin's bridge, Wheatstone bridge and Wien Bridge. Errors and precautions and related problems. Q – Meter.

DC Bridges: Wheat Stone Bridge, Kelvin Bridge and Megaohm Bridge

At the end of the Module 4, students will be able to:

- Explain AC and DC bridge circuits. (BL:2)
- Construct Bridge circuits. (BL:2)

Define the errors and compensation techniques in bridge circuits. (BL:2)

MODULE-5**Active and passive transducers****9h**

Active and passive transducers: Resistance, capacitance, inductance, strain gauges, LVDT, piezo electric transducers, resistance thermometers, thermocouples, thermistors and sensistors. Basic Hall Effect sensors. Calibration and standards and data acquisition systems.

At the end of the Module 5, students will be able to:

- Define calibration, active and passive transducers. (BL:2)
- Explain working of transducers and data acquisition systems. (BL:2)
- Summarize the applications of sensors and transducers. (BL:2)

Total hours: 48 hours

Text Book(s):

1. Electronic instrumentation – H.S.Kalsi, Tata McGraw Hill, 2004, 2/e.
2. Modern Electronic Instrumentation and Measurement Techniques – A.D. Helfrick and W.D. Cooper, PHI, 2002, 5/e.
3. A Course In Electrical And Electronics Measurements And Instrumentation, Shawhney A. K

Reference Book(s):

1. Electronic Instrumentation & Measurements - David A. Bell, PHI, 2003,2/e.
2. Electronic Test Instruments, Analog and Digital Measurements – Robert A.Witte, Pearson Education, 2004,2/e.
- 3.Instrumentation Devices And Systems,Rangan C. S., Sarma G. R. and Mani V. S. V.

NARAYANA ENGINEERING COLLEGE:GUDUR

20EC4013	SATELLITE COMMUNICATIONS							R2020
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
VII	3	0	0	48	3	40	60	100

Pre-requisite: Knowledge of fundamentals of Engineering Physics and chemistry

Course Objectives:

1. To understand functional principles and orbital mechanics of satellite communication system.
2. To summarize the various hardware systems associated with a satellite and the ground station.
3. To design appropriate uplinks and down links for satellites.
4. To Select an appropriate modulation and multiple access schemes for a given satellite communication link.
5. To Analyze communication satellites and the national satellite system
6. To illustrate the services provided by the satellite and its future applications

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

CO 1 Interpret functional principles and orbital mechanics of satellite communication system.(**BL:2**)

CO 2 Design appropriate uplinks and down links for satellites (**BL:3**)

CO 3 Choose an appropriate modulation and multiple access schemes for a given satellite communication link(**BL:3**)

CO 4 Analyze communication satellites and the national satellite system (**BL:3**)

CO 5 Illustrate the services provided by the satellite and its future applications(**BL:2**)

CO-PO Mapping														
CO	COURSE CONTENT												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2										2	3
CO2	3	2	3										2	3
CO3	3	2	2										2	3
CO4	3	1	2										2	3
CO5	3	1	2										2	3

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE -1 INTRODUCTION & ORBITAL MECHANICS 10Hrs

Introduction: Origin of satellite communications, Historical background, basic concepts of satellite communications, frequency allocations for satellite services, applications, future trends of satellite communications.

Orbital Mechanics: Look angle determination, orbital perturbations, orbit determination, launches and launch vehicles, orbital effects in communication systems performance.

At the end of the Module 1, students will be able to:

Explain the basic principles and operation of satellite communication system(BL-2)

Outline the various applications of satellite systems. (BL-2)

Summarize various types of satellites. (BL-2)

Outline the orbits and trajectories of satellite with associated parameters. (BL-2)

MODULE -2 SATELLITE SUBSYSTEMS AND LINK DESIGN 10Hrs

Power supply subsystem, Attitude and Orbit control, Tracking, Telemetry and command subsystem, Payload. Types of earth station, Architecture, Design considerations, Testing, Earth station Hardware, Satellite tracking. Basic transmission theory, system noise temperature and G/T ratio, design of down links, uplink design, design

of satellite links for specified C/N, system design example.

At the end of the Module 2, students will be able to:

Describe various hardware subsystems involved in satellite communication and its functionalities. (BL-2)

Outline the various types of earth stations and their design parameters. (BL-2)

Explain design of satellite links (BL-2)

MODULE-3 MULTIPLE ACCESS

08 Hrs

Various modulation schemes used in satellite communication, Meaning of Multiple Access, Multiple access schemes based on time, frequency, and code sharing namely TDMA, FDMA and CDMA.

At the end of the Module 3, students will be able to:

1. Explain Multiple access schemes
2. Describe Various modulation schemes used in satellite communication

MODULE-4 COMMUNICATION SATELLITES

10Hrs

Introduction, Related Applications, Frequency Bands, Payloads, Satellite Vs. Terrestrial Networks, Satellite Telephony, Satellite Television, Satellite radio, Regional satellite Systems, National Satellite Systems.

At the end of the Module 4, students will be able to:

1. Describe various frequency bands of communication satellites. (BL-2)
2. Compare satellite and terrestrial networks. (BL-2)
3. Outline the concepts of regional and national satellite systems. (BL-2)

MODULE-5 SATELLITE APPLICATIONS

10Hrs

INTELSAT Series, INSAT, VSAT, Mobile satellite services: GSM, GPS, INMARSAT, LEO, MEO, Satellite Navigational System. Direct Broadcast satellites (DBS) - Direct to home Broadcast (DTH), Digital audio broadcast (DAB)- World space services, Business TV(BTV), GRAMSAT, Specialized services – E –mail, Video conferencing, Internet.

At the end of the Module 5, students will be able to:

Explain applications of Geo-Stationary satellites. (BL-2)

Outline the various mobile satellite services(BL-2)

Explain the various applications of direct broadcast satellites(BL-2)

Outline the specialized services provided by satellite. (BL-2)

Total hours:48 Hrs

Text Book(s):

1. T. Pratt and S. W. Bostian, Satellite Communication John Wiley and Sons.
2. S. K. Raman, Fundamentals of Satellite Communication, 1st edition , Pearson , 2011
3. Wilbur L.Prichard, Robert A. Nelson & Henry G.Suyderhoud, “Satellite communications Engineering”, Pearson Publications, 2nd Edition, 2003.
4. Dennis Roddy , Satellite Communications:, Tata McGrawHill, fourth edition.

Reference Book(s):

- 1 D.C.Agarwal, “Satellite communications”, Khanna publications, 5th Ed.
- 2 Anil K. Maini, Varsha Agrawal, Satellite Communications, Wiley India Pvt. Ltd.,2015, ISBN: 978-81-265-2071-8.
- 3 Tri. T. Ha, “Digital satellite communication system”, McGraw Hill.

NARAYANA ENGINEERING COLLEGE:GUDUR

20EC4014	Introduction to MEMS							R2020
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
VII	3	0	0	48	3	40	60	100

Pre-requisite: Knowledge of fundamentals of Engineering Physics and chemistry

Course Objectives:

- 1 To give an exposure about the basics of MEMS
- 2 To understand the materials involved in MEMS
- 3 To Know about fabrication process of micro machined or micro structure devices
- 4 To describe MEMS sensor and Accelerometers
- 5 To Know applications of RF MEMS devices

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

- CO 1** Illustrate the basics of MEMS (BL-2)
- CO 2** Understand the Micro fabrication technology of MEMS (BL-2)
- CO 3** Interpret the concept of micro electronic technology for MEMS micro sensors(BL-2)
- CO 4** Analyze the processing techniques for MEMS accelerometers (BL-4)
- CO 5** Demonstrate the applications of MEMS in various fields (BL-2)

CO-PO Mapping														
CO	COURSE CONTENT												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3										2		
CO2	3	3			1							1	3	1
CO3	3	2	2		1							3		3
CO4	3	1	2		2							1		3
CO5	3	3	3		1							3	3	2

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE -1 INTRODUCTION TO MEMS

9hrs

Introduction to MEMS & Microsystems, Introduction to micro sensors, Evaluation of MEMS, Microsensors, Market Survey, Application of MEMS, MEMS materials, MEMS materials properties.

At the end of the Module 1, students will be able to:

1. Explain Basic concepts of MEMS(BL-2)
2. Outline MaterialsInvolved in MEMS(BL-2)
3. List Applications of MEMS(BL-1)

MODULE -2 MICROELECTRONIC TECHNOLOGY FOR MEMS

10hrs

Microelectronic Technology for MEMS, Micromachining Technology for MEMS, Micromachining Process, Etch Stop Techniques and Microstructure, Surface and Quartz Micromachining, Fabrication of Micro machined Microstructure, Micro-stereo lithography.

At the end of the Module 2, students will be able to:

1. Describe Fabrications Process of Microelectronics for MEMS (BL-2)
2. Explain surface and quartz micromachining(BL-2)
3. Describe Micro-stereo lithography(BL-2)

MODULE-3 MICRO SENSORS

9hrs

MEMS Micro-sensors, Thermal Micro-sensors, Mechanical Micro machined Micro-sensors, MEMS Pressure Sensor, MEMS Flow Sensor, Micro-machined Flow Sensors, MEMS Inertial Sensors, MEMS Gyro Sensor.

At the end of the Module 3, students will be able to:

1. Explain concept of Micro sensors (BL-2)
2. Describe working principle MEMS Thermal sensors(BL-2)
3. Describe working principle MEMS Pressure (BL-2)
4. Describe working principle MEMS Flow sensor(BL-2)
5. Illustrate principle of MEMS Inertial Sensors(BL-2)

MODULE-4 MEMS ACCELEROMETERS

10hrs

Micro-machined Micro accelerometers for MEMS, MEMS Accelerometers for Avionics, Temperature Drift and Damping Analysis, Piezo resistive Accelerometer Technology, MEMS Capacitive Accelerometer, MEMS Capacitive Accelerometer Process, MEMS for Space Application.

At the end of the Module 5, students will be able to:

1. Explain concept of MEMS Accelerometers(BL-2)
 2. Design Piezoresistive MEMS Accelerometers(BL-2)
 3. Design Capacitive MEMS Accelerometers(BL-2)
4. Explain function of MEMS for space application(BL-2)

MODULE-5 MEMS APPLICATIONS

10hrs

Polymer MEMS & Carbon Nano Tubes CNT, Wafer Bonding & Packaging of MEMS, Interface Electronics for MEMS, Introduction to Bio-MEMS and Micro Fluidics, Introduction to Bio Nano-Technology, Bio Sensors, Fluidics, MEMS for Biomedical Applications (Bio-MEMS).

At the end of the Module 6, students will be able to:

1. Explain the interface electronics MEMS(BL-2)
 2. Describe Bio Sensors (BL-2)
3. Explain MEMS for Biomedical applications (BL-2)

Total hours:

48 hrs

Text Book(s):

1. Nadim Maluf Kirt Williams “An Introduction to Micro electromechanical Systems Engineering”, Second Edition, Artech House, Inc. Boston London.
2. T. M. Adams, Introductory to MEMS, Springer, 2010.

Reference Book(s):

1. Varadan, V KandVaradan “Micro-sensors, actuators, MEMS, and electronics for smart structures” Rai-Choudhury P (ed.) Handbook of Microlithography, Micromachining, and Micro fabrication, SPIE Optical Engineering Press
2. J. Allen, Micro Electro Mechanical system design, CRC Press 2009.

ARAYANA ENGINEERING COLLEGE:: GUDUR

20EC4015	INTRODUCTION TO MACHINE LEARNING							R2020
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
VII	3	0	0	48	3	40	60	100

Pre-requisite: Signals and Systems

Course Objectives:

- 1.To understand statistical decision theory
2. To understand shrinkage methods
3. To explain perceptron learning
4. To evaluate instability measures
5. To explain bootstrapping and cross validation
6. To learn various graphical methods

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

- CO 1 **Recall** probability theory (BL-1)
- CO 2 **Explain** regression methods (BL-2)
- CO 3 **Understand** early model (BL-2)
- CO 4 **Explain** decision and regression trees (BL-2)
- CO 5 **Describe** gradient boosting (BL-1)

CO-PO Mapping														
CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO 2
CO1	3	3											1	
CO2	3	3												
CO3	3	3	2										1	
CO4	3	3	3											
CO5	3	3	3										1	

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1 INTRODUCTION

9Hrs

Probability Theory, Linear Algebra, Convex Optimization - (Recap) Week 1: Introduction: Statistical Decision Theory - Regression, Classification, Bias Variance.

At the end of the Module 1, students will be able to:

- Understand probability theory (BL-2)
- Explain linear algebra (BL-2)
- Describe statistical decision theory (BL-1)

MODULE -2 REGRESSION AND CLASSIFICATION

9 Hrs

Linear Regression, Multivariate Regression, Subset Selection, Shrinkage Methods, Principal Component Regression, Partial Least squares.

At the end of the Module 2, students will be able to:

1. Explain linear regression (BL-2)
2. Understand shrinkage methods (BL-2)
3. Calculate partial least squares (BL-4)

MODULE-3 SVM AND NEURAL NETWORKS**9 Hrs**

Linear Classification, Logistic Regression, Linear Discriminant Analysis, Perceptron, Support Vector Machines. Neural Networks - Introduction, Early Models, Perceptron Learning, Back propagation, Initialization, Training & Validation, Parameter Estimation - MLE, MAP, Bayesian Estimation.

At the end of the Module 3, students will be able to:

1. Recall logistic regression (BL-1)
2. Understand Linear discriminant analysis (BL-2)
3. Explain perceptron learning (BL-2)

MODULE-4 DECISION TREE AND REGRESSION TREES**12Hrs**

Decision Trees, Regression Trees, Stopping Criterion & Pruning loss functions, Categorical Attributes, Multi-way Splits, Missing Values, Decision Trees - Instability Evaluation Measures, Bootstrapping & Cross Validation, Class Evaluation Measures, ROC curve, MDL, Ensemble Methods - Bagging, Committee Machines and Stacking, Boosting.

At the end of the Module 4, students will be able to:

- Understand decision and regression trees (BL-2)
- Evaluate instability measures (BL-5)
- Understand bootstrapping and cross validation (BL-2)

MODULE-5 BAYESIAN NETWORKS**9 Hrs**

Gradient Boosting, Random Forests, Multi-class Classification, Naive Bayes, Bayesian Networks, In-directed Graphical Models, HMM, Variable Elimination, Belief Propagation, Partitional Clustering.

At the end of the Module 5, students will be able to:

1. Describe gradient boosting (BL-1)
2. Understand Naive bayes (BL-2)
3. Explain partial clustering (BL-2)

Total hours: 48 hours**Text Book(s):**

1. Tom M. Mitchell, "Machine Learning", McGraw-Hill Education (Indian Edition), 2013.
2. David E. Goldberg, Genetic Algorithms in Search, Optimization and Machine Learning, Addison wesley, 2009.

Reference Book(s):

1. O. Theobald, Machine Learning for absolute beginners, second edition, 2016
2. A. C. Muller & S Guido, Introduction to Machine Learning, OReilly, 2015.

NARAYANA ENGINEERING COLLEGE:GUDUR

20EC4016	RF INTEGRATED CIRCUITS							R2020
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
VII	3	0	0	48	3	40	60	100

Pre-requisite: Analog Electronics

Module 1	Module 2	Module 3	Module 4	Module 5	Total hours
08	10	10	10	10	48

Course Objectives:

- To analyze RF and wireless communication integrated circuits
- To understand concept of Integrated Passive components
- To understand MOS physics.
- To know design of High frequency amplifier
- To design low noise Amplifier, RF Power amplifier, and RF Mixer

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

- CO 1** Explain the architecture of RF system. **(BL-02)**
- CO 2** Analyze MOS FET physics and distributed systems. **(BL-02)**
- CO 3** Design high frequency amplifier for RF applications. **(BL-03)**
- CO 4** Analyze various mixers for RF integrated Circuits. **(BL-03)**
- CO 5** Analyze PLL and power amplifiers for RF applications. **(BL-03)**

CO-PO Mapping														
CO	COURSE CONTENT												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3		1	1								1	2	
CO2	3		2	1	2							1	2	
CO3	3	2	2	2								2	2	
CO4	2		1	2								2	1	
CO5	3	2	2	1	2	1						2	2	
1: Low, 2-Medium, 3- High														

COURSE CONTENT

MODULE -1 INTRODUCTION RF SYSTEMS 08 Hrs

Introduction to RF and wireless systems, basic concepts of RF design, Transmission media and reflections, Maximum power transfer, Parallel RLC Tank, Series RLC Networks, RLC Networks as impedance Transformers, Interconnect at radio frequencies: Skin effect, resistors, Capacitors, Inductors, Transformers **(08 Hrs)**

At the end of the Module 1, students will be able to:

1. Understand the basic concepts of RF design. **(BL-02)**
2. Explain the concept of series and parallel RLC networks. **(BL-02)**

Explain how maximum power transfer can be obtained **(BL-02)**

MODULE -2 A REVIEW OF MOS DEVICE PHYSICS 10 Hrs

Introduction to MOSFET physics, The long – channels approximation, operation in weak inversion (sub threshold), MOS device physics in the short – channel regime, Other effects. Link between lumped and distributed regimes driving-point impedance of iterated structures, Transmission lines in more detail, Behavior of Finite – length transmission lines, summary of transmission line equations **(10 Hrs)**

At the end of the Module 2, students will be able to:

1. Understand the concepts of MOS physics. **(BL-02)**
2. Explain the Link between lumped and distributed systems. **(BL-02)**

Summarize transmission line theory. **(BL-02)**

MODULE-3 HIGH FREQUENCY AMPLIFIER DESIGN (10 Hrs)

Introduction, The smith chart, S-parameters, Band Width Estimation Techniques, Introduction, The method of open – circuit time constant, The method of short circuit time constant, Risetime, Delay and bandwidth. Zeros as bandwidth Enhancers, The shunt –series amplifier, Bandwidth Enhancement with fTDoublers, Tuned amplifiers, Neutralization and unilateralization, Cascaded amplifiers, AM – PM conversion. **(10 Hrs)**

At the end of the Module 3, students will be able to:

1. Design high frequency amplifier for RF applications. **(BL-03)**
2. Explain the concept of Bandwidth Enhancement with fTDoublers. **(BL-02)**

Summarize various Band Width Estimation Techniques. **(BL-02)**

MODULE-4 LOW NOISE AMPLIFIER DESIGN (10 Hrs)

Introduction, Derivation of intrinsic MOSFET two-port noise parameters, LNA topologies: Power match versus noise match, Power-constrained noise optimization, Design examples, linearity and large signal performance, Spurious – free Dynamic range. Mixers: Introduction, Mixer fundamental, Nonlinear systems as linear mixers. **(10 Hrs)**

At the end of the Module 4, students will be able to:

1. Design low noise amplifier for RF integrated Circuits. **(BL-03)**
2. Compare various LNA topologies. **(BL-02)**

Understand the basic concepts of mixers. **(BL-02)**

MODULE-5 RF POWER AMPLIFIERS AND FREQUENCY SYNTHESIS 10 Hrs

Introduction, general considerations, Class A, AB, B and C power amplifier, Class D amplifiers, Class E amplifiers Class F amplifiers, summary of PA characteristics, RF PA design examples. Voltage controlled oscillators, Resonators, Negative resistance oscillators, Phase locked loops, Linearized PLL models, Phase detectors, charge pumps, Loop filters, and PLL design examples. Frequency synthesis and oscillators, Frequency division, integer-N synthesis, Fractional frequency, synthesis, Phase noise, Circuit examples. **(10 Hrs)**

At the end of the Module 5, students will be able to:

1. Summarize various RF power amplifiers. **(BL-02)**
2. Understand the concept of power amplifiers. **(BL-02)**
3. Explain the concept of negative resistance and voltage controlled oscillators. **(BL-02)**

List the applications of PLL. **(BL-01)**

Text Book(s):

- 1 Behzad Razavi, RF Microelectronics , 2nd Edition (2012) (Publisher: Pearson),
- 2 Thomas H. Lee ,The Design Of CMOS Radio-Frequency Integrated Circuits 2nd Edition (2006) (Publisher: Cambridge University Press),
- 3 Gray, Meyer, Hurst, Lewis, Wiley, Analysis and design of analog integrated circuits , Gray, Meyer, Hurst, Lewis, Wiley, c2001

Reference Book(s):

- 1 Design of Analog CMOS Integrated Circuits, Behzad Razavi, McGraw-Hill, 2001.
- 2 RF Circuit Design, Ludwig R. and Bogdanov G Prentice Hall, 2007.
- 3 Wolaver D H, Phase-Locked Loop Circuit Design, Prentice Hall, 1991

NARAYANA ENGINEERING COLLEGE:GUDUR

20EC4017	INTRODUCTION TO INTERNET OF THINGS							R2020
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
VII	3	0	0	48	3	40	60	100

Pre-requisite: Basic programming knowledge.

