COURSE STRUCTURE
AND
DETAILED SYLLABUS

R-18

ELECTRONICS AND COMMUNICATION ENGINEERING

For

B.TECH. FOUR YEAR DEGREE COURSE

(Applicable for the batches admitted for the Academic Year 2018-19)

(I-IV Year Syllabus)

RAJIV GANDHI UNIVERSITYR OF KNOWLEDGE TECHNOLOGIES

Basar, Nirmal, Telangana State – 504107, India.

COURSE STRUCTURE: ELECTRONICS AND COMMUNICATION ENGINEERING

B16 Batch Course Structure for B.Tech
Electronics and Communications Engineering (RGUKT-Basar)

I SEMESTER

Sl. No.	Course Code	Course Title	Course Category	Hours per week			Total contact hours	Credits
				L	T	P		
1	MA1101	Mathematics – I (Matrix theory and Calculus)	BSC	3	1	0	4	4
2	CY1001	Chemistry	BSC	3	1	0	4	4
3	CY1601	Chemistry Lab	BSC	0	0	3	3	1.5
4	ME1001	Engineering workshop	ESC	2	0	0	2	2
5	ME1601	Engineering workshop Lab	ESC	0	0	2	2	1
6	HS1101	Communication Skills-I	HSMC	2	0	0	2	0
7	CS1001	Programming for Problem Solving	ESC	3	0	0	3	3
8	CS1601	Programming for Problem Solving Lab	ESC	0	0	4	4	2
Total				13	2	9	24	17.5
Induction Program (Non-credit)- Syllabus as per AICTE guide lines								

II SEMESTER

Sl. No.	Course Code	Course Title	Course Category	Hours per			Total	Credits
				L	T	P		
1	EE1002	Basic Electrical Engineering	ESC	3	1	0	4	4
2	EE1602	Basic Electrical Engineering lab	ESC	0	0	2	2	1
3	MA1201	Mathematics – II (Differential equations, Vector calculus)	BSC	3	1	0	4	4
4	PH1001	Physics	BSC	3	1	0	4	4
5	PH1601	Physics Lab	BSC	0	0	3	3	1.5
6	CE1001	Engineering Graphics	ESC	1	0	4	5	3
7	HS1001	English	HSMC	2	0	0	2	2
8	HS1601	English Language Lab	HSMC	0	0	2	2	1
9	BM0005	Constitution of India	MC	2	0	0	2	0
10	HS1201	Communication Skills – II	HSMC	2	0	0	2	0
Total				16	3	11	30	20.5

III SEMESTER

Sl. No.	Course Code	Course Title	Course Category	Hours per week			Total contact hours	Credits
				L	T	P		
1	EC2101	Digital Electronic Circuits	PCC	3	0	0	3	3
2	EC2701	Digital Electronic Circuits lab	PCC	0	0	2	2	1
3	EC2102	Electronic Devices and Circuits	PCC	3	1	0	4	4
4	EC2702	Electronic Devices and Circuits lab	PCC	0	0	2	2	1
5	EC2103	Signals and Systems	PCC	3	1	0	4	4
6	EC2901	Electronics mini Project-I	PJT	0	0	2	2	1
7	MA2101	Mathematics-III (Linear algebra, Complex analysis)	BSC	3	1	0	4	4
8	HS2101	Essence of Indian Traditional Knowledge	MC	2	0	0	2	0
9	BS2101	Environmental Science	MC	3	0	0	3	0
Total				16	3	6	26	18

IV SEMESTER

Sl. No.	Course Code	Course Title	Course Category	Hours per week			Total contact hours	Credits
				L	T	P		
1	EC2201	Analog Circuits	PCC	3	0	0	3	3
2	EC2801	Analog Circuits lab	PCC	0	0	2	2	1
3	EC2202	Control systems	PCC	3	0	0	3	3
4	EC2203	Electromagnetic Waves	PCC	3	0	0	3	3
5	EC2204	Probability Theory and Stochastic Processes	PCC	3	1	0	4	4
6	CS2205	Object Oriented Programming	ESC	3	0	0	3	3
7	CS2804	Object Oriented Programming lab	ESC	0	0	2	2	1
8	EC2902	Electronics mini Project-II	PJT	0	0	2	2	1
9	BM0007	Managerial Economics and Financial analysis	HSMC	3	0	0	3	3
Total				18	1	6	25	22

V SEMESTER

Sl. No.	Course Code	Course Title	Course Category	Hours per week			Total contact hours	Credits
				L	T	P		
1	EC3101	Analog and Digital Communications	PCC	3	0	0	3	3
2	EC3701	Analog and Digital Communications lab	PCC	0	0	2	2	1
3	EC3102	Computer Architecture	PCC	3	0	0	3	3
4	EC3103	Digital Signal Processing	PCC	3	0	0	3	3
5	EC3702	Digital Signal Processing lab	PCC	0	0	2	2	1
6	EC3104	RF and Microwave Engineering	PCC	3	0	0	3	3
7	EC3703	RF and Microwave Eng. Lab	PCC	0	0	2	2	1
8	EC3105	VLSI Engineering	PCC	3	0	0	3	3
9		Open Elective-1 (Preferably Numerical Methods)		3	0	0	3	3
10	ECSEM	Technical Seminar (on recent trends)	PJT	0	0	2	2	1
Total				18	0	8	26	22

VI SEMESTER

Sl. No.	Course Code	Course Title	Course Category	Hours per week			Total contact hours	Credits
				L	T	P		
1	EC3201	Digital System Design	PEC	3	0	0	3	3
2	EC3801	Digital Systems Design and VLSI Lab	PCC	0	0	2	2	1
3	EC3202	Micro-Controllers and Interfacing	PCC	3	0	0	3	3
4	EC3802	Micro-Controllers lab	PCC	0	0	2	2	1
5	EC_	Pattern Recognition	PEC	3	0	0	3	3
6	CS3203	Operating Systems	ESC	3	0	0	3	3
7	BM0003	Operations Research (Management Dept)	HSMC	3	0	0	3	3
8	ECP01	Mini Project	PJT	0	0	4	4	2
9	ECCV-I	Comprehensive Viva-I						0
10	ECP02	Summer Internship						1
Total				15	0	8	23	20

VII SEMESTER

Sl. No.	Course Code	Course Title	Course Category	Hours per week			Total contact hours	Credits
				L	T	P		
1	EC_	Signal Processing stream elective	PEC	3	0	0	3	3
2	EC_	Communications stream elective	PEC	3	0	0	3	3
3	EC_	Embedded systems stream elective	PEC	3	0	0	3	3
4	ECP03	Project Stage-I	PJT	0	0	6	6	3
5	BM0010	Professional Law and Ethics	HSMC	3	0	0	3	3
6	CS4101	Computer Networks	ESC	3	0	0	3	3
7	CS4701	Computer Networks lab	ESC	0	0	2	2	1
Total				15	0	8	23	19

VIII SEMESTER

Sl. No.	Course Code	Course Title	Course Category	Hours per week			Total contact	Credits
				L	T	P		
1	EC_	Program Elective-4 (Preferably course on Antennas)	PEC	3	0	0	3	3
2	EC_	Open Elective-3	PEC	3	0	0	3	3
3		Open Elective-4		3	0	0	3	3
4		Open Elective-5		3	0	0	3	3
5	ECP04	Project Stage-II	PJT			16	16	8
6	ECCV-II	Comprehensive viva-II						0
Total				12	0	16	28	20

B16 Batch Course Curriculum for B.Tech
Electronics and Communications Engineering (RGUKT-Basar)

I SEMESTER

MA1101 **MATHEMATICS - I**

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **4-0-0-4**

Course Objectives:

- To give a thorough explanation of real sequences and series.
- To introduce the concepts of Euclidean space and the behavior of functions in them.
- To emphasize the applications of differentiation on real functions and their geometrical inferences.
- Introduction to Numerical analysis.
- To Introduce Fourier series and it's applications.