Course Objectives:

- To study fundamental concepts of IoT
- To build simple IoT Systems by integration of sensors and actuators with Arduino.
- To expose the student to a variety of embedded boards and IoT Platforms
- To understand data analytics and cloud in the context of IoT

5 To create simple IoT applications.

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

- CO 1** Understand the various concepts, terminologies and architecture of IoT systems.(BL-2)
- CO 2** Apply design concept to IoT solutions.. (BL-3)
- CO 3** Apply the concept of Raspberry Pi to implement an IoT/(BL-3)
- CO 4** Apply data analytics and use cloud offerings related to IoT (BL-3)
- CO 5** Create IoT solutions using sensors, actuators and Devices.(BL-6)

CO-PO Mapping														
CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	1		1							1	2	1
CO2	3	2	1		2							2	2	2
CO3	3	2	2	1	2							2	2	2
CO4	3	2	2	1	2							2	2	2
CO5	3	2	3		3							2	2	3

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1 INTRODUCTION

10 Hrs

Introduction to IoT, Sensing, Actuation, Basics of networking, Communication protocols, Sensor networks, Machine-to-Machine communications, Interoperability in IoT.

At the end of the Module 1, students will be able to:

- Explain IoT architecture. [BL-2]
- Interpret different protocols and compare them [BL-2]
- Utilize the Internet communication protocols for IoT applications [BL-3]

MODULE -2 ARDUINO PROGRAMMING

9 Hrs

Introduction to Arduino programming, Integration of sensors and actuators with arduino, Introduction to Python programming.

At the end of the Module 2, students will be able to:

1. Outline the architecture of Arduino [BL-2]
2. Develop simple applications using Arduino [BL-3]
3. Explain about python programming [BL-2]

MODULE-3 RASPBERRY PI

10 Hrs

Introduction to Raspberry Pi, Implementation of IoT with raspberry Pi, Introduction to SDN, SDN for IoT.

At the end of the Module 3, students will be able to:

1. Outline the architecture of Raspberry Pi [BL-2]
 2. Develop simple applications using Raspberry Pi [BL-3]
- Explain the concept of SDN for IoT[BL-2]

MODULE-4 DATA HANDLING AND ANALYTICS

9 Hrs

Data handling and analytics, Cloud computing, Sensor-Cloud, Fog computing.

At the end of the Module 4, students will be able to:

1. Explain the concept of Cloud computing[BL-2]
2. Use various techniques of data storage and analytics in IoT[BL-3]

MODULE-5 APPLICATIONS OF IOT

10 Hrs

Smart cities and smart homes, Connected vehicles, Smart grid, Industrial IoT, Agriculture, Healthcare, Activity monitoring.

At the end of the Module 5, students will be able to:

- 1 Explain various applications of IoT[BL-2]
- 2 Design a solution for a given IoT application [BL-6]

Total hours: 48 Hours

Text Book(s):

1. 1. Adrian McEwen, Hakim Cassimally - Designing the Internet of Things, Wiley Publications, 2012.
2. S. Misra, C. Roy, and A. Mukherjee, 2020. Introduction to Industrial Internet of Things and Industry 4.0, CRC Press.

Reference Book(s):

1. 1. Adrian McEwen, Hakim Cassimally, "Designing the Internet of Things", John Wiley and Sons, 1st edition, 2014.
2. Matt Richardson, Shawn Wallace, "Getting Started with Raspberry Pi", O'Reilly (SPD), 3rd edition, 2014.
3. ArshdeepBahga, Vijay Madisetti - Internet of Things: A Hands-On Approach, Universities Press, 2014.

NARAYANA ENGINEERING COLLEGE:GUDUR

20EC4018 **BIO-MEDICAL INSTRUMENTATION**

R2021

hrs	Credit			Semester	Hours / Week	Total	CIE	SEE	TOTAL
	L	T	P	Max Marks	C				
VII	3	1	0	48	4	40	60	100	

Pre-requisite: Subject (Human being)

Stimulous,transducers,signal conditioning equipment,control device.

Course Objectives:

1. To understand fundamentals of Biomedical Instrumentation.
2. To familiarize with the electrodes used in medical Instrumentation.
3. To study various Bio-medical Instruments.
4. To analyse the bio electrical signals.
5. To understand the safety measures for medical equipment.

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

CO 1 Explain the components of medical instruments and fundamentals of cell.(BL-2)

CO 2 Demonstrate the working of Bio-electrodes. (BL-2)

CO 3 Explain the significance of cardiac Instrumentation. (BL-2)

CO 4 Illustrate the principles of Neuro-muscular Instrumentation. (BL-2)

CO 5

Explain respiratory Instrumentation & Summarize the safety measures of bio-medical equipment. (BL-2)

CO-PO Mapping														
CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2												2	
CO2	2	2										1	2	
CO3	2	2										1	2	
CO4	2	2										1	2	
CO5	2	2										1	2	

1: Low, 2-Medium, 3- High

COURSE CONTENT

Module-1 **Components of Medical Instrumentation System** **10hrs**

Components of Medical Instrumentation System, Bio – amplifier, Static and dynamic characteristics of medical instruments, Bio signals and characteristics, Problems encountered with measurements from human beings.(5h)

Organisation of cell, Derivation of Nernst equation for membrane Resting Potential Generation and Propagation of Action Potential,Conduction through nerve to neuro-muscular junction. (5h)

At the end of the Module 1, students will be able to:

- Explain basic components of medical equipment.(BL-2)
- Explain cell structure. (BL-2)
- Define action,resting potentials. (BL-1)

Module-2 **Electrodes in Medical Instrumentation** **8hrs**

Bio Electrodes – Biopotential Electrodes-External electrodes, Internal Electrodes, Biochemical Electrodes
Mechanical function, Electrical Conduction system of the heart, Cardiac cycle, Relation between electrical and mechanical activities of the heart.(8h)

At the end of the Module 2, students will be able to:

- Explain working of bio-electrodes.(BL-2)
- Classify types of electrodes based on measurement.(BL-2)
- Explain mechanical action of heart.(BL-2)

Module-3 Cardiac Instrumentation 10hrs

Cardiac Instrumentation Blood pressure and Blood flow measurement, Specification of ECG machine, Einthoven triangle, Standard 12-lead configurations, Interpretation of ECG waveform with respect to electromechanical activity of the heart, Therapeutic equipment, Pacemaker, Defibrillator, Shortwave diathermy, Hemodialysis machine..(10h)

At the end of the Module 3, students will be able to:

- Explain cardiac instrumentation concepts.(BL-2)
- Demonstrate working of ECG.(BL-2)
- Interpret ECG waveforms.(BL-2)

Module-4 Neuro-Muscular Instrumentation 8hrs

Neuro-Muscular Instrumentation ,Specification of EEG and EMG machines, Electrode placement for EEG and EMG recording, Interpretation of EEG and EMG.(8h)

At the end of the Module 4, students will be able to:

- Explain the basics of neuro muscular activity.(BL-2)
- □ Demonstrate working of EEG.(BL-2)
- Interpret EEG and EMG signals.(BL-2)

Module-5 Respiratory Instrumentation & Safety Measures

12hrs

Respiratory Instrumentation Mechanism of respiration, Spirometry, Pneumotachograph Ventilators.

Patient electrical safety, types of hazards , natural protective mechanism, leakage current, patient isolation, hazards in operation rooms, grounding conditions in hospital environment.

At the end of the Module 5, students will be able to:

- Explain respiratory instrumentation fundamentals.(BL-2)
- Explain about ventilators.(BL-2)
- Classify respiratory instrumentation mechanism and their advantages. (BL-2)
- Explain the significance of safety measures for medical equipment. (BL-2)
- Summarize the safety measure of equipment. (BL-2)
- Demonstrate the grounding mechanisms for medical equipment. (BL-2)

Total hours:48 hours

Text Book(s):

1. Biomedical Instrumentation and Measurements – Leslie Cromwell and F.J. Weibell, E.A. Pfeiffer, PHI, 2nd Ed, 1980.
2. Medical Instrumentation, Application and Design – John G. Webster, John Wiley, 3rd Ed., 1998.
3. Bio-medical Instrumentation by M. Arumugam.

Reference Book(s):

1. Principles of Applied Biomedical Instrumentation – L.A. Geoddes and L.E. Baker, John Wiley, 1975.
2. Hand-book of Biomedical Instrumentation – R.S. Khandpur, TMH, 2nd Ed., 2003.

ARAYANA ENGINEERING COLLEGE:GUDUR

20EC4019	WIRELESS COMMUNICATIONS							R2020
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
VII	3	0	0	48	3	40	60	100

Pre-requisites:

- ✓ Signal processing techniques.
- ✓ Familiarity with mathematical tools like Linear Algebra, Vector spaces, Probability, Statistics and Random processes, Fourier Series and Transform.
- ✓ Digital communication systems basics.

Course Objectives:

- 1.To introduce the concepts and techniques associated with Wireless Cellular Communication systems.
2. To familiarize with state of art standards used in wireless cellular systems.
3. To understand the emerging technologies of wireless and mobile communications and simulate them.
- 4.To describe signal processing in GSM.
- 5.To differentiate CDMA and GSM.

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

CO 1 Apply cellular concepts to evaluate the signal reception performance in a cellular network and traffic analysis to design cellular network with given quality of service constraints.(BL:3)

CO 2 Determine the type and appropriate model of wireless fading channel based on the system parameters and the property of the wireless medium.(BL:4)

CO 3 Distinguish various multiple access schemes used in wireless communication.[BL:4]

CO 4 Analyze the measures to increase the capacity in GSM systems- sectorization and Spatial Filtering for Interference Reduction. [BL:4]

CO 5 Design wireless communication systems with key 3G (e.g., CDMA) and 4G (OFDM) technologies.(BL-3)

3. Biomedical Telemetry – Mackay, Stuart R., John Wiley, 2nd edition,1968.

CO-PO Mapping														
CO	PO												PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2										3	3
CO2	3	2	2										3	3
CO3	3	2											3	3
CO4	3	2											3	3
CO5	3	2											3	3

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1 INTRODUCTION TO CELLULAR CONCEPTS

Hours:08

Cellular concept-frequency reuse, channel assignment, hand off, Interference Trunking and grade of service, cell splitting, sectoring, microcell concept.

At the end of the Module 1, students will be able to:

7. Explain the frequency reuse concept.(BL:2)
8. Describe handoff mechanism in wireless communications.(BL:2)
9. Explain microcell concept. (BL:2)

MODULE -2 RADIO WAVE PROPAGATION AND FADING

Hours:9

Introduction to radio wave propagation-free space propagation model, ground reflection (2-ray) model, impulse response model of a multipath II channel, parameters of mobile multipath channels. Type of small scale fading, fading effect due to multipath time delay spread and Doppler spread, diversity technique for mobile wireless radio system.

At the end of the Module 2, students will be able to:

Explain different types of fading techniques. (BL:2)

Explain parameters of multipath channels.(BL:2)

Describe diversity technique for mobile wireless radio system .(BL:2)

MODULE-3 MULTIPLE ACCESS TECHNIQUES

Hours:9

Multiple access technique for wireless communication-FDMA, TDMA, III spread spectrum multiple access-FHMA, CDMA, Hybrid spread spectrum technique-space division multiple access- packet radio.

At the end of the Module 3, students will be able to:

Describe multiple access techniques for wireless communications. (BL:2)

Differentiate FDMA & CDMA. (BL:2)

Explain packet radio and packet radio protocols. (BL:2)

MODULE-4 GLOBAL SYSTEM FOR MOBILE (GSM)

Hours:7

GSM-GSM network architecture, GSM channel type, frame structure for GSM,(signal processing in GSM-speech coding, channel coding, IV interleaving, ciphering, burst formatting, modulation, frequency hopping, demodulation).

Authentication and security in GSM, GSM call procedures, GSM hand off procedures

At the end of the Module 3, students will be able to:

Explain signal processing in GSM. (BL:2)

Differentiate GSM call procedures and handoff procedures. (BL:2)

Explain frequency hopping techniques. (BL:2)

MODULE-5 CODE DIVISION MULTIPLE ACCESS (CDMA)

Hours:10

CDMA digital cellular standards- Introduction, frequency and channel V specification, forward and reverse CDMA channel, CDMA call processing, soft hand off.

Performance of a CDMA system, comparison of CDMA with GSM, digital cellular standards- DECT, PDC.

At the end of the Module 5, students will be able to:

Explain CDMA call processing. (BL:2)

Describe the performance of CDMA system. (BL:2)

Compare CDMA and GSM. (BL:2)

Text Book(s):

1. Andrea Goldsmith, "Wireless Communications", Cambridge University Press, 2005.
2. Simon Haykin& Michael Moher, "Modern Wireless Communications", Pearson Education, 2007.
3. T. S. Rappaport, "Wireless Communication, Principles & Practice", Dorling Kindersley (India) Pvt. Ltd.,2009.
4. G. L. Stuber, "Principles of Mobile Communications", 2nd Edition, Springer Verlag. 2007.

NARAYANA ENGINEERING COLLEGE:: GUDUR

20EC4020	Fundamentals of Nano and Quantum Photonics							R2020
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
VII	3	0	0	48	3	40	60	100

Pre-requisite:

Course Objectives:

1. To understand the basic concepts of Electromagnetic Radiation, Diffraction limit of Light and Light- matter interaction.
2. To study the concepts of Plasmonics and Photonics in metallic nanostructures and nanoparticles.
3. To understand the unusual propagation of EM waves in 2-dimensional periodic potential.
4. To Analyze Nanofabrication techniques of photonic devices.
5. To Analyze Quantum harmonic oscillator, Phasor diagrams and quadratures in canonical Quantization.

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

- CO 1 **Demonstrate** the basic concepts of Electromagnetic Radiation, Diffraction limit of Light and Light-matter interaction. (BL-2)
- CO 2 **Illustrate** the concepts of Plasmonics and Photonics in metallic nanostructures and nanoparticles.
- CO 3 **Explain** the unusual propagation of EM waves in 2-dimensional periodic potential. (BL-2)
- CO 4 **Analyze** Nanofabrication techniques of photonic devices. (BL-4)
- CO 5 **Analyze** Quantum harmonic oscillator, Phasor diagrams and quadratures in canonical Quantization. (BL-4)

Reference Book(s):

1. Kamilo Feher, 'Wireless Digital Communication', Dorling Kindersley (India) Pvt Ltd.
2. R. L. Peterson, R. E. Ziemer & David E. Borth, "Introduction to Spread Spectrum Communication", Prentice Hall, 1995.
3. A. J. Viterbi, "CDMA- Principles of Spread Spectrum", Prentice Hall, 1995

CO-PO Mapping														
CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	3	3	2	2									2	2
CO2	3	3	2										2	
CO3	3	2	2										1	2
CO4	3	3	3										1	1
CO5	3	3	2										2	2
1: Low, 2-Medium, 3- High														

COURSE CONTENT

MODULE – 1 INTRODUCTION TO NANO ELECTRONICS

9 Hrs

Introduction to nano-photonics, Review of electro-magnetics, Maxwell equations and Wave optics, Electromagnetic radiation and evanescent waves, the Diffraction limit of light, Light-matter interaction - Dielectric function, Kramers- Kronig relationship, Drude-Lorentz and drude models, Inter-band and Intra-band transitions.

At the end of the Module 1, students will be able to:

To understand the concepts of Electro-magnetics, Maxwell equations and wave optics. (BL-2)

To understand Electromagnetic radiation and Diffraction limit of light. (BL-2)

To explain Dielectric function, Kramers-Kronig relationship. (BL-2)

MODULE -2 PLASMONICS AND PHOTONICS 10 Hrs

Plasmonics - Quasi-static limit, Nano-particle as a plasmonic atom, Size-dependent absorption and scattering, Coupled nano-particles, Plasmon hybridization, Dielectric nano-photonics – Photonics in 2D, 1D and 0D semiconductors, Selection rules, Photonic density of states, Electromagnetic waves in 1D periodic potential - Scattering from planar interfaces, Photonic band-gaps, Rayleigh anomalies.