Course Outcomes:

At the end of the course student will be able to

- Explain concept of limit of function of two variables
- Understand the two path criterion to show that a limit does not exist and apply it to solve problems about limits
- Memorize definition of partial derivative and illustrate geometric meaning withthe aid of sketches.
- Provide geometrical meaning of second partial derivative with respect to onevariable
- Calculate directional derivatives and gradients &Apply it to solve problems involving steepest ascent and normal vectors to level curves.
- Apply the method of Lagrange Multipliers to solve such constrained optimization problems.
- Understand & apply various theorems like, Rolle's theorem.Lagrange's Mean value theorem, Cauchy Mean Value theorem in Calculus.
- Understand & Apply various tests for convergence of sequences & series
- Find the find the fourier series of periodic functions
- Find the Fourier sine and cosine series for functions defined on an interval.
- Use to numerical methods in modern scientific computing
- Find the roots of various types of equations using Numerical methods & find the area under the curve using Trapezoidal Rule, Simpson $\frac{1}{3}$ Rule, Simpson $\frac{3}{8}$ Rule

UNIT-I

Sequence: Definition of sequence, convergence, limit of a sequence, divergence, oscillation, bounded and monotonic sequences, Bounded sequences,Sandwich theorem, Algebra of limits, L'Hospital Rule in sequences, subsequences and its limit.

Series: Infinite series, partial sum, convergence, divergence, oscillation, Geometric series, Telescoping series, Algebra of Limits, n^{th}- term test, Comparison test, Comparison test (Limit Form), Integral test, D'Alembert's Ratio test, Cauchy's Root test, Alternating series, Leibnitz's Rule, Absolute convergence, Conditional convergence, Power series, Radius of convergence for a power series.

UNIT-II

Differential calculus: Rolle's theorem, Lagrange's mean value theorem, Cauchy's Mean-value theorem, Taylor's Theorem and Expansion, Maclaurin's Theorem and Expansion, Indeterminate forms and application of L'Hospital Rule. Radius of curvature, Envelope, Increasing and decreasing functions, concavity, convexity and point of inflexion, Asymptotes-Curve Tracing(Sketching)

UNIT-III

Functions of Several Variable Calculus:
Definition of continuity and differentiability in single variable, n-dimensional Euclidean space, Neighborhood of a point in n-dimensional Euclidean space, Functions in n-variables, Functions in 2 & 3 variables, Interior points, Boundary points, open and closed regions,Limit and continuity, Two-path test, Discontinuities, Partial Differentiation, Clairaut's theorem(for mixed Partial Derivatives), Laplace equation, Homogeneous functions , Euler's theorem for Homogeneous functions, Differentials and derivatives, Derivatives of composite functions, Chain Rule, Jacobians, Taylor's Theorem, Maxima and minima, Lagrange's method of multipliers.

UNIT-IV:

Fourier Series:
Definition of Fourier Series, Fourier Series representation of function, Limit of Convergence of Fourier Series, Even & Odd functions, Gibb's Phenomenon, Sine and Cosine Series, Limit of Convergence of Sine & Cosine Series. Integration and Differentiation of Fourier Series, Bessel's Inequalities, Parseval's Theorem.

UNIT-V

Numerical Methods:

Introduction: True value, Approximate Value, Error, Error percentage, Application of Numerical Analysis in various fields.

Numerical Analysis in solving Algebraic equations: Algebraic equations, Transcendental equations, Bisection Method, Regula -Falsi Method, Newton-Raphson Method.

Numerical Integration: Trapezoidal Rule, Simpson $\frac{1}{3}$ Rule, Simpson $\frac{3}{8}$ Rule

Text Books:

1. Thomas Calculus, Maurice D.Wier, Joel Hass Eleventh Edition, Pearson Education ,2008
2. R.K. Jain & S.R.K.Iyengar, Advanced Engineering Mathematics, Third Edition, Narosa publications, 2007.
3. Erwin Kreyszig, Advanced Engineering Mathematics, 8th Edition, John Wiley & Sons Ltd 2006.

Suggested References:

1. B.S. Grewal and J.S. Grewal, "Higher Engineering Mathematics",(40th Edition), Khanna Publishers,2007
2. S.S. Sastry ,Introductory Methods of Numerical Analysis ,Third Edition, Prentice Hall India

CY1001 **CHEMISTRY**

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **3-1-0-4**

Unit I: Spectroscopy

Introduction to spectroscopy, electromagnetic radiations, different types of spectroscopy, principle of spectroscopy, spectrophotometer Microwave spectroscopy: principle, microwave spectra of diatomic molecules, selection rules for microwave spectra, applications of microwave spectroscopy: determination of bond length, dipole moment measurement, determination of isotopic mass of an element. Infrared spectroscopy: introduction and principles of IR, types of vibrations: bending and stretching, Hooke's law for stretching vibrations, characteristic frequencies of common functional groups, IR instrumentation, interpretation and applications of IR spectrum with examples.
Ultra-violet spectroscopy: Introduction and principle of UV spectroscopy, color interpretation with VBT and MOT, types of electronic transitions, selection rules, chromophores and auxochromes with examples, conjugation effect, absorption and intensity shifts, applications of UV spectroscopy.

Unit II: Chemical kinetics

Complex reactions: definition and classification of complex reactions, definition of reversible reactions with examples, rate law derivation for reversible reactions. Consecutive reactions: definition, rate law derivation and examples of consecutive reactions.Parallel reactions: definition, rate law derivation and examples of parallel reactions.Steady-state approximation: introduction, kinetic rate law derivation by applying steady state approximation in case of the oxidation of NO and pyrolysis of methane. Chain reactions: introduction, types and mechanism of chain reactions, stationary and non-stationary chain reactions with examples, deriving the kinetic rate equation using a general chain reaction. Photochemical reactions: introduction, Stark-Einstein law of photochemical equivalence, photophysical processes: IC, ISC, fluorescence and phosphorescence with examples, kinetic rate law derivation incase of photochemical decomposition of HI and photochemical combination of H_2 and Br_2.

Unit III: Electrochemistry

Types of electrodes: introduction, metal-metal ion electrodes, metal-insoluble salt-anion electrodes, calomel electrode, gas-ion electrodes, hydrogen and chlorine electrodes, oxidation-reduction electrodes, amalgam electrodes.

Types of cells: classification into chemical and concentration cells, chemical cells with transference and without transference, classification of concentration cells into electrolyte and

electrode concentration cells, electrolyte concentration cells with and without transference, amalgam and gas concentration cells, examples for these cells.

EMF and applications of EMF: determination of pH, determination of the valency of the ions, potentiometric titrations. pH: definition of pH and determination of pH by various methods, acid-base titrations. Thermodynamic data: enthalpy and entropy of cell reactions, Gibbs-Helmholtz equation and applications.

Unit IV: Corrosion and its prevention

Mechanism of Dry and wet corrosion (rusting of iron), Types of corrosion, galvanic corrosion, stress corrosion, pitting and crevice corrosion. Factors affecting corrosion, preventive measures (proper design, Cathodic and Anodic protection, Electroplating, tinning, galvanizing.

Unit V: Organic reactions and synthesis of a drug molecule

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecules like Aspirin, Ibuprofen.

Unit VI: Phase Rule:

Terminology, one component system (H_2O system, S- system and CO_2 – system), two components system, Cooling curves, simple eutectic system (Pb – Ag), system with congruent melting point (Zn – Mg).

Unit VII: Engineering Materials:

Polymers: Types of Polymerization (Chain & Step growth). Plastics: Thermoplastic & Thermo setting resins; Preparation, properties,engineering applications of PVC, Teflon and Bakelite.

Lubricants: Classification with examples-Characterstics of a good lubricant & mechanism of lubrication (thick film, thin film and extreme pressure) –properties of lubricants: viscosity, Cloud point, flash and fire points.

Refractories: Classification, characteristics of a good refractory and applications.

Nanomaterials: Introduction, preparation by sol-gel & chemical vapour deposition methods. Applications of nanomaterials.