At the end of the Module 2, students will be able to:

1. To explain Quasi-static limit and nano-particle as a plasmonic atom in Plasmonics.(BL-2)
2. To understand Photonics in 2D, 1D and 0D semiconductors. (BL-2)
3. To explain Electromagnetic waves in 1D periodic potential. (BL-2)

MODULE-3 EM WAVES IN 2D PERIODIC POTENTIAL 10 Hrs

Electromagnetic waves in 2D periodic potential - Electric and magnetic meta-materials, Negative refractive index, Super-lens and hyper-lens, Plasmonic and Dielectric meta-surfaces, Light emitting(active) meta-materials - Optical gain, Radiative and non-radiative transitions, Amplified emission, Lasing threshold, Nano-lasers.

At the end of the Module 3, students will be able to:

1. To explain Electromagnetic waves in 2D periodic potential.(BL-2)
2. To understand Super-lens and hyper-lens, Plasmonic and Dielectric meta-surfaces. (BL-2)
3. To explain Light emitting(active) meta-materials - Optical gain, Radiative and non-radiative transitions, amplified emission, Lasing threshold, Nano-lasers. (BL-2)

MODULE-4 NANO-FABRICATION OF PHOTONIC DEVICES 8 Hrs

Nanofabrication of photonic devices – Examples from recent literature on nano-photonic devices, Classical to quantum nano-photonics (small dimensions + low intensity/few photons), Photon statistics - photonics in the quantum regime, Classification of light by photons statistics, Super-poissonian and sub-poissonian light, Photo-detection, Photon anti-bunching - Hanbury-Brown twiss interferometer, Second-order correlation function, Photon bunching and anti-bunching, Single-Photon sources.

At the end of the Module 4, students will be able to:

- 1 To analyze the nanofabrication of photonic devices. (BL-4)
- 2 To understand the concepts of photon statistics.(BL-2)
3. To explain photon bunching and anti-bunching. (BL-2)

MODULE-5 CANONICAL QUANTIZATION 11 Hrs

Canonical quantization - Quantum harmonic oscillator, Phasor diagrams and quadratures, Vacuum fluctuations, Coherent states, Number-phase uncertainty, Resonant light-atom interactions - time-dependent Schrodinger equations, Strong and weak coupling, Rabi-oscillations.

At the end of the Module 5, students will be able to:

- 1 To Analyze Quantum harmonic oscillator, Phasor diagrams and quadratures in canonical Quantization. (BL-4)
- 2 To understand coherent states, Number-phase uncertainty of canonical Quantization. (BL-2)
- 3 To understand Resonant light-atom interactions. (BL-2)

Total hours: 48 hours

NARAYANA ENGINEERING COLLEGE:: GUDUR

20EC4021	DIGITAL IMAGE PROCESSING							R2020
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
VII	3	0	0	48	3	40	60	100

Pre-requisite: Signals and Systems, Digital communication

Course Objectives:

1. To Recall the digital image fundamentals and learn various image transforms
2. To perform image enhancement techniques in spatial and frequency domain
3. To Understand image degradation model and Compare three color models.
4. To Analyze various image compression techniques
5. To Analyze the image segmentation and representation techniques.

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

- CO 1 **Recall** the digital image fundamentals and **Explain** various image transforms **(BL:1&BL:2)**
 CO 2 **Implement** basic image processing techniques(spatial & frequency domain) **(BL:3)**

CO 3 **Summarize** image degradation model, algebraic approach, Inverse filtering, Least mean square filters **(BL:2)**

Compare three colour models **(BL: 4)**

CO 4 **Analyze** different image compression techniques **(BL:4)**

CO 5 **Analyze** the image segmentation and representation techniques **(BL:4)**

Text Book(s):

1. Optical Meta materials: Fundamentals and Applications. Wenshan Cai and Vladimir Shalaev, Springer (2010).
2. Introduction to Nanophotonics, Sergey V. Gaponenko, Cambridge University Press (2010).

Reference Book(s):

1. Nano and quantum optics -An introduction to basic principles and theory. Ulrich Hohenester.1st edition, Springer (2020).
2. Quantum optics: an introduction, Fox, M. 1st edition, Oxford University Press (2006).

CO-PO Mapping														
CO	PO												PSO	
	PO 1	PO 2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO 12	PSO 1	PSO 2
CO1	2	1											1	
CO2	1	2		1										
CO3	3	2	1	1	1									
CO4	1	1			1								1	
CO5	1	1		1	1								1	

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1 INTRODUCTION TO IMAGE PROCESSING & IMAGE TRANSFORMS 10 Hrs

Fundamentals of image processing: Image acquisition, Image sampling and quantization, Relationships between pixels, Image geometry, Gray level transformations, Histogram processing: Histogram equalization.
 Image transforms: 2-D DFT, Properties. Walsh transform, Hadamard transform, Discrete cosine transform, Haar transform, Slant transform, KL transform, Comparison of different transforms.

At the end of the Module 1, students will be able to:

- 1 Understand the basic components that constitutes an image. (BL-2)
- 2 Understand various image transformation techniques (BL-2)
- 3 Compare different transforms (BL-4)

MODULE -2

IMAGE ENHANCEMENT

10 Hrs

Image enhancement: Arithmetic and logical operations, Point processing, Image smoothing and sharpening filters in spatial domain (by spatial domain methods), Image smoothing and image sharpening filters in frequency domain, Homo-morphic filter (by frequency domain methods), comparison of filters in frequency domain and spatial domain.

At the end of the Module 2, students will be able to:

1. Compute arithmetic and logic operations (BL:3)
2. Translate image enhancement techniques in spatial and frequency domain (BL:2)
3. Analyze performance of communication systems in the presence of noise. (BL:4)

MODULE-3 IMAGE RESTORATION

9 Hrs

Image restoration: Image degradation/Restoration model, Noise models, Restoration in the presence of noise only-spatial filtering - mean, Order statistic and adaptive filters. Estimating the degradation function, Inverse filtering, Weiner filtering, Constrained least squares filtering.

Color image processing: Color models—RGB, YUV, HSI; Color transformations— formulation, Color complements, Color image smoothing and sharpening.

At the end of the Module 3, students will be able to:

1. Summarize image restoration using degradation model (BL:2)
2. Understand least mean square filters (BL:2)
3. Compare three (RGB, YUV and HIS) color models (BL:4)

MODULE-4 IMAGE COMPRESSION

9 Hrs

Image compression: Types of redundancy, Lossless compression: Variable length coding, LZW coding, Bit plane coding, Predictive coding- DPCM. Lossy compression: Transform coding, Basics of image compression standards: JPEG, JPEG 2000.

At the end of the Module 4, students will be able to:

- 1 Explain various image compression techniques. (BL:2)
- 2 Differentiate lossless and lossy compression techniques. (BL:2)
- 3 Recall image compression standards. (BL:1)

MODULE-5 IMAGE SEGMENTATION & MULTI-RESOLUTION IMAGE PROCESSING 10 Hrs

Image segmentation: Detect ion of discontinuities- Point, Line and edge Detection, Thresholding-global thresholding, Adaptive thresholding, Region based segmentation.

Wavelets and multi-resolution image processing: Uncertainty principles of Fourier transform, Time-frequency localization, Continuous wavelet transforms, Wavelet bases and multi-resolution analysis, Wavelets and sub band filter banks, Wavelet packets.

At the end of the Module 5, students will be able to:

- 1 Demonstrate the image segmentation (BL:3)

- 2 Identify point, line and edge detection techniques (BL:1)
- 3 Analyze wavelets and multi-resolution image processing. (BL:4)

Total hours: 48 hours

Text Book(s):

1. R. C. Gonzalez and R. E. Woods, Digital Image Processing, Second Edition, Pearson Education 3rd edition 2008
2. Anil Kumar Jain, Fundamentals of Digital Image Processing, Prentice Hall of India. 2nd edition 2004.

Reference Book(s):

1. Rafael C. Gonzalez, Richard E woods and Steven L. Eddins, Digital Image processing using MATLAB”, Tata McGraw Hill, 2010.
2. William K. Pratt, “Digital Image Processing, John Wiley, 3rd Edition, 2004.
3. S jayaraman, S Esakkirajan, T Veerakumar, Digital Image processing”, Tata McGraw-Hill.

NARAYANA ENGINEERING COLLEGE:GUDUR

20EC4022	Low Power VLSI Design							R2021
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
VII	3	0	0	48	3	40	60	100

Pre-requisite: Electron Devices, Fundamentals in digital design, VLSI Design.

Course Objectives:

1. To identify low-power design approaches, power estimation and analysis.
2. To study different types of metal–oxide–semiconductor (MOS) inverters.
3. To analyze the sources of low-power and to study different voltage scaling techniques for low power.
4. To analyze different low-power techniques using switched capacitance.
5. To get familiar with CAD tools and to analyze different techniques for minimizing leakage power techniques.

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

CO 1 Identify the sources of power consumption and understand MOS transistor characteristics (BL-2)

CO 2 Understand different low-power design approaches, power estimation and analysis (BL-2)

CO 3 Design low power adder circuits and systems.(BL-3)

CO 4 Design low power multiplier circuits and systems. (BL-3)

CO 5 Understand different types of SRAMs/DRAMs for low power applications **and study** modern CAD tools **with reduction techniques.** (BL-2)

CO-PO Mapping														
CO	PO												PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2											3	
CO2	3	1	2		1								2	
CO3	3	2	2		1	1							2	1
CO4	3	2	2		1	1							3	2
CO5	3	2	2		1	1							2	2

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1 Introduction & MOS Transistor 10hours

Introduction, structure of MOS Transistor, Modes of operation of MOS Transistor, Electrical characteristics of MOS Transistors, MOS Transistors as a switch, MOS inverters and Combinational circuits, Sources of Power dissipation in CMOS.

At the end of the Module 1, students will be able to:

- 1.Recall fundamentals of low power design concepts to classify various power dissipation mechanisms (BL1)
- 2 .Understand the impact of power on system performance and reliability.(BL2)
3. Understand the behavior of MOS transistor and its characteristics. (BL2)

MODULE -2 Low-Power Design Approaches 9hours

Introduction, short-circuit power dissipation, switching power dissipation, glitching power dissipation, leakage power dissipation. Supply voltage scaling techniques and minimizing switching capacitance techniques for low power.

At the end of the Module 2, students will be able to:

1. Identify the sources of power dissipation in digital IC systems. (BL2)
2. Understand importance of Voltage scaling.(BL2)
3. Illustrate the various threshold voltage techniques based on low power.(BL2)
4. Compare Pipeline and Parallel Processing Approaches.(BL2)
5. Understand the concept of Switches capacitance Minimization Approaches.(BL2)

MODULE-3 Low-Voltage Low-Power Adders 10hours

Introduction, Standard Adder Cells, CMOS Adder's Architectures – Ripple Carry Adders, Carry Look Ahead Adders, Carry Select Adders, Carry Save Adders, Low-Voltage Low Power Design Techniques –Trends of Technology and Power Supply Voltage, Low-Voltage Low-Power Logic Styles.

At the end of the Module 3, students will be able to:

At the end of the Module 3, students will be able to:

1. Understand the importance of Standard Adder Cells in CMOS Architecture.(BL2)
2. Demonstrate the various CMOS Adder Architectures. (BL2)
3. Apply the Low-Voltage Low-Power Logic Styles for VLSI circuits.(BL3)

MODULE-4 Low-Voltage Low-Power Multipliers 10hours

Introduction, Overview of Multiplication, Types of Multiplier Architectures, Braun Multiplier, Baugh Wooley Multiplier, Booth Multiplier, Introduction to Wallace Tree Multiplier.

At the end of the Module 4, students will be able to:

1. Understand the importance of various low- voltage and low-power power multipliers.(BL2)
2. Build the Low-Voltage Low-Power Multipliers.(BL3)
3. Compare different types of low power multipliers.(BL2)

MODULE-5 Low-Voltage Low-Power Memories & CAD tools 9hours

Basics of ROM, Low-Power ROM Technology, Future Trend and Development of ROMs, Basics of SRAM, Memory Cell, Low-Power SRAM Technologies, Basics of DRAM, Self-Refresh Circuit, Future Trend and Development of DRAM, CAD tools for low power VLSI circuits.

At the end of the Module 5, students will be able to:

1. Demonstrate the working principle and operation of different Memories.(BL2)
2. Understand of Low-Voltage Low-Power Memories and Basics of DRAM.(BL2)
3. Develop low power adders, multipliers and memories for efficient design of systems.(BL3)
4. Study CAD tools for low power.(BL2)

Text Books:

1 Ajit Pal, Low Power VLSI Circuits and Systems, Springer, first edition, 2015. <https://doi.org/10.1007/978-81-322-1937-8>.

2Kaushik Roy, SharatC.Prasad, Low Power CMOS VLSI Design, Wiley India 1 edition (January 1, 2009).

4 Low-Voltage, Low-Power VLSI Subsystems – Kiat-Seng Yeo, Kaushik Roy, TMH Professional Engineering, 1st edition 2004

5 P. Rashinkar, Paterson and L. Singh, “Low Power Design Methodologies”, Kluwer Academic, 2002

Reference Books:

1Low Power CMOS Design – AnanthaChandrakasan, IEEE Press/Wiley International, 1998.

2Low Power CMOS VLSI Circuit Design – Kaushik Roy, Sharat C. Prasad, John Wiley & Sons, 2003.

1. Practical Low Power Digital VLSI Design – Gary K. Yeap, Kluwer Academic Press, 2002.

2. Low Power CMOS VLSI Circuit Design – A. Bellamour, M. I. Elamasri, Kluwer Academic Press,1995.

5.CMOS Digital Integrated Circuits – Analysis and Design – Sung-Mo Kang, Yusuf Leblebici, TMH,2011.

NARAYANA ENGINEERING COLLEGE:GUDUR

20EC4023 **ADVANCED EMBEDDED LOGIC DESIGN**

R2020

Semester	Hours / Week			Total hrs	Credit	Max Marks		TOTAL
	L	T	P			CIE	SEE	
VII	3	0	0	48	3	40	60	100

Pre-requisite: Microprocessor and microcontrollers

Course Objectives:

1. To illustrate the significance of embedded system and its hardware.
 2. To compare various board memory devices based on performance.
 3. To understand the architecture of the MSP430.
 4. To summarize various digital input and output ports.
 5. To apply interfacing techniques for MSP430 communication peripherals.
5. To interpret the case study of MSP 430.

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

CO 1 Illustrate the significance of embedded system and its hardware. **(BL-02)**

CO 2 Compare various board memory devices based on performance. **(BL-04)**

CO 3 Understand the architecture of the MSP430. **(BL-02)**

CO 4 Summarize various digital input and output ports. **(BL-02)**

CO 5 Apply interfacing techniques for MSP430 communication peripherals. **(BL-03)**

CO-PO Mapping														
CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1				2	1				2	1	2	2	
CO2	2				2	1								
CO3			2	1	2	1			2					2
CO4	1													
CO5			1	1						1	1	2		

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE - 1 Introduction to Embedded Electronic Systems and Microcontrollers **10hrs**

An Embedded System-Definition, Embedded System Design and Development Life Cycle, An Introduction to Embedded system Architecture, The Embedded Systems Model, Embedded Hardware: The Embedded Board and the von Neumann Model, Embedded Processors: ISA Architecture Models, Internal Processor Design.

At the end of the Module 1, students will be able to:

Explain the model of embedded systems. (BL-02)

Summarize the hardware of embedded system. (BL-02)

Understand the concept of processor performance. (BL-02)

MODULE - 2 Board Memory **10 hrs**

Memory Management of External Memory and Performance, Approaches to Embedded Systems. Small Microcontrollers, Anatomy of a Typical Small Microcontroller, Small Microcontrollers Memory, Embedded Software, Introduction to small microcontroller (MSP430).

At the end of the Module 2, students will be able to:

1. Explain the types of memories available. (BL-02)

2. Summarize the memory management of external memory and its performance. (BL-02)
3. Understand the approaches to embedded systems. (BL-02)
4. Compare various board memory devices based on performance. (BL-04)

MODULE-3 MSP430 – I

10hrs

MSP430 Processor, Functions, Interrupts, and Low-Power Mode: Functions and Subroutines, Storage for Local Variables, Passing Parameters to a Subroutine and Returning a Result, Mixing C and Assembly Language, Interrupts, Interrupt Service Routines, Issues Associated with Interrupts, Low-Power Modes of Operation.

At the end of the Module 3, students will be able to:

1. Explain the MSP 430 processor. (BL-02)
2. Demonstrate Memory and Memory Organization. (BL-02)
3. Understand the concept of Interrupts and Interrupt Service Routines. (BL-02)

MODULE-4 MSP430 – II

8 hrs

Digital Input, Output, and Displays: Parallel Ports, Digital Inputs, Switch Debounce, Digital Outputs, Interface between Systems, Driving Heavier Loads, Liquid Crystal Displays, Simple Applications of the LCD.

Timers: Watchdog Timer, Timer_A, Timer_A Modes, Timer_B, Timer_B Modes, Setting the Real-Time Clock, State Machines.

At the end of the Module 4, students will be able to:

1. Explain the various digital inputs and outputs. (BL-02)
2. List the applications of LCD's. (BL-01)
3. Understand the simple applications of the LCD. (BL-02)
4. Summarize the watch dog timer with its modes. (BL-02)

MODULE-5 MSP430 Communication

10hrs

Communication Peripherals in the MSP430, Serial Peripheral Interface, SPI with the USI, SPI with the USCI, A Thermometer Using SPI Modes, Inter-integrated Circuit Bus(I²C) and its operations, State Machines for I²C Communication, A Thermometer Using I²C, Asynchronous Serial Communication, Asynchronous Communication with the USCI_A.

At the end of the Module 5, students will be able to:

1. List the Communication Peripherals in the MSP430(BL-01)
2. Study theSPI with the USCI(BL-01)
3. Apply interfacing techniques for MSP430 communication peripherals(I²C, SPI, UART). (BL-03)

Total hours:

48 hours

Text Book(s):

1. Tammy Noergaard “Embedded Systems Architecture: A Comprehensive Guide for Engineers and Programmers”, Elsevier(Singapore) Pvt.Ltd.Publications, 2005.
2. John H. Davies “MSP430 Microcontroller Basics”,Elsevier Ltd Publications, Copyright 2008.
3. Peter Marwedel, “Embedded System Design”, Science Publishers, 2007.