Refer Books

1. Engineering Chemistry, Jain & Jain
2. Engineering Chemistry, Shashi Chawla
3. Chemistry for Engineers, B. K. Ambasta
4. Engineering Chemistry, H. C. Srivastava

ME1001 Engineering Workshop

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **2-0-0-2**

Course Objectives:

- To understand the basic manufacturing process of producing a component by casting, forming plastic molding, joining processes, machining of a component either by conventional or by unconventional processes.
- To understand the advanced manufacturing process of additive manufacturing process.

Course Outcome:

- Students will gain knowledge of the different manufacturing processes which are commonly employed in the industry, to fabricate components using different materials.

Module – 1:*Metal Casting*: Introduction, Tools, Types of Patterns, Pattern Materials, Types of casting – Sand, Die and other casting processes and Applications

Module – 2:*Metal Forming*: Introduction, Classification, Types of Bulk and sheet metal forming and Applications.

Module – 3:*Powder Metallurgy*: Introduction, Powder production methods, Compaction, Sintering, Secondary operations and Applications.

Module – 4:*Joining:* Types of Joining, Introduction to Welding, Brazing and soldering, Arc, Solid state welding processes.

Module – 5:*Conventional Machining processes*: Introduction to machining operations; Lathe operations, Drilling, Milling and Grinding.

Module – 6:*Unconventional Machiningprocesses*.

Module – 7:*CNC Machining and Additive manufacturing*

Text Books:

(i) Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.

(ii) Kalpakjian S. and Steven S. Schmid, "Manufacturing Engineering and Technology", 4th edition, Pearson Education India Edition, 2002.

Reference Books

(i)Gowri P. Hariharan and A. Suresh Babu,"Manufacturing Technology – I" Pearson Education, 2008.

(ii) Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice Hall India, 1998.

(iii) Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGrawHill House, 2017.

HS1101 COMMUNICATION SKILLS- I

Externals: 60 Marks **L-T-P-C**

Internals: 40 Marks **2-0-0-0**

Objectives:

- To make the students efficient communicators via experiential learning.
- To enhance learners' analytical and creative skills, so that they will be capable to address a wide variety of challenges in their professional lives.
- To help learners to improve the leadership qualities and professional etiquette
- To expose learners to an effective communicative environment.

SYLLABUS:

Unit I – Introduction to communication

Introduction – Importance of Communication Skills – Definition – Scope and Nature – Verbal and Nonverbal communication

Unit II – Reading Skills

Reading Comprehension of unseen passage – Prose – News Paper Reading and Analysis (Editorial)

Unit III - Grammar

1. Parts of Speech
2. Subject and predicate
3. Articles – Determiners
4. Conjunctions (Linkers; connectors; cohesive devices)
5. Verbs – Transitive and Intransitive - Finite and Infinite - Regular and Irregular - Modals
6. Tenses
7. Prepositions/Prepositional verbs
8. Adverbs – types and their order in sentences
9. Adjectives
10. Including Degrees of Comparison and also Quantifiers

Unit IV – Enhancing Vocabulary

Developing Professional vocabulary – Using Dictionary: Spelling – Grammar and Usage

Unit V - Composition

Paragraph – Essay - Expansion - Describing the Pictures – Giving Directions – Situational Dialogue writing – Social and Professional Etiquette – Telephone Etiquette

OUTCOMES:

Students will be able to:

- develop interpersonal communication, small group interactions and public speaking.
- exercise the writing assignments, precise writing for informational, persuasive and creative purposes.
- apply right form of structural usage of sentences in their written and oral communication.
- develop confidence and skills related reading comprehension.
- improve a logical framework for the critical analysis of spoken, written, visual and mediated messages upon a diverse platform.
- demonstrate the ability to apply vocabulary in practical situations.