Reference Book(s):

1. Manuel Jiménez Rogelio,PalomeraIsidoroCouvertier “Introduction to Embedded Systems Using Microcontrollers and the MSP430” Springer Publications, 2014.
2. Frank Vahid, Tony D. Givargis, “Embedded system Design: A Unified Hardware/Software Introduction”, John Wily & Sons Inc.2002.
3. Arnold S Burger, “Embedded System Design”, CMP Books, 2002.
4. Rajkamal, “Embedded Systems: Architecture, Programming and Design”, TMH Publications,Second Edition, 2008.

NARAYANA ENGINEERING COLLEGE:GUDUR

20EC4024 VIRTUAL INSTRUMENTATION

R2020

Semester	Hours / Week			Total	hrs	Credit	Max Marks		TOTAL
	L	T	P				CIE	SEE	
VII	3	1	0	48	4	40	60	100	

Pre-requisite:Nil

Course Objectives:

6. To understand what is Virtual instrumentation and to realize the architecture of VI.
7. To familiarize with the VI software and learn programming in VI.
8. To study various Instrument Interfacing and data acquisition methods.
9. To understand various analysis tools in LabVIEW.
10. Develop programs for Process control applications.

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

- CO 1** Explain the evolution, advantages, techniques, architecture of VI.(BL-2)
- CO 2** Design VI for the given specifications using programming structures. (BL-6)
- CO 3** Explain the significance of data acquisition. (BL-2)
- CO 4** Classify common instrument interfaces with industrial applications. (BL-2)
- CO 5** Explain the analysis tools in LabVIEW. (BL-2)

CO-PO Mapping														
C O	PO												PSO	
	P O 1	P O 2	P O 3	P O 4	P O 5	PO 6	P O 7	PO 8	P O 9	P O 10	PO1 1	P O 12	PS O 1	PS O 2
CO1	2												2	
CO2	2	2	2		2							2	2	2
CO3	2												2	2
CO4	2				2								2	
CO5	2												2	

1: Low, 2-Medium, 3- High

COURSE CONTENT

Module-1

INTRODUCTION

8h

Historical perspective – Need of VI – Advantages of VI – Define VI – Block diagram & Architecture of VI – Data flow techniques – Graphical programming in data flow – Comparison with conventional programming. (8h)

At the end of the Module 1, students will be able to:

- Explain virtual instrument, VI block diagram and architecture.(BL-2)
- Summarize the data flow techniques. (BL-2)
- Compare the differences between conventional and graphical programming. (BL-2)

Module-2

PROGRAMMING STRUCTURES OF VI

10h

VIS and sub-VIS – Loops and charts – Arrays – Clusters – Graphs – Case & sequence structures – Formula nodes – Local and global variable – String & file input..(8h)

At the end of the Module 2, students will be able to:

- Explain the programming structures of VI.(BL-2)
- Design Virtual Instruments.(BL-6)

- Explain the VI's and Sub VI's.(BL-2)

Module-3

DATA ACQUISITION

8h

DIO – Counters and timers – PC Hardware structure – Timing – Interrupts – DMA – Software and Hardware Installation – GPIB/IEEE 488 concepts – Embedded system buses – PCI – EISA – CPCL..(8h)

At the end of the Module 3, students will be able to:

- Explain Data acquisition concepts.(BL-2)
- Demonstrate hardware and software installation.(BL-2)
- Classify embedded buses.(BL-2)

Module-4

INTERFACING

10h

Current loop – RS 232C/RS 485 – Interface basics: USB – PCMCIA – VXI – SCXI – PXI – networking basics for office and industrial application VISA and IVI – Image acquisition and processing – Motion Control – DMM – Waveform generator..(8h)

At the end of the Module 4, students will be able to:

- Explain the interface basics of VI.(BL-2)
- □ Explain process of image acquisition and processing.(BL-2)
- Define VISA and its application.(BL-1)

Module-5

INDUSTRIAL APPLICATIONS

12h

Fourier transforms – Power spectrum – Correlation methods – Windowing and filtering- PID controller tool box. Pressure control system – Flow control system – Level control system– Temperature data acquisition system – Motion control employing stepper motor.

At the end of the Module 6, students will be able to:

- Explain the industrial applications of VI. (BL-2)
- Summarize PID controller toolbox (BL-2)
- Demonstrate the data acquisition methodologies. (BL-2)

Total hours:48hours

Text Book(s):

1. Dr. Sumathi. S and Prof. Surekha. P, “LabVIEW Based Advanced Instrumentation Systems”, 2nd edition, 2007.
2. Gary Johnson, “LabVIEW Graphical Programming”, McGraw Hill, 2006.
3. Jovitha Jerome, Virtual Instrumentation Using Labview, PHI

Reference Book(s):

1. Lisa .K, Wells and Jeffrey Travis, “LABVIEW for Everyone”, Prentice Hall, 2009.
2. Skolkoff, “Basic concepts of LABVIEW 4”, PHI, 1998.
3. Gupta. S, Gupta. J.P, “PC Interfacing for Data Acquisition and Process Control”, ISA, 1994.
4. Amy. L.T, “Automation System for Control and Data Acquisition”, ISA, 1992.

NARAYANA ENGINEERING COLLEGE:GUDUR

20EC4025 **SIGNAL PROCESSING FOR mm WAVE COMMUNICATION FOR 5G AND BEYOND**
R 2020

Semester	Hours / Week			Total hrs	Credit	Max Marks		TOTAL
	L	T	P			CIE	SEE	
VII	3	0	0	48	3	40	60	100

Pre-requisite:

Course Objectives:

1. To understand wireless channel- a ray tracing model.
2. To understand the various channel related concepts.
3. To study the antenna array processing concept.
4. To describe the hybrid beam forming concept.
5. To outline the parameter estimation in mm wave system.

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

- CO 1** Understand the wireless channel model(**BL-2**)
CO 2 Understand the channel related concepts (**BL-2**)
CO 3 Study the concept of antenna array processing. (**BL-2**)
CO 4 Explain the concept of hybrid beamforming. (**BL-2**)
CO 5 Analyze various parameters in mm wave system. (**BL-2**)

CO-PO Mapping														
CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2											1	
CO2	2	3	1										2	
CO3	2	3	1										2	1
CO4	2	2	1									1	1	
CO5	2	3	1										2	1

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1 INTRODUCTION TO 5G 08 Hrs

Wireless Channel–A ray tracing model-Part-I (With an outline on modern modem structure), Wireless Channel–A ray tracing model.

At the end of the Module 1, students will be able to:

- 1.Explain A ray tracing model (**BL-02**)
2. Explain wireless channel(**BL-01**)

MODULE -2 CHANNEL PARAMETERS 10 Hrs

Understanding of various channel related parameter statistics. Narrow band and broadband aspect, mmWave channel model, Understanding angle of arrival (AoA) and angle of departure (AoD) concept, understanding channel gain.

At the end of the Module 2, students will be able to:

1. Understand the channel related parameter statistics. (BL-02)
2. Explain the mm wave channel model (BL-02)
3. Understand channel gain. (BL-02)

MODULE-3 BEAMFORMING

10 Hrs

Introduction of single antenna beam forming in mmWave, an antenna array processing concept, Details of beam forming in mmWave: Concept of antenna many fold vector, beam parameters, efficiency of beams pattern.

At the end of the Module 3, students will be able to:

1. Explain single antenna beam forming in mm wave. (BL-02)
2. Understand the concept of antenna array processing (BL-02)
3. Calculate beam parameters and efficiency (BL-03)

MODULE-4 HYBRID FORMING

10 Hrs

Hybrid beam forming concept. Beam forming in MIMO system Part-I (Pre-coder, phase shifter, equalizer concepts), Hybrid beam forming concept. Beam forming in MIMO system Part-II (Optimization of design parameters), MIMO-OFDM with mmWave beam forming.

At the end of the Module 4, students will be able to:

1. Understand the concept of hybrid beam forming (BL-02)
2. Summarize the MIMO system (BL-02)
3. Explain the MIMO-OFDM (BL-02)

MODULE-5 mm WAVE SYSTEM

10 Hrs

Parameter estimation in mm Wave system (Mainly LMMSE based), Introduction of impairments and a basic analysis in mm Wave system

At the end of the Module 5, students will be able to:

1. Describe the parameters of mm wave system (BL-2)
2. Analyze the mm wave system (BL-02)

Total hours:48 hours

Text Book(s):

1. Fundamental of Wireless Communication By David Tse, Pramod Viswanathan
2. Millimeter Wave communication Systems By Kao-Cheng Huang, Zhaocheng Wang

Reference Book(s):

1. T. S. Rappaport, Millimeter Wave Wireless Communications

NARAYANA ENGINEERING COLLEGE:GUDUR

20EC4026	HIGH SPEED ELECTRONICS							R2020
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
VII	3	0	0	48	3	40	60	100

Module 1	Module 2	Module 3	Module 4	Module 5	Total
8H	10H	10H	10H	10H	48H

Pre-requisite: Basic knowledge on semiconductor materials, VLSI Design.

Course Objectives:

1. Study the fundamental properties and models of high-speed signals and interconnects
2. To give exposure on the band diagrams of HBT & hetero junction devices
3. Explain the characteristics of hetero-junction devices
4. Understand the applications of high speed transistors
5. Demonstrate the fabrication techniques of high speed electronic devices.

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

- CO 1** Explain the characteristics of semiconductor materials and structure of metal semiconductor.(BL-02)
- CO 2** Explain Structure and band diagram of homojunction devices.(BL-02)
- CO 3** Compare the characteristics of MOSFET and high speed Heterojunction MOSFET.(BL-02)
- CO 4** Explain small signal switching model of high speed devices.(BL-02)
- CO 5** Analyze the high gain frequency performance of HBTs.(BL-04)

CO-PO Mapping														
CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	1									1		
CO2	2	2	1									1	2	2
CO3	2	3	2									1		
CO4	2	2	2	1								1		
CO5	2	2	2	1								1		

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1 Semiconductor Material Characteristics

8H

Review of Crystal Structure: Crystal structure of important semiconductors (Si, GaAs, InP) , electrons in periodic lattices ,energy band diagram, carrier concentration and carrier transport phenomenon, electrical - optical - thermal and high field properties of semiconductors.

At the end of the Module 1, students will be able to demonstrate knowledge in

1. Recall the importance of semiconductor materials.(BL-01)
2. Understand the energy band diagram of semiconductor. (BL-02)
3. Explain the carrier concentration and carrier transport phenomenon. (BL-02)
4. Understand the high field properties of semiconductors. (BL-02)

MODULE -2 Homojunction Devices

10H

Homojunction Devices (BJT and FET): Structure - band diagram - operation - I-V and C-V characteristics (analytical expressions) - small signal switching models.

At the end of the Module 2, students will be able to:

1. Understand the Homojunction devices structures. (BL-02)
 2. Explain the band diagram of HBT. (BL-02)
3. Compare the characteristics of Homojunction devices with semiconductor. (BL-02)

MODULE-3 MOS Devices

10H

MOS Diode: Structure ,band diagram ,operation , C-V characteristics , effects of oxide charges, avalanche injection , high field effects and breakdown, Heterojunction Based MOSFET: Band diagram , structure , operation ,I-V and C-V characteristics (analytical expressions) ,MOSFET breakdown and punch through ,subthreshold current ,scaling down,Alternate High k-dielectric Materials: HF-MOSFETs , SOI MOSFET , buried channel MOSFET ,charge coupled devices.

At the end of the Module 3, students will be able to:

5. Understand the effect of oxide charges. (BL-02)
 6. Explain the importance of high field effects.(BL-02)
 7. Study the operation and characteristics of Heterojunction based MOSFET. (BL-02)
8. Compare various MOSFET Properties. (BL-02)

MODULE-4 Advanced Devices

10H

HBT and HEMT Devices: AlGaAs/ GaAs, InP and SiGe based HBT and HEMT structure , band diagram ,operation , I-V and C-V characteristics (analytical expressions) ,small signal switching models , benefits of heterojunction transistor for high speed applications.

At the end of the Module 4, students will be able to:

6. Define HBT and HEMT Devices.(BL-01)
7. Apply the knowledge of semiconductors to study HBT and HEMT structure. (BL-02)
8. Understand the characteristics and operation of Advanced devices. (BL-02)
9. List the high speed applications. (BL-01)

MODULE-5 Hetero junction Bipolar transistors (HBTs) structures

10H

Principle of operation and the benefits of hetero junction BJT for high speed applications. GaAs and InP based HBT device structure and the surface passivation for stable high gain high frequency performance. SiGe HBTs and the concept of strained layer devices, High Frequency resonant ,tunneling devices, Resonant, tunneling hot electron transistors

Text Book(s):

- 1 Nandita Das Gupta and Amitava Das Gupta, "Semiconductor Devices: Modeling and Technology", Prentice Hall of India, 2004.
- 2 M. S. Tyagi, "Introduction to Semiconductor Materials and Devices", John Wiley and Sons, 2008.
- 3 S. M. Sze, "Physics of Semiconductor Devices", 3rd edition, John Wiley and Sons,2007
- 4 J. Singh, "Semiconductor Devices: Basic Principles", John Wiley and Sons,2007

Reference Book(s):

1. C. Y. Chang, F. Kai, GaAs High-Speed Devices: Physics, Technology and Circuit Applications Wiley
2. Cheng T. Wang, Ed., Introduction to Semiconductor Technology: GaAs and Related Compounds, John Wiley & Sons,
3. David K. Ferry, Ed., Gallium Arsenide Technology, Howard W. Sams & Co., 1985
4. Avishay Katz, Indium Phosphide and Related materials: Processing, Technology and Devices, Artech House, 1992.

NARAYANA ENGINEERING COLLEGE:: GUDUR

20EC4027	DIGITAL SPEECH PROCESSING							R2020
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
VII	3	0	0	48	3	40	60	100

Pre-requisite: Signals and Systems & Digital Signal Processing

Course Objectives:

1. To understand the basic concepts of Speech processing and categories and location of speech sounds in Spectrograms.
2. To study Uniform tube modeling for speech production and speech perception methods for auditory system.
3. To analyze time domain methods for speech processing.
4. To Apply STFT for analysis and filtering of speech and Cepstral Transform for extraction of speech parameters.
5. To understand conversion of text to speech and speech recognition methods.

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

- CO 1 **Demonstrate** the basic concepts of speech and audio processing.(BL-2)
- CO 2 **Apply** Uniform tube modelling for speech production and speech perception methods for auditory system.(BL-3)
- CO 3 **Analyze** time domain methods for speech processing.(BL-4)
- CO 4 **Apply** STFT for analysis and filtering of speech and Cepstral Transform for extraction of speech parameters.(BL-3)
- CO 5 **Illustrate** conversion of text to speech and speech recognition methods.(BL-2)
5. S.M. Sze, High Speed Semiconductor Devices, Wiley (1990) ISBN0-471-62307-5

CO-PO Mapping															
CO	PO											PSO			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 0	PO 1	PO 1	PO 1	PSO 1	PSO 2
CO1	3	2	2											2	
CO2	3	2	1											1	2
CO3	3	3	2	1										1	1
CO4	3	2	2											2	2
CO5	3	2	2											2	2

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1 INTRODUCTION TO SPEECH PROCESSING

9 Hrs

Introduction: Introduction to speech processing, Digitization and Recording of speech signal, Review of Digital Signal Processing Concepts.

At the end of the Module 1, students will be able to:

1. Understand the basic concepts of Speech processing.(BL-2)
2. Explain need of Digitization and recording of speech signal.(BL-2)
3. Understand the production of speech from Human.(BL-2)

MODULE -2 ACOUSTIC PHONETICS

10 Hrs

Human Speech production, Acoustic Phonetics and Articulatory Phonetics, Different categories speech sounds and Location of sounds in the acoustic waveform and spectrograms.

At the end of the Module 2, students will be able to:

1. Explain Human speech production. (BL-2)
2. Understand Acoustic Phonetics. (BL-2)
3. Explain different categories of speech sounds. (BL-2)

MODULE-3 TIME DOMAIN METHODS

8 Hrs

Uniform Tube Modeling of Speech Production, Speech Perception, Time Domain Methods in Speech Processing, Analysis and Synthesis of Pole-Zero Speech Models

At the end of the Module 3, students will be able to:

1. Understand Uniform tube modeling. (BL-2)
2. Understand time domain methods for speech processing. (BL-2)
3. Analyze the analysis and synthesis of speech for Pole-Zero model. (BL-4)

MODULE-4 SHORT-TIME FOURIER TRANSFORM

10 Hrs

Short-Time Fourier Transform, Analysis- FT view and Filtering view, Synthesis-Filter bank summation (FBS) Method and OLAMethod. Features of Extraction, Extraction of Fundamental frequency.

At the end of the Module 4, students will be able to:

1. Understand the Short-Time Fourier Transform method. (BL-2)
2. Apply STFT for analysis and filtering of speech. (BL-3)
3. Understand extraction of fundamental frequency for speech. (BL-2)

MODULE-5 SPEECH PROSODY

11 Hrs

Speech Prosody, Speech Prosody Modeling
TTS, ASR and spoken language acquisition.

-Fujisaki Model; Speech based Applications-

At the end of the Module 5, students will be able to:

1. Understand conversion of text to speech. (BL-2)
2. Understand speech recognition methods. (BL-2)
3. Explain the concepts of speech based applications. (BL-2)

Total hours: 48 hours

Text Book(s):

1. Douglas O'Shaughnessy, Speech Communications: Human & Machine, IEEE Press, Hardcover 2/e, 1999; ISBN: 0780334493.
2. Nelson Morgan and Ben Gold, Speech and Audio Signal Processing: Processing and Perception of Speech and Music, July 1999, John Wiley & Sons, ISBN: 0471351547

Reference Book(s):

1. Donald G. Childers, Speech Processing and Synthesis Toolboxes, John Wiley & Sons, September 1999; ISBN: 0471349593
2. Thomas F. Quatieri, Discrete-Time Speech Signal Processing: Principles and Practice, Prentice Hall; ISBN: 013242942X; 1/e
3. Rabiner and Juang, Fundamentals of Speech Recognition, Prentice Hall, 1994.