Suggested References:

1. Joseph Mylal Biswas book of English Grammar
2. R. Murphy -Cambridge Press
3. Wren and Martin
4. The Good Grammar book by OUP
5. Communication skills by M. Raman and Sangeeta Sharma
6. How to Win Friends and Influence People by Dale Carnigie
7. How to Read and Write Better by Norman Lewis
8. Better English by Norman Lewis
9. Use of English Collocations by OUP
10. www.humptiesgrammar.com
11. www.bbcactiveenglish.com
12. www.gingersoftware.com
13. www.pintest.com

CS1001 PROGRAMMING FOR PROBLEM SOLVING

Externals: 60 Marks **L-T-P-C**
Internals: 40 Marks **3-0-0-3**

Objectives:

- To introduce the basic concepts of Computing environment, number systems and flowcharts
- To familiarize the basic constructs of C language – data types , operators and expressions
- To understand modular and structured programming constructs in C
- To learn the usage of structured data types and memory management using pointers
- To learn the concepts of data handling using pointers

Detailed Contents:

UNIT-I: Introduction to Programming & Arithmetic expressions and precedence(8 Lectures)

Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.) - (1 lecture).
Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode with examples. (1 lecture)
From algorithms to programs; source code, variables (with data types) variables andmemory locations, Syntax and Logical Errors in compilation, object and executable code- (2 lectures) Arithmetic expressions and precedence (2lectures).

UNIT-II: Conditional Branching , Loops & Arrays(12 Lectures)

Writing and evaluation of conditionals and consequent branching (3 lectures) Iteration and loops (3 lectures**)**
Arrays (1-D, 2-D), Character arrays and Strings(6 lectures)

UNIT-III: Function & Basic Algorithms(11 Lectures)

Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference(5 lectures)

Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)(6 lectures)

UNIT-IV: Recursion &Structure(9 lectures)

Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.(5 Lectures) Structures, Defining structures and Array of Structures(4 lectures)

UNIT-V: Pointers & File handling(7 lectures)

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

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

Suggested Text Books

(i) Byron Gottfried, Schaum's Outline of Programming with C,McGraw-Hill

(ii) E. Balaguruswamy, Programming in ANSI C, TataMcGraw-Hill

Suggested Reference Books

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

Course Outcomes:

- Formulate simple algorithms for arithmetic and logical problems.
- Translate the algorithms to programs (in c language).
- Test and execute the programs and correct syntax and logical errors.
- Implement conditional branching, iteration and recursion.
- Decompose a problem into functions and synthesize a complete program using divide and conquer approach.
- Use arrays, pointers and structures to formulate algorithms and programs.
- Apply programming to solve matrix addition and multiplication problems and searching and sorting problems.
- Apply programming to solve simple numerical method problems, namely rot finding of function, differentiation of function and simple integration.

CY1601 ENGINEERING CHEMISTRY LABORATORY

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **0-0-3-1.5**

Course Objectives:

- To learn the preparation of organic compounds in the laboratory
- To estimate the hardness and alkalinity of the given sample of water
- To understand the Job's method for determining the composition
- Learns how to use the pH meter and polarimeter
- Synthesis of a pharmacutically active drug

1. **Synthesis**
   i. Synthesis of soap from cheap oil.
   ii. Synthesis of Thiokol rubber

2. **Volumetric analysis**
   i. Estimation of alkalinity of water
   ii. Estimation of total hardness of water by EDTA method

3. **Job's method**
   i. Determination of composition of Ferric-Thiocyanate complex by Job's method

4. **pH meter**
   i. Estimation of the strength of a weak acid by pH metry

5. **Polarimeter**
   i. Determination of specific rotation of sucrose by polarimeter

6. **Synthesis of Aspirin Drug (NSAID)**

Course Outcomes:

Minimum knowledge on basic synthesis, quantitative and qualitative analysis is being imparted

Reference books:

1. College Practical Chemistry by V K Ahluwalia, Sunita Dhingra, Adarsh Gulati
2. Practical Engineering Chemistry by K Mukkanti
3. A Text Book of Engineering Chemistry: by Shashi Chawla
4. Essentials of Experimental Engineering Chemistry by Shashi Chawla
5. Comprehensive Practical Organic Chemistry – Preparation and Quantitative analysis byV K Ahluwalia, Renu Aggarwal

ME1601 ENGINEERING WORKSHOP LABORATORY

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **0-0-2-1**

Course Outcomes: Upon completion of this laboratory course

- Students will be able to fabricate components with their own hands.