NARAYANA ENGINEERING COLLEGE:GUDUR

20EC4028	FPGA Architectures							R2020
Semester	Hours / Week			Total hrs	Credit	Max Marks		TOTAL
	L	T	P			C	CIE	
VII	3	0	1	48	4	40	60	100

Pre-requisite: Programmable logic devices, Combinational and Sequential logic circuit design

Course Objectives:

- 1.To Understand the idea of programmable logic devices used in applications.
- 2.To Understand the Field Programmable Gate Array Architecture, Configurable Logic Block, Configurable I/O Block, Programmable Interconnection, Logic Optimization and Technology Mapping.
3. To acquire knowledge on various commercially available FPGA Architectures.
- 4.To Understand the Concepts of Placement and Routing in FPGAs.
- 5.To understand the SRAM and Antifuse Programming Technologies.
- 6.To Understand the FSM, Basic Concepts, Basic Properties, pertinent for Parallel Controllers.

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

- CO 1** Explain the Programmable logic devices and different types of Complex programmable logic device family's architectures.(BL-2)
- CO 2** Interpret the FPGA Architecture, Logic synthesis, Logic Optimization and Technology Mapping..(BL-2)
- CO 3** Understand the Logic Block Architecture, placement and routing. .(BL-2)
- CO 4** Outline the various Xilinx and ActelFPGAs (BL-2)
- CO 5** Develop a simple Traffic Light controller, various adders and Decade Counter using FPGAs.(BL-3)

CO-PO Mapping															
CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		2										1	1	
CO2	3	1	1												
CO3	2	2	1												
CO4	3	2	2										1	1	
CO5	3	2	3										1	1	

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE-1 PROGRAMMABLE LOGIC DEVICES

10 hrs

ROM, PLA, PAL, PLD, – Features, Programming and Applications, Complex Programmable Logic Devices: Altera Series – Max 5000/7000 Series, Altera FLEX Logic – 10000 Series CPLD, AMD's – CPLD (Mach 1 To 5), Cypress FLASH 370 Device Technology, Lattice Plsi's Architectures – 3000 Series, Speed Performance and in System Programmability.

At the end of the Module 1, students will be able to:

- 1.Explain the basic structure of a programmable logic array (PLA).(BL2)
- 2.Differentiate between ROM,PAL,PLA,SPLD,CPLD,FPGA.(BL2)
- 3.Describe the architecture of the Altera MAX 7000 family of CPLDs.(BL2)
4. Illustrate the various Architectures of Complex Programmable Logic Devices Families.(BL2)

MODULE-2 FIELD PROGRAMMABLE GATE ARRAYS AND PROGRAMMING TECHNIQUES

10hrs

Introduction to FPGAs, FPGA Design Flow, Configurable Logic Block, Programmable Interconnects, and

Configurable I/O blocks in FPGAs, Logic Synthesis, Logic Optimization, and Technology Mapping for FPGA, The Chortle-crf Technology Mapper and the Chortle-d Technology Mapper.

Static RAM Programming Technology, Anti-fuse Programming Technology, EPROM and EEPROM Programming Technology, Summary of Programming Technologies

At the end of the Module 2, students will be able to:

1. Compare the features of Various FPGAs in terms of their Architecture, Configurable logic block and routing (BL2)
2. Demonstrate the basics of FPGA, FPGA Design Flow, and configurable logic block, programmable interconnects.(BL2)
3. Illustrate the Configurable Logic Block. (BL2)
4. Explain the different types programming technologies, programmable logic block architectures and their interconnects.(BL2)

MODULE-3 PLACEMENT & ROUTING FPGAs

9hours

Introduction to Placement, Mincut-Based, Iterative Improvement and Simulated Annealing Placements, Introduction to Routing, Routing Terminology, General Strategy for Routing in FPGAs, Routing for Row-Based FPGAs , Introduction to Segmented Channel Routing and Maze Routing, Definitions for Segmented Channel Routing .

At the end of the Module 3, students will be able to:

1. Understand the concepts of Placement and routing in FPGAs.(BL2)
 2. Explain the Segmented Channel Routing and Maze Routing.(BL2)
3. Compare the features of Various FPGAs in terms of their Architecture, Configurable logic block and routing.(BL2)

MODULE-4 Xilinx and Actel FPGA

10 hrs

Introduction, Device Architecture: Simple SRAM Programmable FPGA Architecture, Design Trade-offs, Xilinx XC2000, XC3000 , XC4000 Architectures and Programming the FPGA.

Introduction, Device Architecture: Principles of Programming Routing, Routing Architecture of the Actel FPGAs, ACT1, ACT2, ACT3 Architectures Commercially Available FPGAs: Xilinx, Actel, Altera, Plessey, Plus Logic, Advanced Micro Devices (AMD), Quick Logic and Algotronix.

At the end of the Module 4, students will be able to:

1. Explain SRAM Programmable FPGAs.(BL2)
2. Understand the Xilinx Family FPGA.(BL2)
3. Explain the Routing architecture .(BL2)
4. Understand the ACTEL FPGA(BL2)

MODULE-5 FINITE STATE MACHINES

9hrs

Introduction to Finite State Machine, State Transition Table, and State Assignments for FPGAs, Problem of Initial State Assignment for One Hot Encoding, Hazard and One-Hot Encoding, State machines: Encoded and One Hot, Petri Nets for State Machines: Basic Concepts, Basic Properties, Extended Petri Nets for Parallel Controllers, Simple Example-A Traffic Light Controller. Design considerations using FPGAs of parallel adder cell, parallel adder, and sequential circuits-Decade Counter

At the end of the Module 5, students will be able to:

1. Design finite state machines for various applications.(BL3)
 2. Describe One Hot Encoding and Pertinent for state machines.(BL2)
 3. Understand the Basic Concepts and properties of State Machines.(BL2)
4. Develop parallel adder Cell, Parallel adder and Decade Counter.(BL3)

Total hours:48 hours

Text Books:

1. S.Brown, R.Francis, J.Rose, Z.Vransic, "Field Programmable Gate Array", Kluwer Publications, 1992.
2. P.K.Chan & S. Mourad, "Digital Design Using Field Programmable Gate Array", prentice Hall (Pte), 1994.

3.J. Old Field, R.Dorf, "Field Programmable Gate Arrays", John Wiley & Sons, New York, 1995.

Reference Books:

1. S.Trimberger, Edr. "Field Programmable Gate Array Technology", Kluwer Academic Publications, 1994.

2. Bob Zeidman, "Designing with FPGAs & CPLDs", CMP Books, 2002.

3. Digital Systems Design - Charles H. Roth Jr, LizyKurian John, CengageLearning..

4. Digital Design Using Field Programmable Gate Arrays - Pak K. Chan/SamihaMourad, Pearson

5. FPGA based System Design - Wayne Wolf, Prentice Hall Modern Semiconductor Design Series.

NARAYANA ENGINEERING COLLEGE:: GUDUR

20EC4029	Embedded system design with ARM							R2020
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
VII	3	0	0	48	3	40	60	100

Pre-requisite: Basic knowledge on Computer Organization, Digital Logic Design, Microprocessors & Microcontrollers.

Course Objectives:

1. To understand ARM microcontroller architecture
2. To design D/A and A/D converters
3. To demonstrate various sensing units
4. To understand demonstrate ON feedback control system
5. To explain internet of things

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

- CO 1 Outline the concepts of embedded system (BL-2)
- CO 2 Explain sensors and actuators (BL-2)
- CO 3 Distinguish various sensing units (BL-4)
- CO 4 Understand object tracking using GPS and GSM(BL-2)
- CO 5 Outline basic concepts of Internet of things (BL-2)

CO-PO Mapping														
CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	3		3		2								2	2
CO2	3		3										2	2
CO3	3	2	2										2	2
CO4	3	2	3										2	2
CO5	3		3										2	2

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1 INTRODUCTION TO EMBEDDED SYSTEMS

9Hrs

Introduction to Embedded Systems and Microcontrollers, Instruction Set Architecture of ARM Microcontroller, and Assembly Language Programming.

At the end of the Module 1, students will be able to:

- Outline the basic concepts of embedded systems (BL-2)
- Understand the architecture of ARM microcontroller(BL-2)
- Develop assembly language program (BL-3)

MODULE -2 EMBEDDED FIRMWARE

12 Hrs

D/A and A/D converter, Sensors, Actuators and their Interfacing, Microcontroller Development Boards.

At the end of the Module 2, students will be able to:

1. Explain D/A and A/D converters (BL-2)
2. Understand actuators and their interfacing (BL-2)
3. Understand microcontroller development boards (BL-2)

MODULE-3 EMBEDDED PROGRAMMING

9 Hrs

Embedded Programming platforms, Demonstration of Temperature sensing unit, Light sensing unit, Sound sensing unit.

At the end of the Module 3, students will be able to:

1. Explain embedded programming platforms (BL-2)
2. Understand various sensing units. (BL-2)

MODULE-4 EMBEDDED SYSTEM AND APPLICATION DEVELOPMENT 11 Hrs

Demonstration ON Feedback control system, Relay control unit, driving electrical appliances like motors, bulb, pump, etc, Object tracking using GPS and GSM.

At the end of the Module 4, students will be able to:

- Understand demonstration ON feed back control system (BL-2)
- Explain relay control unit (BL-2)
- Understand object tracking using GPS and GSM (BL-2)

MODULE-5 EMBEDDED SYSTEM AND APPLICATION DEVELOPMENT 7 Hrs

Demonstration ON Introduction to Internet of Things, Smart home concepts, Motion sensing using accelerometer, control of appliances over SMS.

At the end of the Module 5, students will be able to:

- Retrieve Demonstration ON (BL-1)
- Outline internet of things (BL-2)
- Develop control of appliances over SMS (BL-3)

Total hours: 48 hours

Text Book(s):

1. David E. Simon, An Embedded Software Primer, Pearson Education Asia, First Indian Reprint 2000.
2. Rajkamal, Embedded Systems Architecture, Programming and Design, TMH, 2003
3. Wayne Wolf, Computers as Components: Principles of Embedded Computing System Design, Morgan Kaufman Publishers - Elsevier 3ed, 2008.

Reference Book(s):

1. Frank Vahid and Tony Givargis, Embedded Systems Design – A Unified Hardware / Software Introduction, John Wiley, 2002.
2. Jonathan W. Valvano, “Embedded Microcomputer Systems Real Time Interfacing”, 3rd Edition Cengage Learning, 2012.
3. Iyer - Embedded Real time Systems, 1e, McGraw Hill Education New Delhi, 2003.

At the end of the Module 2, students will be able to:

- Define the concepts of Signalconversion. (BL-1)
- Classify actuating devices and their operation. (BL-2)
- Explain the control valve characteristics. (BL-2)

MODULE-3

CONTROLLER

12h

Basic control actions – Discontinuous control mode, Continuous control mode- Proportional, Single speed floating, Integral and Derivative– Composite control modes – P+I, P+D and P+I+D control modes.(6h)

Response of controller for different types of test inputs –Integral windup – Auto manual transfer. Selection of control mode for different processes – Typical control schemes for level, flow, pressure and temperature.

Controller Tuning: – Zeigler and Nichols open and Closed loop methods, Performance indices– Based on evaluation criteria – ISE, IAE, ITAE.(6h)

At the end of the Module 3, students will be able to:

- Summarize controller modes. (BL-2)
- Classify the controller modes. (BL-2)
- Compare the characteristics of controllers. (BL-2)
- Define the testing of control system. (BL-1)
- Demonstrate control schemes for level, flow, pressure and temperature systems. (BL-2)
- Explain the tuning mechanisms of controller. (BL-2)

MODULE-4

VARIOUS CONTROL SCHEMES

8h

Feed Forward Control, Cascade control, Ratio control, Over ride control, Split range control, Selective control, Adaptive control, Inferential control.(8h)

At the end of the Module 5, students will be able to:

- Classify the control strategies in process industry. (BL-2)
- Explain the characteristics of control strategies. (BL-2)
- List the applications of these strategies. (BL-2)

MODULE-5

MULTIVARIABLE CONTROL

10h

Introduction -Control loop interaction –motivation – general pairing problem- relative gain array- properties- application of RGA- RGA sensitivity zeros and performance limitation – scaling consideration-block diagram analysis- decoupling design of non interacting control loops Piping and Instrumentation Diagram, Instrument terms and Symbols. Introduction to Intelligent controllers.(10h)

At the end of the Module 5, students will be able to:

- Explain loop interaction. (BL-2)
- Analyse the impact of interaction. (BL-4)
- Explain the mathematical concepts of RGA. (BL-2)

Total hours:48 hours

Text Book(s):

1. C.Stefanopoulos, —Chemical process control, Prentice Hall of India.1998.
2. Singh, Process Control PHI Learning,2009 Format
- 3.Curtis D Johnson,Process Control Instrumentation Technology TMH.

Reference Book(s):

1. D.P. Eckman, —Automatic Process Control, Wiley Eastern Ltd.,1972.
2. D.R. Coughanowr, —Process System Analysis and Control, Second Edition, McGraw Hill1991.
3. K. Ogata, —Modern Control Engineering, Prentice Hall of India,1982.

Open Electives (OE) offered by ECE Department

S. No	Subject
1	Image Processing
2	Embedded Systems
3	Nano Technology
4	VLSI Design
5	Sensors and Actuators
6	Internet of Things (IoT)
7	Microprocessors and Microcontrollers
8	Wireless Sensor Networks
9	Microprocessor and Interfacing
10	Data Communication and Networks
11	Digital Logic Design
12	Principles of Communication

NARAYANA ENGINEERING COLLEGE:GUDUR

20EC3001	IMAGE PROCESSING							R2020
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
	3	0	0	48	3	40	60	100

Pre-requisites: **Basics of signals and images.**

Course Objectives:

- To understand the image fundamentals and basic operation involved in image processing.
- To outline various images transforms.
- To illustrate the concepts of image enhancement in spatial and frequency domain.
- To understand the concepts of image restoration and segmentation
- To acquire knowledge on image compression methods.

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

CO 1 Demonstrate the image processing fundamentals and basic relationship between pixels. **(BL-02)**

CO 2 Compare the working principles of various image transforms. **(BL-03)**

CO 3 Illustrate the concepts of image enhancement in spatial and frequency domain. **(BL-02)**

CO 4 Analyze the image restoration techniques and concepts of segmentation **(BL-03)**

CO 5 Categorize different image compression methods. **(BL-04)**

CO-PO Mapping														
CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2												1	
CO2	2	3	1		1								2	
CO3	2	1	2		1								2	
CO4	2	1	2		1								2	1
CO5	2	1	2		1								1	

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1 INTRODUCTION TO IMAGE PROCESSING

09 Hrs

Steps in Digital Image Processing , Components, Elements of Visual Perception – Image Sensing and acquisition, image sampling and quantization, Arithmetic and logical operations, image geometry.

At the end of the Module 1, students will be able to:

1. Understand the fundamentals of image processing. **(BL-02)**
2. Explain the formation of digital image. **(BL-02)**
3. Explain the concept of image sampling and quantization. **(BL-02)**

MODULE -2 IMAGE TRANSFORMS

10 Hrs

IMAGE TRANSFORMS: Introduction, 2-D DFT, properties, Walsh transform, Hadamard transform, discrete cosine transform, Haar transform, comparison of different transforms.

1. Understand the basic concepts of image transforms. **(BL-02)**
2. Explain efficient image transform for conversion. **(BL-02)**
3. Compare various image transforms. **(BL-02)**

MODULE -3 IMAGE ENHANCEMENT

9 Hrs

IMAGE ENHANCEMENT: Gray level transformations, Histogram processing, image smoothing and sharpening filters in spatial domain (by spatial domain methods), Image smoothing and image sharpening filters in frequency domain, homomorphic filtering.

At the end of the Module 2, students will be able to:

1. Explain gray level transformation technique. **(BL-02)**
2. Explain various image enhancement techniques. **(BL-02)**
3. Illustrate the concept of homomorphic filter. **(BL-02)**

MODULE-4 IMAGE RESTORATION & SEGMENTATION

10 Hrs

IMAGE RESTORATION & SEGMENTATION: Image degradation/Restoration model, Noise models, Restoration in the presence of Noise only- spatial filtering- mean, order statistic and adaptive filters. Estimating the degradation function, Inverse filtering, Wiener filters. Detection of discontinuities- Point, line and edge Detection, Thresholding- global thresholding, adaptive thresholding, Region based Segmentation.

At the end of the Module 4, students will be able to:

1. Explain Image restoration using filtering Techniques. **(BL-02)**
2. Compare the different noise models. **(BL-02)**
3. Select the proper filtering technique for image restoration. **(BL-01)**
4. Explain the thresholding techniques for image segmentation. **(BL-02)**

MODULE-5 IMAGE COMPRESSION

10 Hrs

IMAGE COMPRESSION: Types of redundancy, lossless compression: Huffman coding, Arithmetic coding, Variable length coding, bit plane coding, predictive coding- DPCM. Lossy compression: Transform coding, basics of image compression standards: JPEG, JPEG 2000

At the end of the Module , students will be able to:

1. Explain the various image compression techniques. **(BL-02)**
2. Explain Lossy image compression model. **(BL-02)**
3. Understand image compression standards. **(BL-02)**
4. Compare lossy and loss less compression models. **(BL-02)**

Total hours:48 hours

Text Book(s):

- 1 R.C. Gonzalez and R.E. Woods, Digital Image Processing, fourth Edition, Pearson Education Global edition 2018
- 2 Anil Kumar Jain, Fundamentals of Digital Image Processing, Prentice Hall of India. 2nd edition 2004
- 3 S. Shridhar, Digital Image Processing, Oxford University Press.

Reference Book(s):

- 1 Rafael C. Gonzalez, Richard E woods and Steven L. Eddins, Digital Image processing using MATLAB”, Tata McGraw Hill, 2010.
- 2 S jayaraman, S Esakkirajan, T Veerakumar, Digital Image processing”, Tata McGraw Hill
- 3 William K. Pratt, “Digital Image Processing, John Wiley, 3rd Edition, 2004.

NARAYANA ENGINEERING COLLEGE:GUDUR

20EC3002	EMBEDDED SYSTEMS						R2020
Semester	Hours / Week			Total hrs	Credit	Max Marks	
	L	T	P		C	CIE	SEE
	3	0	0	48	3	40	60
							TOTAL
							100

Pre-requisite: Basic knowledge on Computer Organization, Digital Logic Design, Microprocessors &

Microcontrollers.

Course Objectives:

- To understand the technology behind the embedded computing systems.
 - To outline the design issues of embedded systems.
 - To develop software programs for embedded systems.
 - To understand the internal architecture, addressing modes & instruction set of MSP430.
- To understand the concepts of real time operating system and multitasking.

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

CO 1 Demonstrate the basic structure and design of an Embedded System. **(BL-02)**

CO 2 Illustrate the different hardware modules and design approaches of embedded firmware.**(BL-02)**

CO 3 Analyze the internal architecture, addressing modes & instruction set of MSP430. **(BL-04)**

CO 4 Develop embedded programs for various applications. **(BL-03)**

CO 5 Interpret the concepts of real time operating system and multitasking. **(BL-02)**

CO-PO Mapping														
CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2												2	
CO2	2	1	2		2								2	1
CO3	2		2		2								2	1
CO4	2		2	1	2								1	2
CO5	2	1	2	1	2								1	2

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1 Introduction to Embedded Systems

10 Hrs

Definition of Embedded Systems, History of Embedded Systems, Classification, major application areas, characteristics and quality attributes of Embedded Systems. Anatomy of Embedded Processor, memory, software.

At the end of the Module 1, students will be able to :

Outline the basic concepts and history of embedded systems. **(BL-02)**

List the various application areas of embedded systems. **(BL-01)**

Explain the quality attributes of embedded systems. **(BL-02)**

Understand the memory and software concepts of embedded processor. **(BL-02)**

MODULE -2 Embedded Firmware

10 Hrs

Reset Circuit, Brown-out protection circuit, Oscillator Unit, Real Time Clock, Watch dog Timer, Embedded Firmware Design Approaches and Development Languages.

ROM, RAM, Memory selection for Embedded System, Sensors and Actuators, Onboard and External Communication Interface.

At the end of the Module 2, students will be able to:

List the various embedded hardware modules. **(BL-01)**

Explain embedded firmware design approaches. **(BL-02)**

Understand the interfacing of onboard and external communication. **(BL-02)**

MODULE-3 Architecture of MSP 430

08 Hrs

Introduction, Functional Block Diagram, Pin out, CPU, Memory, Memory mapped I/O, Clock Generator, Interrupts, Resets, Addressing modes, Instruction set.

At the end of the Module 3, students will be able to:

Understand the internal architecture of MSP430 microcontroller. **(BL-2)**

Explain memory organization of MSP430 microcontroller. **(BL-2)**

Explain various addressing modes to represent data in an instruction. **(BL-2)**

MODULE-4 Embedded Programming

10Hrs

Development Environment – C Language, Assembly Language. Programming, Sample programs – Light LEDs, Read input from a switch, Flashing light by delay, Automatic control, use of Subroutines, Timers, Interrupts, Functions, Header files and low power modes.

At the end of the Module 4, students will be able to:

1. Understand the programming concepts of C language. **(BL-02)**

2. Develop embedded programs for various applications. **(BL-03)**

3. Explain the use of subroutines, timers and interrupts. **(BL-02)**

MODULE-5 RTOS Based Embedded System Design

10 Hrs

Introduction, Operating System basics, Types of Operating Systems, Task, Process & Threads. Interrupt routines in RTOS, Multiprocessing and Multitasking, Scheduling, Task Communication, message passing, Task synchronization techniques and issues.

At the end of the Module 5, students will be able to:

Understand the basic concepts of operating systems. **(BL-02)**

Explain multiprocessing and multitasking. **(BL-02)**

Explain interrupt routines in RTOS. **(BL-02)**

List the various issues of task synchronization techniques. **(BL-01)**

Total hours: 48 hours

Text Book(s):

- 1 David E. Simon, An Embedded Software Primer, Pearson Education Asia, First Indian Reprint 2000.
- 2 Wayne Wolf, Computers as Components: Principles of Embedded Computing System Design, Morgan Kaufman Publishers - Elsevier 3ed, 2008.
- 3 Rajkamal, Embedded Systems Architecture, Programming and Design, TMH, 2003

Reference Book(s):

1. Frank Vahid and Tony Givargis, Embedded Systems Design – A Unified Hardware / Software Introduction, John Wiley, 2002.
2. Iyer - Embedded Real time Systems, 1e, McGraw Hill Education New Delhi, 2003.
3. K.V. Shibu, Introduction to Embedded Systems, 2e, McGraw Hill Education India, 2016.
4. Lyla B. Das, Embedded Systems: An Integrated Approach, 1/e , Lyla B. Das, Embedded Systems, 2012.
5. Steve Heath, Embedded Systems Design, Newnes – Elsevier 2ed, 2002
6. Tammy Noergaard, Embedded Systems Architecture, A Comprehensive Guide for Engineers and Programmers, Newnes – Elsevier 2ed, 2012.

NARAYANA ENGINEERING COLLEGE:GUDUR

20EC3003	NANO TECHNOLOGY						R2021
Semester	Hours / Week			Total hrs	Credit	Max Marks	
	L	T	P		C	CIE	SEE
	3	0	0	48	3	40	60
						TOTAL	100

Pre-requisite: Courses on Basic Engineering Physics, Basic Engineering Chemistry and Electronic Devices.

Course Objectives:

- To understand the basic scientific concepts of nano science.
 - To illustrate the properties of nano materials.
 - To understand synthesis and fabrication of nano structures.
 - To illustrate the various characterization techniques of nano materials.
- To summarize the applications of nano technology in various science, engineering and technology fields.

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

- CO 1** Demonstrate the history of nano science and technology. **(BL-02)**
- CO 2** Outline different properties and structure of nano materials. **(BL-02)**
- CO 3** Illustrate bottom-up and top-down approach in synthesis & fabrication. **(BL-02)**
- CO 4** Analyze different microscopy & spectroscopy techniques. **(BL-03)**
- CO 5** Apply the carbon Nano technology for real time applications. **(BL-03)**

CO-PO Mapping														
CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3													
CO2	3												1	
CO3	2	2	2		1								1	
CO4	3	1	1		1								1	
CO5	2	1	2		1								2	1

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1 Introduction to Nano Technology **09 Hrs**

History of nano science, definition of nano meter, nano materials, nano technology, Classification of nano materials, Crystal symmetries, crystal directions, crystal planes. Band structure.

At the end of the Module 1, students will be able to :

1. Explain the history of nano science and nano technology. **(BL-02)**
2. Classify nano materials. **(BL-02)**

Understand the concepts of crystal symmetries, crystal directions & crystal planes. **(BL-02)**

MODULE -2 PROPERTIES OF NANO MATERIALS **09 Hrs**

Mechanical properties, electrical properties, dielectric properties, thermal properties, magnetic properties, opto electronic properties. Effect of size reduction on properties, electronic structure of nano materials.

At the end of the Module 2, students will be able to:

1. Understand the mechanical and electrical properties of nano materials. **(BL-02)**
2. Explain the magnetic and dielectric properties of nano materials. **(BL-02)**
Explain the structure of nano materials. **(BL-02)**

MODULE-3 SYNTHESIS AND FABRICATION

10 Hrs

Synthesis of bulk polycrystalline samples, growth of single crystals. Synthesis techniques for preparation of nano particle – Bottom Up Approach – sol gel synthesis, CVD; Top Down Approach – Ball milling, lithography. Requirements for realizing semiconductor nano structures,.

At the end of the Module 3, students will be able to:

1. Outline the steps involved in synthesis of nano particles. **(BL-02)**
2. Explain bottom-up and top-down approach in synthesis & fabrication. **(BL-02)**
3. Understand growth techniques for nano structures. **(BL-02)**

MODULE-4 CHARACTERIZATION TECHNIQUES

10 Hrs

X-Ray diffraction, scanning electron microscopy, transmission electron microscopy, atomic force microscopy, XANES and XAFS, angle resolved photoemission spectroscopy, photoluminescence spectra, Raman spectroscopy.

At the end of the Module 4, students will be able to:

1. Explain X-Ray diffraction and Scherrer method. **(BL-02)**
2. Understand different microscopy techniques. **(BL-02)**
3. Illustrate different spectroscopy techniques. **(BL-02)**

MODULE-5 CARBON NANO TECHNOLOGY & APPLICATIONS

10 Hrs

Characterization of carbon allotropes, synthesis of diamond – nucleation of diamond, growth and morphology. Applications of nano crystalline diamond films, grapheme, applications of carbon nano tubes. Applications in material science, biology and medicine, surface science, energy and environment. Applications of nano structured thin films, applications of quantum dots.

At the end of the Module 5, students will be able to:

1. Understand the characterization of carbon allotropes. **(BL-02)**
2. Explain the synthesis and nucleation of diamond. **(BL-02)**
3. List the applications of carbon nano tubes. **(BL-01)**
4. List the applications of nano technology in material science, biology and medicine. **(BL-01)**
5. Explain the applications of nano structured thin films. **(BL-02)**

Total hours: 48 hours

Text Book(s):

1. Nano science and nano technology by M.S Ramachandra Rao, Shubra Singh, Wiley publishers.
2. Introduction to Nano Technology by Charles P. Poole, Jr., Frank J. Owens, Wiley publishers.
3. Nano Essentials- T. Pradeep/TMH.

Reference Book(s):

1. Nanotechnology by Jermy J Ramsden, Elsevier publishers.
2. Nano Materials- A.K. Bandyopadhyay/ New Age Introdu.
3. Nanotechnology the Science of Small by M.A Shah, K.A Shah, Wiley Publishers.
4. Principles of Nanotechnology by Phani Kumar, Scitech.

NARAYANA ENGINEERING COLLEGE:GUDUR

20EC3004	VLSI DESIGN							R2020
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
	3	0	-	48	3	40	60	100

Pre-requisite: Basics of semiconductor devices, Electronics circuits, Digital logic Design, Physics.

Course Objectives:

1. To understand the fabrication process of MOS, CMOS, Bi-CMOS Transistors, the electrical properties of MOS circuits
2. To Know the design rules, layout diagrams, stick diagrams and will also acquaint with knowledge on electrical constraint while designing
3. To know the design of various complex logic gates using CMOS and other forms of logic.
4. Subsystem design is used in VLSI integrated circuits for adders, multipliers, shifters, ALUs and Array Subsystems used in sequential circuit designs i.e. SRAM, DRAM.
5. To know the architectural details of FPGAs, CPLDs and procedural steps to develop semiconductor ICs like Full-Custom, Semi-Custom & programmable ICs.

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

- CO 1** Analyze the MOS Device Equations & CMOS basic inverter characteristics. (BL-4).
- CO 2** Apply the concepts of stick diagrams and layout design rules for CMOS Circuits. (BL-3).
- CO 3** Design the digital complex logic gate design of various types using CMOS and other forms of logic. (BL-6).
- CO 4** Develop various Data Path subsystems, parity generators, and array of memories to compensate trade-off area, speed and power requirements. (BL-6).
- CO 5** Demonstrate the semiconductor IC design such as PLAs, FPGAs and CPLDs. (BL-3).

CO-PO Mapping														
CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	1	2		1								2	
CO 2	3	1	2		2								2	1
CO 3	3	1	2	1	2								2	1
CO 4	3	1	3	1	2								2	2
CO5	3	1	3	2	2								2	3

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE-1 Introduction to MOS Technologies

12 hours

Introduction to integrated circuit technologies, Basic of MOS transistors, enhancement mode MOS transistor, depletion mode MOS transistor, NMOS and CMOS fabrication, BICMOS.

ELECTRICAL PROPERTIES : I_{ds} - V_{ds} relationships, Threshold Voltage, Body effect, Channel length modulation, gm, gds, figure of merit ω_0 , Pass transistor, NMOS Inverter, CMOS Inverter analysis and design, Latch-up in CMOS circuits

At the end of the Module 1, students will be able to:

1. Illustrate the evolution of Integrated Circuits and MOS Technologies. (BL-2).
2. Compare Bipolar, NMOS, CMOS, BICMOS and GaAs technologies. (BL-2).
3. Explain PMOS Fabrication Process. (BL-2).
4. Interpret the fundamentals of MOS devices and its V-I characteristics.(BL- 4)
5. Compare the relative merits of the three different forms of pull-up for an inverter circuit.(BL-2).

MODULE-2 VLSI CIRCUIT DESIGN PROCESS

9 hours

VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layout, 2 μ m CMOS Design rules for wires, Contacts and Transistors Layout Diagrams for NMOS, CMOS Inverters and Gates, Scaling of MOS Circuits: Scaling models, Scaling factors for device parameters, Limitations of Scaling.

At the end of the Module 3, students will be able to:

1. Develop the Layout of simple MOS circuits using Lambda based **design** rules. (BL-3).
2. Demonstrate how the NMOS, CMOS transistors layouts are built using 2 μ m CMOS Design rules.
3. Illustrate the scaling models and scaling factors for NMOS,PMOS and CMOS Devices.(BL-2)
4. Infer the limitations of scaling.

MODULE-3 GATE LEVEL DESIGN

9 hours

Logic gates and other complex gates, Switch logic, Other Forms of CMOS Logic: Pseudo-nMOS logic, Dynamic CMOS logic, Clocked CMOS (C² MOS) logic, CMOS Domino Logic, n-p CMOS logic.

At the end of the Module 4, students will be able to:

1. Demonstrate any logic function into Gate level design. (BL-2)
2. Illustrate various logic circuits with different design styles. (BL-2)
3. Explain CMOS domino logic and give its advantages and disadvantages. (BL-2)
4. Compare the other forms of CMOS Logic. (BL-2)

MODULE-4 DATA PATH SUBSYSTEMS

9 hours

Shifters, Design of an ALU Subsystem, Adders, Multipliers, Parity generators, SRAM, DRAM, ROM, Serial Access Memories, and Content Addressable Memory.

At the end of the Module 5, students will be able to:

1. Interpret the different architectures for adders. (BL-2)
2. Identify the speed and area trade off Adders, Multipliers and shifters. (BL-3)
3. Demonstrate the working principle and operation of different Memories. (BL-2).
4. Illustrate the read and write operations in static RAM with neat diagram. (BL-2)

MODULE-5 IMPLEMENTATION STRATEGIES

9hours

Full custom, Standard Cell, Gate Array based ASICs, PLA, PAL, PLD, and CPLD & FPGA Architecture. Programmable Array Logic, Design Approach.

At the end of the Module 6, students will be able to:

1. Illustrate the techniques of chip design using programmable devices. (BL-2).
2. Demonstrate the architecture and routing procedures of CPLD & FPGA. (BL-2).

Total hours: **48 hours**

Text Books:

1. Kamran Eshraghian, Douglas A. Pucknell and Sholeh Eshraghian, *Essentials of VLSI Circuits and Systems*, PHI, 2005.
2. P.P. Sahu, *VLSI Design*, TMH, 1st edition 2013.
3. K.Lal Kishore and V.S.V. Prabhakar, "VLSI DESIGN", IK Publishers, 1st edition 2009

Reference Books:

1. John P Uyemura, *Introduction to VLSI Circuits and Systems*, Wiley India, 2006
2. Jhon F. Wakerly, "Digital Design Principles & Practices", Pearson Education Asia, 3rd Edition, 2005.
3. John M. Rabaey, *Digital Integrated Circuits: A Design Perspective*, PHI, 2nd Edition, 1997.
4. Wayne Wolf, "Modern VLSI Design", Pearson Education, 3rd Edition, 2008.
5. Sabastian smith, "Application Specific Integrated Circuits", Addison Wesley Publishing Company Incorporated, 2008
6. Principles of CMOS VLSI Design- Weste and Eshraghian, Pearson Education, 1999

NARAYANA ENGINEERING COLLEGE:GUDUR

20EC3005	Sensors & Actuators							R2020
Semester	Hours / Week	Total	hrs	Credit	Max Marks			
	L	T	P		C	CIE	SEE	
	3	0	0	48	3	40	60	
							TOTAL	
							100	

Pre-requisite:Engineering Physics

Course Objectives:

1. To Understand the basic concepts of sensors.
2. To study about the construction of various sensors.
3. To study about the various sensors types based on their applications.
4. To study about the micro level sensors
5. To study about the actuators.

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

- CO 1** Demonstrate the fundamentals and different types of displacement measuring sensors.(BL-2)
- CO 2** Illustrate proximity, force and pressure sensors. (BL-2)
- CO 3** Analyze the working principles of velocity, level and flow measuring sensors. (BL-3)
- CO 4** Interpret the concept of temperature, motion and light sensors. (BL-2)
- CO 5** Demonstrate working principle of micro sensors and Actuators (BL-2)

CO-PO Mapping														
CO	PO												PS	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS 1	PS 2
CO1	2	1	2		1		1						2	1
CO2	2	1	2		1		1						2	1
CO3	2	1	2		1		1						2	1
CO4	2	1	2		1		1						2	1
CO5	2	1	2		1		1						2	1

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1 DISPLACEMENT MEASUREMENT 10hours

Sensors - Basic requirements of sensors- Classification of sensors- Static and Dynamic characteristics of sensors-Displacement

Sensors- Linear and Rotary displacement sensors- Potentiometer, Capacitive and Inductive type displacement sensor- position sensors- Optical encoder, Photoelectric sensor, Hall Effect Sensor.

At the end of the Module 1, students will be able to:

- Explain the basic working of displacement sensors. (BL-2)
- Summarize types of displacement sensors. (BL-2)
- Illustrate the working principle of optical sensors. (BL-2)

MODULE – 2 MEASUREMENT OF PROXIMITY, FORCE PRESSURE AND FORCE 9hrs

MEASUREMENT OF PROXIMITY, FORCE AND PRESSURE: Eddy current proximity sensor- Inductive Proximity sensor- Capacitive Proximity sensor -Pneumatic Proximity sensors- Proximity Switches- Contact and Noncontact type – Strain Gauge – Diaphragm Pressure Sensor- Capsule

Pressure

sensors- Bellows Pressure Sensor- Bourdon tube pressure sensor- Piezo-electric Sensor- Tactile sensor.

At the end of the Module 2, students will be able to:

- Compare principles of proximity, force and pressure sensors. (BL-2)
- Explain industrial applications of these sensors. (BL-2)
- Demonstrate the sensing measurements of these sensors. (BL-2)

MODULE – 3 MEASUREMENT OF VELOCITY, FLOW AND LEVEL 9 hours

MEASUREMENT OF VELOCITY, FLOW AND LEVEL: Tachogenerator - Pyroelectric sensors - Ultrasonic sensor – Resistive sensor- Pitot tube – Orifice plate - flow nozzle- Venturi tubes – Rotameter- Electromagnetic flow meter. Float level sensor- Pressure level sensor- Variable capacitance sensor. (

At the end of the Module 3, students will be able to:

1. Explain the basics of velocity, flow and level sensors. (BL-2)
2. Compare the characteristics of these sensors. (BL-2)
3. Summarize the applications. (BL-2)

MODULE – 4 MEASUREMENT OF TEMPERATURE, MOTION AND LIGHT 8 hours

Thermocouples- Thermistors - Thermodiodes - Thermotransistors- Bimetallic Strip- Resistance Temperature Detector- Infrared Thermography. Vibrometer and accelerometer- seismic accelerometer. Photoresistors -

Photodiodes - Phototransistors- Photoconductors.

At the end of the Module 4, students will be able to:

1. Explain the functioning of temperature, motion and light sensors. (BL-2)
 2. Summarize the advantages of these sensors. (BL-2)
- Outline the working of sensors in industries. (BL-2)

MODULE – 5 MICRO SENSORS AND ACTUATORS 12 hours

MICRO SENSORS: Principles and examples, Force and pressure micro sensors, position and speed micro sensors, acceleration micro sensors, chemical sensors, biosensors, temperature micro sensors and flow micro sensors.

ACTUATORS: Actuation principle, shape memory effects-one way, two way and pseudo elasticity. Types of micro actuators- Electrostatic, Magnetic, Fluidic, Inverse piezo effect, other principles.

At the end of the Module 5, students will be able to:

1. Define the principle of microsensors. (BL-2)
2. Explain construction of micro sensors. (BL-2)
3. Explain about micro actuators. (BL-2)
4. Illustrate the industrial applications of actuators. (BL-2)

Total hours: 48 hours

Text Book(s):

1. Sawhney. A.K, “Course in Mechanical Measurements and Instrumentation”, Dhanpat Rai and Sons, 1997.
2. Patranabis. D, “Sensors and Transducers”, Wheeler publisher, 1994.
3. Sergej Fatikow and Ulrich Rembold, Microsystem “Technology and Microbotics” First edition, Springer-Verlag New York, Inc, 1997.

Reference Book(s):

1. Thomas G. Bekwith and Lewis Buck. N, “Mechanical Measurements, Oxford and IBH publishing Co. Pvt. Ltd.
2. Massood Tabib and Azar, “Microactuators Electrical, Magnetic, thermal, optical, mechanical, chemical and smart structures”, First edition, Kluwer academic publishers, Springer, 1997.
3. Manfred Kohl, “Shape Memory Actuators”, first edition, Springer
4. Gupta. I.C, “A Text book of Engineering Metrology”, Dhanpat Rai and Sons, 1996.
5. “ASTE Hand Book of Industries Metrology”, Prentice Hall of India, 1992.

NARAYANA ENGINEERING COLLEGE:GUDUR

20EC3006 Internet of Things (IoT)

R2020

Semester	Hours / Week			Total	hrs	Credit	Max Marks		TOTAL
	L	T	P			C	CIE	SEE	
3	0	0	48	34060	100				

Pre-requisite: Basic Programming Language, Fundamentals of internet technology, computer networks,

Course Objectives:

- To learn fundamentals of IoT
- To Learn how to build hardware
- To Learn software for IoT based systems
- To design and implement IoT circuits and solutions.

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

- CO 1** Illustrate the general concepts of Internet of Things (IoT) (BL-2)
- CO 2** Interpret the concepts of networking & communication in IoT (BL-2)
- CO 3** Analyze IoT Models and architectures (BL-4)
- CO 4** Analyze Physical devices endpoints in IoT (BL-3)
- CO 5** Demonstrate the principles of IoT Systems for specific applications (BL-2)

CO-PO Mapping														
CO	COURSE CONTENT												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3				1								2	1
CO2	2		1										2	
CO3	3	1											1	
CO4	2		3		2								2	
CO5	2		3		2								1	2

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE -1 INTRODUCTION TO INTERNET OF THINGS 10hrs

The Internet of Things Today , Elements of an IoT ecosystem Time for Convergence , Characteristics of IoT, Physical design of IoT,, Logical design of IoT, IoT enabling technologies, IoT levels and deployment

At the end of the Module 1, students will be able to:

- Explain usage of the term “The Internet of Things” in different contexts. (BL-2)
- Describe the concepts of internet of things(BL-2)
- Explain IOT Levels (BL-2)

MODULE -2 NETWORKS AND COMMUNICATION:9hrs

Networking Technology, Communication Technology, Processes Data Management, Prototyping embedded devices, Sensors and actuators, Embedded computing basics.

At the end of the Module 2, students will be able to:

- Explain concepts of networking & communication in IoT(BL-2)

- Describe Basic elements in IoT (BL-2)
- Explain embedded computing basics(BL-2)
- What is importance of sensors and actuators in IOT(BL-2)

MODULE-3 IOT ARCHITECTURES

9hrs

Elements of IOT System, The IoT Reference Model, IoT Reference Architecture, The iCore Functional architecture, Privacy preserving Sharing of IoT Data

At the end of the Module 3, students will be able to:

- Describe the elements of IoT System (BL-2)
- Select the IoT & iCore Reference model, Architectures for specific applications (BL-3)
- Explain importance of privacy in preserving and sharing of data in IoT for various applications. (BL-2)

MODULE-4 IOT PHYSICAL DEVICES AND ENDPOINTS 10 hrs

Introduction to Arduino, Arduino UNO, Installing the Software, Fundamentals of Arduino Programming

Introduction to RaspberryPi, Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming RaspberryPi with Python

- Describe the function of Arduino (BL-2)
- Explain fundamentals of Arduino programming(BL-2)
- Describe configuration procedure of RaspberryPi(BL-2)

MODULE-5 APPLICATIONS OF IOT 10 hrs

Home automation, Smart Cities, Smart Energy and the Smart Grid, Smart Transportation and Mobility, Industry applications- Value Creation and Challenges, Other IoT applications , Case studies in IoT system for Home automation , cities , Agriculture applications

At the end of the Module 4, students will be able to:

1. Explain importance of automation (BL-2)
2. Explain various applications of IOT (BL-2)
3. Describe impact of IoT in Industrial applications (BL-2)
4. Describe the Role of IoT in Smart cities (BL-2)

Total Hours:48 hrs

Text Book(s):

- 1 ArshdeepBahga, Vijay Madiseti, "Internet of Things: A Hands-on-Approach", VPT, 1st Edition, 2014.
- 2 Ovidiu Vermesan ,PeterFriess "Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems", 2013 River Publishers
- 3 Raj Kamal, Internet of Things, First edition, McGraw Hill

Reference Book(s):

- 1 Jeeva Jose, Internet of Things, Khanna Book Publishing Co., New Delhi
- 2 Adrian McEwen, Hakim Cassimally, "Designing the Internet of Things", John Wiley and Sons, 1st Edition, 2014.
- 3 Francis Da Costa, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", Apress Publications, 1st Edition, 2013.
- 4 Matt Richardson, Shawn Wallace, "Getting Started with Raspberry Pi", O'Reilly (SPD), 3rd Edition, 2014.

NARAYANA ENGINEERING COLLEGE: GUDUR

20EC3007	MICROPROCESSORS AND MICROCONTROLLERS						R2020
Semester	Hours / Week			Total hrs	Credit	Max Marks	
	L	T	P		C	CIE	SEE
IV	2	0	2	48	3	40	60
						TOTAL	100

Pre-requisite: Knowledge on switching theory and logic design, basics of computer organisation, architecture and basic programming techniques.

Course Objectives:

- To study the internal architecture, interrupts & memory organization of 8086 microprocessor.
 - To understand the programming concepts using 8086.
 - To impart the basics of the MSP 430 and its variants.
 - To understand programming techniques using interrupts, instruction set & addressing modes
5. To provide the knowledge on low power modes of MSP 430.

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

- CO 1** Demonstrate the internal architecture, memory organisation and interrupt structure of 8086 microprocessor.(**BL-2**)
- CO 2** Construction of a maintainable assembly language program for an algorithm. (**BL-3**)
- CO 3** Interpret the concepts of low power modes of MSP 430.(**BL-2**)
- CO 4** Develop programs using software interrupts and addressing modes of MSP430.(**BL-3**)
- CO 5** Compare various on chip peripherals of MAP 430.(**BL-3**)

CO-PO Mapping														
CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3													
CO2	2	1	3										1	1
CO3	3		2		2								2	1
CO4	2		2		1								1	1
CO5	2	1	2										1	1

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1 8086 MICROPROCESSOR **10 h**

Introduction, Microprocessor Evolution, Intel 8086 Microprocessor: Features block diagram, Register Organization, Memory organization, Interrupts and Interrupt Vector Table.

At the end of the Module 1, students will be able to:

- List the features of 8086 microprocessor.(BL-1)
 - Explain the architecture of 8086 microprocessor.(BL-2)
 - Describe the memory organization of 8086 microprocessor.(BL-1)
- Explain the concept of interrupt handling of 8086.(BL-2)

MODULE 2 PROGRAMMING WITH 8086 **10 h**

Instruction Formats -Addressing Modes-Instruction Set of 8086, Assembler Directives, Macros and Procedures. Simple ALP's.

At the end of the Module 2, students will be able to:

- Explain the different addressing modes in 8086. (BL-2)
- Explain different instruction set of 8086 (BL-2)

MODULE-3 LOW POWER RISC MSP430**10 h**

Low power RISC MSP430 block diagram, features and architecture, Variants of the MSP430 family viz. MSP430x2x, MSP430x4x, MSP430x5x and their targeted applications, Register set.

At the end of the Module 3, students will be able to:

1. List the features of MSP 430 microcontroller.(BL-1)
2. Explain the architecture of MSP 430 microcontroller.(BL-2)
3. Compare variants of MSP 430. (BL-2)

MODULE-4 ADDRESSING MODES & INTERRUPTS OF MSP430**8 h**

Addressing modes, Instruction set, Memory address space; I/O ports pull up/down resistors concepts, Interrupts and interrupt programming.

At the end of the Module 4, students will be able to:

1. Apply data in MSP 430 programming using addressing modes. (BL-3)
2. Explain the instruction set of MSP 430. (BL-2)
3. Do programming using interrupts.(BL-3)
4. Lists interrupt types supported by MSP430. (BL-2)

MODULE-5 ON-CHIP PERIPHERALS OF MSP 430**10 h**

On-chip peripherals (Analog & Digital), ADC, Comparator and data transfer using DMA controller, Watchdog timer, System clocks, Timers & Real Time Clock (RTC), Low power modes. Serial Communication Protocols: UART, USB, I2C & SPI and implementation using MSP430.

At the end of the Module 5, students will be able to:

1. List the on chip peripherals of MSP 430 microcontroller.(BL-1)
2. Discuss MSP430 clock system. (BL-2)
3. Explain the operation of watchdog timer.(BL-2)
4. Explain the concept of Real Time Clock (RTC). (BL-2)
5. List the features of UART, USB, SPI, and I2C. (BL-1)
6. Explain the UART, I2C, SPI interface using MSP430. (BL-2)

Total hours:48 Hours**Text Book(s):**

1. "Microprocessor and Microcontrollers", N. Senthil Kumar, M. Saravanan, S. Jeevanathan, Oxford Publishers. Second Edition, 2016
2. MSP430 microcontroller basics. John H. Davies, Newnes Publication, I st Edition, 2008
3. "The X86 Microprocessors , Architecture, Programming and Inerfacing" , Lyla B.Das ,Pearson Publications,2010

Reference Book(s):

1. Advanced microprocessors & microcontrollers", K M Burchandi& A K Ray, 3 rd edition, 2013
2. "Microprocessor and Interfacing: Programming and Hardware", Douglas V.Hall, McGrawHill
3. "8086 microprocessor: Programming and Interfacing the PC", Kenneth Ayala Cengage Learning.

CO-PO Mapping		
CO	PO	PSO

NARAYANA ENGINEERING COLLEGE:GUDUR

20EC3008	WIRELESS SENSOR NETWORKS							R2020
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
	3	0	0	48	3	40	60	100

Course Objectives:

1. To introduce the characteristics, basic concepts and systems issues in Wireless sensor networks.
2. To illustrate architecture and protocols in wireless sensor networks.
3. To identify the trends and latest development of the technologies in the area.
4. To provide a broad coverage of challenges and latest research results related to the design and management of wireless sensor networks.
5. To describe sensor node hardware

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

- CO 1** Interpret the concepts of sensor networks for various applications.(BL-2)
- CO 2** Demonstrate wireless transmission technology and systems.(BL-2)
- CO 3** Determine the suitable medium access protocols, localization techniques and routing protocols (BL-3)
- CO 4** Compare various routing protocols and issues.(BL-2)
- CO 5** Select suitable Operating system , platform and tools for WSN (BL-4)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3												1	
CO2	3		1										1	
CO3	2		1										2	
CO4	3		3										2	
CO5	2	1	2		2								1	1
1: Low, 2-Medium, 3- High														

COURSE CONTENT

MODULE – 1 INTRODUCTION TO WIRELESS SENSOR NETWORKS Hours:8

Introduction, Applications of Wireless Sensor Networks, WSN Standards, IEEE 802.15.4, Zigbee Network Architectures and Protocol Stack – Network architectures for WSN, classification of WSN, protocol stack for WSN.

At the end of the Module 1, students will be able to:

- Describe wireless sensor networks and their architectures.(BL-2)
- Explain the applications, standards and protocols in WSN. (BL-2)
- Classify the WSN. (BL-2)

MODULE -2 WIRELESS TRANSMISSION TECHNOLOGY AND SYSTEMS Hours: 10

Wireless Transmission Technology and Systems – Radio Technology, Available Wireless Technologies. Wireless Sensor Technology - Sensor Node Technology, Hardware and Software, Sensor Taxonomy, WN Operating Environment.

1. At the end of the Module 2, students will be able to:
2. Describe wireless transmission technologies..(BL-2)
3. Explain the issues in WSN..(BL-2)
4. Explain about nodes, hardware and software in WSN. (BL-2)
5. Describe Hardware and Software, Sensor Taxonomy.(BL-2)

MODULE-3 MAC PROTOCOLS FOR WIRELESS SENSOR NETWORKS Hours: 8

Fundamentals of MAC Protocols, MAC Protocols for WSNs, Contention-Based protocols: Power Aware Multi-Access with Signaling - Data-Gathering MAC, Contention-Free Protocols: Low-Energy Adaptive Clustering Hierarchy, B-MAC, S-MAC.

At the end of the Module 3, students will be able to:

1. Describe the fundamentals of MAC layer. (BL-2)
2. Explain MAC protocols. (BL-2)
3. Explain Contention-Free Protocols(BL-2)
4. List and explain Contention-Based protocols(BL-2)

MODULE-4 DEPLOYMENT AND CONFIGURATION Hours: 10

Target tracking, Localization and Positioning, Coverage and Connectivity, Single-hop and Multihop Localization, Self-Configuring Localization Systems.

Routing Protocols and Data Management for Wireless Sensor Networks - Routing Challenges and Design Issues in Wireless Sensor Networks, Routing Strategies in Wireless Sensor Networks, Routing protocols

At the end of the Module 4, students will be able to:

1. Describe localization and positioning concepts.(BL-2)
2. Explain routing challenges.(BL-2)
3. Determines the efficiency of WSN. (BL-2)
4. Compare Routing Strategies In WSN(BL-2)

MODULE-5 ENERGY EFFICIENCY POWER CONTROL& OPERATING SYSTEM Hours: 12

Need for energy efficiency and power control in WSN, passive power conservation mechanisms, active power conservation mechanisms. Operating System Design Issues, TinyOS, Contiki – Task management, Protothreads, Memory and IO management, Sensor Node Hardware – Tmote, Micaz, Programming Challenges, Node-level Software Platforms, Node-level Simulators

At the end of the Module 5, students will be able to:

1. Describe power conservation mechanisms in WSN.(BL-2)
2. Explain the OS design issues in WSN. (BL-2)
3. Illustrate Selection OS for WSN. (BL-2)
4. Describe Memory and IO management. (BL-2)
5. Describe Sensor Node Hardware(BL-2)

Total hours:48 hours

Text Book(s):

1. HolgerKerl, Andreas Willig, “Protocols and Architectures for Wireless Sensor Network”, JohnWiley and Sons, 2005(ISBN:978-0-470-09511-9).

2. Raghavendra, Cauligi S, Sivalingam, Krishna M., ZantiTaieb, “Wireless Sensor Network”,Springer 1st Edition. 2004(ISBN:978-4020-7883-5).
3. Feng Zhao, Leonidas Guibas, “ Wireless Sensor Network”,Elsevier, 1st Edition. 2004 (ISBN: 13- 978-1-55860-914-3).

Reference Book(s):

- 1.Kazem Sohraby, Daniel Minoli, TaiebZnati, “Wireless Sensor Networks, Technology, Protocols and Applications”, Wiley, 2007.
- 2.Jun Zheng, Abbas Jamalipour, “Wireless Sensor Networks: A Networking Perspective”, Wiley, 2009.
- 3.Ian F. Akyildiz, Mehmet Can Vuran, “Wireless Sensor Networks”, Wiley, 2010
- 4.Ibrahiem M. M. El Emary, S. Ramakrishnan, “Wireless Sensor Networks: From Theory to Applications”, CRC Press Taylor & Francis Group, 2013.

NARAYANA ENGINEERING COLLEGE:GUDUR

20EC3009 **MICRO PROCESSORS & INTERFACING** R2020

Semester	Hours / Week			Total hrs	Credit	Max Marks		TOTAL
	L	T	P			CIE	SEE	
	3	0	0	48	3	40	60	100

Pre-requisite: Basic knowledge on Integrated circuits, memories and Number systems.

Course Objectives:

1. To study the internal architecture, registers & memory organization of 8086 microprocessor.
2. To understand the concept of various advanced processors like Pentium & ARM processors.
3. To impart the basics of the MSP 430 and its variants.
4. To identify suitable low power modes & clock systems for MSP430.
5. To understand serial communication protocols using MSP430.

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

CO 1 Demonstrate the internal architecture, registers & memory organization of 8086 microprocessor. (BL-2)

CO 2 Compare the architectural features of advanced processors like Pentium & ARM processors. (BL-3)

CO 3 Summarize the features, architecture, addressing modes and instruction set of MSP 430. (BL-2)

CO 4 Interpret the concepts of low power modes, clock system & interrupts of MSP 430. (BL-2)

CO 5 Apply interfacing techniques for serial communication protocols using MSP 430. (BL-3)

CO-PO Mapping														
CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3		1										1	
CO2	3		1										1	1
CO3	2		1										1	1
CO4	2		2										1	1
CO5	3		2										1	1

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE -1 8086 MICROPROCESSOR

10 h

Introduction, Microprocessor Evolution, Intel 8086 Microprocessor: Features, block diagram, Register Organization, Flag Register, Timing and Control Signals

At the end of the Module 1, students will be able to:

List the features of 8086 microprocessor. (BL-1)

Explain the architecture of 8086 microprocessor. (BL-2)

Compare the generations of microprocessors based on applications. (BL-2)

List various timing & control signals available in microprocessors. (BL-1)

MODULE -2 ADVANCED PROCESSORS

8 h

ARM Processor (Cortex-M series) Fundamentals: Registers, Current Program Status Register, Pipeline, Exceptions, Interrupts, core extensions, Operating Modes, ARM processor families & Applications.

At the end of the Module 2, students will be able to:

1. Compare various versions of Pentium processors based on architecture. (BL-2)
2. List the operating modes of various advanced processors. (BL-1)
3. Explain the ARM processor internal architecture. (BL-2)

MODULE-3 MIXED SIGNAL PROCESSOR (MSP430)

10 h

Low power RISC MSP430 block diagram, features and architecture, Variants of the MSP430 family viz. MSP430x2x, MSP430x4x, MSP430x5x and their targeted applications, Register set, Addressing modes, Instruction set, Memory address space.

At the end of the Module 3, students will be able to:

- List the features of MSP 430 microcontroller.(BL-1)
- Explain the architecture of MSP 430 microcontroller.(BL-2)
- Discuss MSP 430 addressing modes of MSP430. (BL-2)
- Explain the instruction set of MSP 430. (BL-2)
- Compare variants of MSP 430. (BL-2)

MODULE-4 INTERRUPTS & LOW POWER MODES OFMSP430

10 h

I/O ports pull up/down resistors concepts, Interrupts and interrupt programming, low power modes, Active vs Standby current consumption, FRAM vs Flash for low power & reliability.

At the end of the Module 4, students will be able to:

- Compare the low power modes of MSP 430 microcontroller.(BL-2)
- List the functions of pull up resistors used in MSP430. (BL-1)
- List interrupt types supported by MSP430. (BL-1)

MODULE-5 INTERFACING SERIAL COMMUNICATION PROTOCOLS 10 h

Serial communication basics, Synchronous/Asynchronous protocols: UART, USB, I2C & SPI. Implementing and programming UART, I2C, SPI interface using MSP430.

At the end of the Module 5, students will be able to:

1. List the features of UART, USB, SPI, and I2C. (BL-1)
2. Explain the UART, I2C, SPI interface using MSP430. (BL-2)
3. Compare synchronous and asynchronous interfaces. (BL-2)

Total hours:48 hours

Text Book(s):

- 1 “Microprocessor and Microcontrollers”, N. Senthil Kumar, M. Saravanan,S.Jeevanathan, Oxford Publishers, Second Edition, 2016
- 2 MSP430microcontrollerbasics.JohnH.Davies,NewnesPublication,IstEdition,2008
- 3 “The X86 Microprocessors , Architecture, Programming and Inerfacing” , Lyla B.Das ,Pearson Publications,2010

Reference Book(s):

- 1 Advanced microprocessors & microcontrollers”, A K Ray, K M Burchandi 3nd edition, 2013.
- 2 “Microprocessor and Interfacing: Programming and Hardware”, Douglas V.Hall, McGrawHill
- 3 “8086 microprocessor: Programming and Interfacing the PC”, Kenneth Ayala, Cengage Learning

NARAYANA ENGINEERING COLLEGE:GUDUR

20EC3010 **DATA COMMUNICATIONS & NETWORKING** R2020

Semester	Hours / Week			Total hrs	Credit	Max Marks		TOTAL
	L	T	P			CIE	SEE	
	3	0	0	48	3	40	60	100

Pre-requisite: Programming Course, Introduction to Operating Systems Course, Network Communication Course, Wireless Communications Course.

Course Objectives:

6. To understand the basics of data communication and various network categories
 7. To Demonstrate different switching datagram networks
 8. To interpret different multiple access techniques
 9. To outline the importance of network layer
 10. To summarize the significance of transport layer
11. To Illustrate various technologies like SONET,STS Multiplexing, ATM

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

- CO 1** Demonstrate the basics of data communication and various network categories. **(BL-02)**
- CO 2** Analyze the switching datagram networks. **(BL-03)**
- CO 3** Interpret different multiple access techniques. **(BL-02)**
- CO 4** Outline the importance of network layer. **(BL-02)**
- CO 5** Analyze the significance of transport layer. **(BL-04)**

CO-PO Mapping														
CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3													
CO2	2		1										1	1
CO3	3		2										2	2
CO4	2	1	1										1	1
CO5	2	1	1										2	1

1: Low, 2-Medium, 3- High

**COURSE CONTENT
MODULE-1**

INTRODUCTION

08 HRS

Introduction, components and characteristics of data communication, data representation, Data Transmission mode-simplex, half duplex, full duplex, Difference between Digital and Data Communication, Serial and parallel data transmission, Multiplexing.

Introduction to networks: Definition of Computer Network, Applications of Computer Networks, Categories Networks-LAN, MAN and WAN , Concept of Protocol , Open System Interconnection (OSI) Model, TCP / IP.

At the end of the Module 1, students will be able to:

1. Understand various data transmission modes. (BL-02)
2. Compare digital and data communication (BL-02)
3. List the various applications of computer networks. (BL-01)

MODULE2 SWITCHING CONCEPTS

08 HRS

Virtual Circuit Networks, Structure of a switch, Ethernet Physical Layer, Data Link Layer-Error detection and Correction.

Data Link Control: Framing, Flow and Error Control Protocols, Noiseless Channel and Noisy Channel Protocol, HDLC, Point-to-Point Protocol.

At the end of the Module 2, students will be able to:

- understand the concept of virtual circuit networks (BL-02)
- Explain error detection and correction(BL-02)
- Compare noisy and noiseless channels. (BL-02)
- Illustrate the point to point protocol. (BL-02)

MODULE-3 Multiple Access Technologies

08 HRS

RANDOH, CDMA, CSMA/CD, CSMA/CA, Controlled Access, Channelization, Wired LANs: IEEE Standards, Standard Ethernet, Fast Ethernet, Gigabit Ethernet, Wireless LAN, IEEE 802.11, Bluetooth IEEE 802.16

At the end of the Module 3, students will be able to:

1. Explain the different multiple accessing techniques. (BL-02)
2. List the various IEEE Standards. (BL-01)
3. Understand the concept of Fast Ethernet (BL-02)
- Compare the standard Ethernet with the fast Ethernet. (BL-02)

MODULE-4 Network Layer

08 HRS

Design Issues, Routing Algorithms, congestion control algorithms, IPV4 Addresses, connectingDevices, Virtual LAN IPV6 Addresses, Internet Protocol, Hardware Addressing versus IP Addressing, IP Data Gram.

At the end of the Module 4, students will be able to:

1. Outline the design issues of network layer (BL-02)
2. Explain the concept of routing algorithms(BL-02)
3. Compare Hardware Addressing versus IP Addressing. (BL-02)
4. Understand the concept of IP data gram(BL-02)

MODULE-5 Transport Layer

08HRS

Transport Layer Protocol, User Datagram Protocol(UDP) and Transmission Control Protocol(TCP), Automated Teller Machine(ATM), Cryptography-Introduction, types and applications, Network Security- levels and types, Cellular telephony; SONET / SDH

At the end of the Module 4, students will be able to:

1. Explain TCP and UDP protocols. (BL-02)
2. Understand the basic concepts of cryptography. (BL-02)
3. Outline the features of ATM(BL-02)
4. List the features of cryptography (BL-01)
5. understand the concept of SONET (BL-02)

Total hours: 48 hours

Text Book(s):

1. Wayne Tomasi, "Introduction to Data Communications and Networking", 2005, Pearson Education, India.
2. Fred Halsall, Lingana Gouda Kulkarni (2006), Computer Networking and the Internet, 5th edition, Pearson Education India, New Delhi, India.
3. Behrouz A Forouzan, Debdeep Mukhopadhyay, "Cryptography and Network Security", 2nd edition, Tata McGraw Hill, India.

Reference Book(s):

1. Behrouz A Forouzan (2007), Data Communications and Networking, 4th edition, Tata McGraw Hill, India
2. A. S. Tanenbaum, "Computer Networks", PHI.
W. Stallings, "Data and Computer Communication", PHI

NARAYANA ENGINEERING COLLEGE:GUDUR

20EC3011 **DIGITAL LOGIC DESIGN**

R2020

Semester	Hours / Week			Total hrs	Credit	Max Marks		TOTAL
	L	T	P			CIE	SEE	
	3	0	0	48	3	40	60	100

Pre-requisite: Basic knowledge on number system and algebra.

Course Objectives:

- To study the basic concepts of number systems and binary codes.
- To minimize Boolean expressions using map and Q-M method.
- To design combinational and sequential circuits.
- To familiarize Registers & counters using Flip-Flops.
- To understand the concept of memory organization

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

- CO 1** Demonstrate the basic number systems, binary codes and Boolean algebra **(BL-2)**
- CO 2** Apply minimization techniques on Boolean expressions. **(BL-3)**
- CO 3** Design combinational circuits using logic gates **(BL-3)**
- CO 4** Analyze synchronous sequential circuits. **(BL-4)**
- CO 5** Illustrate the classification of memories and programmable logic devices **(BL-2)**

CO-PO Mapping														
CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2											1
CO2	2	2	2										1	
CO3	2	2	2										1	1
CO4	2	2	2										2	1
CO5	2	1	1										1	1

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1 NUMBER SYSTEMS & BOOLEAN ALGEBRA 10 h

Number Systems: Introduction, Number Systems, Number base conversions, 1's and 2's Complements, BCD code, Excess -3 codes, Gray code, ASCII code, Error Detection and Correction Codes.

Boolean Algebra: Basic definition, Basic theorems and properties, Boolean Functions, Canonical & Standard forms, Logic gates, implementation of Boolean functions using logic gates

At the end of the Module 1, students will be able to:

1. List number systems. (BL-1)
2. Illustrate different code conversions. (BL-2)
3. List Theorem's and properties of Boolean algebra (BL-1)
4. Explain the functionality of logic gates (BL-2)

MODULE -2 SIMPLIFICATION OF BOOLEAN FUNCTIONS 8 h

Introduction, Karnaugh map simplification, Don't care conditions, Prime Implicants, Quine-McCluskey method Simplification, NAND & NOR Implementations, Two Level Implementations.

At the end of the Module 2, students will be able to:

1. Apply basic laws and De Morgan's theorems to simplify Boolean expressions (BL-3)
2. Explain map and Q-M method to minimize Boolean expressions. (BL-2)
3. Implement Boolean expression using universal gates. (BL-3)
4. Implement Boolean expression using two level methods. (BL-3)

MODULE-3 COMBINATIONAL CIRCUITS**10 h**

Introduction, Design Procedure, Adders, Subtractor, Binary Adder-Subtractor, BCD Adder, Binary Multiplier, Magnitude Comparator, Multiplexers, De-multiplexers, Decoders, Encoders and Code Converters.

At the end of the Module 3, students will be able to:

1. Design combinational logic circuits. (BL-3)
 2. Implement Boolean expression using multiplexer. (BL-3)
 3. Implement higher order MUX using lower order MUX. (BL-3)
4. Design code converters using gates. (BL-3)

MODULE-4 SEQUENTIAL CIRCUITS**12 h**

Introduction, Latches, Flip-flops, Master-slave flip flops, Edge-triggered flip-flops, Flip-Flop conversions, Design of Synchronous Sequential Circuits: State Equations, State Table, State reduction, State assignment, State diagram, Mealy and Moore machine models, Registers, Shift Registers, Counters: Synchronous counters, Asynchronous counters & other counters.

At the end of the Module 4, students will be able to:

4. Describe behavior of latches & flip flops. (BL-2)
 5. Analyze the flip-flop conversions. (BL-3)
 6. Analyze synchronous sequential circuits. (BL-3)
 7. Explain the design procedure of sequential circuits. (BL-2)
8. Design synchronous sequential circuits using state reduction & assignment process. (BL-3)

MODULE-5 MEMORY & PROGRAMMABLE LOGIC DEVICES**8 h**

Introduction, Random Access Memory, Types of RAM, Memory decoding, Read Only Memory, Types of ROM, Flash memory, Programmable Logic Devices (PLDs): Basic concepts, Programmable Read Only Memory (PROM), Programmable Array Logic (PAL) and Programmable Logic Array (PLA).

At the end of the Module 5, students will be able to:

4. Explain PROM, PAL and PLA. (BL-2)
 5. Compare digital logic families. (BL-2)
6. Illustrate the characteristics of digital IC's. (BL-2)

Total hours: 48 hours**Text Book(s):**

1. M. Morris Mano, M.D. Ciletti, "Digital Design", 5th edition, Pearson, 2018.
2. R. P. Jain, "Modern Digital Electronics", 4th edition, McGraw Hill Education (India Private Limited), 2012.
3. Anil K. Maini, "Digital Electronics: Principles, Devices and Applications", Willey, 2007

Reference Book(s):

1. Anand Kumar, Switching Theory and Logic Design, PHI, 2008
2. Charles H. Roth, Fundamentals of Logic Design, Thomson Publications, 5th Edition, 2004.
3. John. M Yarbrough, "Digital Logic Applications and Design", Thomson Learning, 2006.

NARAYANA ENGINEERING COLLEGE:GUDUR

20EC3012	PRINCIPLES OF COMMUNICATION							R2020
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
	3	0	0	48	3	40	60	100

Pre-requisite: Basic knowledge on analog and digital signals

Course Objectives:

- 1 To understand the classification of electronic communication systems, various sources and types of noise.
- 2 To summarize the different amplitude modulation techniques.
- 3 To compare angle modulation techniques.
- 4 To understand the concept of sampling and various pulse modulation techniques
- 5 To select the appropriate modulation and demodulation techniques for transmission and reception of digital signals

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

- CO 1** Summarize the different amplitude modulation techniques. **(BL-2)**
- CO 2** Explain the angle modulation techniques **(BL-2)**
- CO 3** Illustrate the concept of sampling and various pulse modulation techniques **(BL-2)**
- CO 4** Select the appropriate modulation and demodulation techniques for transmission and reception of digital signals**(BL-3)**
- CO 5** Apply various coding techniques for obtaining maximum coding efficiency**(BL-3)**

CO-PO Mapping														
CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PSO 2
CO1	3	1												
CO2	3	2	1										2	1
CO3	3	1	2										1	1
CO4	3	1											1	1
CO5	2	2	2										1	1

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1 AMPLITUDE MODULATION

10Hrs

Elements of communication system, classification of electronic communication systems, Sources of information, Analog, Digital and Pulse signals, Message, Information.

Amplitude Modulation: Definition of modulation, Time domain and frequency domain representation of AM signal, Generation and Demodulation of AM waves, Bandwidth and power relations, Generation and demodulation of DSB-SC& SSB-SC, Comparison of amplitude modulation techniques.

At the end of the Module 1, students will be able to:

- 1 Understand the elements of communication system (BL-2)
 - 2 Summarize the types of electronic communication systems (BL-2)
 - 3 Explain the concept and need of modulation. (BL-2)
 - 4 Outline the different modulation systems. (BL-2)
- 5 Compare different amplitude modulation techniques. (BL-2)

MODULE-2 ANGLE MODULATION

10Hrs

Introduction to angle modulation, Frequency and Phase modulations, Advantages of FM over AM, Bandwidth considerations, Narrow Band and Wide Band FM, Generation of FM waves – Direct method, Indirect method, Demodulation of FM: Slope demodulators, Foster-Seelay demodulator.

Noise: Sources of noise, Classification of noise, Noise bandwidth, Signal to noise ratio, Noise temperature, noise figure and Power spectral density

At the end of the Module 2, students will be able to:

- 1 Explain different angle modulation techniques. (BL-2)
 - 2 Outline the advantages of FM over AM. (BL-2)
 - 3 Compare FM and PM. (BL-2)
- 4 Explain various noise sources and parameters.(BL-2)

MODULE-3 SAMPLING THEORY AND PULSE MODULATION

10Hrs

Sampling theory: Introduction, Sampling theorem for band limited signals, Nyquist rate and Nyquist interval, Sampling techniques.

Pulse Modulation: Pulse amplitude modulation (PAM) & demodulation, Pulse Width and Pulse Position modulations and demodulation schemes, Multiplexing-Frequency Division Multiplexing, Time Division Multiplexing.(Qualitative treatment only)

At the end of the Module 3, students will be able to:

- 1 Understand the concept of sampling and nyquist interval. (BL-2)
 - 2 Summarize different sampling techniques. (BL-2)
 - 3 Explain various pulse modulation techniques. (BL-2)
- 4 Compare FDM and TDM. (BL-2)

MODULE-4 DIGITAL TRANSMISSION AND MODULATION

09 Hrs

Digital Transmission: Base band digital signals, Advantages of digital communication, Block diagram of PCM, Quantization, Effect of quantization, Quantization error, DM, ADM and comparison.(Qualitative treatment only)

Digital Modulation: ASK, FSK, PSK, Modulation and Demodulation - Coherent and Non-coherent techniques. (Qualitative treatment only)

At the end of the Module 4, students will be able to:

1. Outline the advantages of digital communication. (BL-2)
 2. Compare different digital communication techniques. (BL-2)
3. Explain various digital modulation techniques. (BL-2)

MODULE-5 INFORMATION THEORY AND CODING

09Hrs

Concept of Information, Entropy and Rate of Information, Coding efficiency, Shannon-Fano and Huffman Coding, Error Control Coding, Error Detection and Correction Codes, Block Codes. (Qualitative treatment only)

At the end of the Module 5, students will be able to:

- 1 Explain the concept of information and entropy. (BL-2)

- 2 Apply various coding techniques to achieve maximum coding efficiency. (BL-3)
- 3 Explain error detection and correction codes. (BL-2)

Total hours: 48 hours

Text Book(s):

- 1 Herbert Taub and Donald L. Schilling, "Principles of Communication Systems", Tata McGraw Hill Publication.
- 2 R.P. Singh and S D Sapre, Communication Systems – Analog and Digital, TMH, 2nd edition 2007.
- 3 Simon Haykin, Communication Systems, John Wiley, 2nd edition 2007.

Reference Book(s):

- 1 Communication Systems Engineering – John. G. Proakis and Masoud Salehi, PHI, 2nd Ed. 2004.
- 2 B.P.Lathi, "Modern Digital and Analog Communication Systems", Oxford University Press.
- 3 Sam Shanmugam, Digital and Analog Communication Systems, John Wiley, 2006.