List of Experiments:

1. **Fitting –** Step and V Fit
2. **Carpentry** – Half lap joint and Dove tail joint
3. **House Wiring**– Series, Parallel, Staircase and Godown wiring
4. **Tin Smithy**– Tray and Cylinder
5. **Welding** – Bead formation, Butt and Lap joint welding
6. **Foundry**– Mold preparation with Single piece and Split piece pattern
7. **Machining** – Plain turning, Facing, Step and Taper turning
8. **Plastic molding** – Demo
9. **WIRE EDM, CNC, 3D Printer** – Demo

CS1601 **Programming for Problem Solving**

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **0-0-4-2**

Course Objectives

- Understand the fundamentals of programming in CLanguage.
- Write, compile and debug programs inC.
- Formulate solution to problems and implement inC.
- Effectively choose programming components to solve computingproblems

Detailed Contents:

List of Tutorials/Experiments:

Week 1

Tutorial 1: Problem solving using computers:

Lab1: Familiarization with programming environment

Week 2

Tutorial 2: Variable types and type conversions:

Lab 2: Simple computational problems using arithmetic expressions

1. Write a C program to find the area of a circle using the formula: Area = PI *r2
2. Write a C program to find the area and volume of sphere.
   (Formula are: Area =4*PI*R*R Volume =4/3*PI*R*R*R.)
3. Write a C program to convertcentigradeinto Fahrenheit.
   (Formula: C=(F-32)/1.8.)
4. Write a C program to read in twointegersand display one as a percentage of the other. Typically your output should looklike 20 is 50.00% of 40 assuming that the input numbers where 20 and 40. Display the percentage correct to 2 decimal places.

Week 3

Tutorial 3: Branching and logical expressions:

Lab 3: Problems involving if-then-else structures

1. Write a C program to find the maximum from given threenos.
2. Write a C program to find that the accepted no is Negative, Positive orZero.
3. Write a program which reads two integer values. If the first is lesser print the

message **"up"**. If the second is lesser, print the message **"down"** if they are equal, print the message **"equal"**if there is an error reading the data, print a message containing the word**"Error".**

4. Write a C program that prints the given three integers in ascending order using if –else.
5. Given as input three integers representing a date as day, month, year, print the number day, month and year for the next day's date. Typical input: "28 2 1992" Typical output: "Date following 28:02:1992 is29:02:1992"

Week 4 & 5

Tutorial 4: Loops, while and for loops:

Lab 4: Iterative problems e.g., sum of series

1. Write a C program to find the sum of first 100 odd nos. and even nos.
2. Write a C program to display first 100 primenos.
3. Write a C program to read in a three digit number produce followingoutput

   (Assuming that the input is 347) 3 hundreds, 4 tens, 7 units
4. Write a C program to display Fibonacciseries
5. Write a C program to calculate the following i.sum=1-x2/2!+x4/4!-x6/6!+x8/8!-x10/10!+…..... ,

   ii.sum=x-x3/3!+x5/5!. .....,

   iii.sum=1+x/1!+x^2/2!+x^3/3!..... ,
6. Write a C program to find the roots of a Quadraticequation.

Week 6

Tutorial 5: 1D Arrays: searching, sorting:

Lab 5: 1D Array manipulation

1. C program that reads N integer numbers and arrange them in ascending order using BubbleSort
2. C program that reads N integer numbers and arrange them in ascending order using selectionSort
3. C program that reads N integer numbers and arrange them in ascending order using insertion Sort
4. C program that reads N integer numbers and arrange them in ascending order using MergeSort

Week 7

Tutorial 6: 2D arrays and Strings

Lab 6: Matrix problems, String operations

1. Write a C program to perform the basic Matrixoperations

   i) Addition ii) Subtractioniii)Multiplicationiv)Transpose.

2. Write a C program to determine if the given string is apalindrome or not
3. Write a C program to count the lines, words and characters in a given text
4. Write a C program to search a word in a given sentence.

Week 8

Tutorial 7: Functions, call by value:

Lab 7: Simple functions

1. Write a C Function for the followingtask
   i) Calculating Factorial
   ii) Find value of a given Fibonacciterm
   iii) Swapping the values of twovariable

2. Write a C program that uses functions to performthe followingoperations:
   i) To insert a sub-string in to a given main string from a given position.
   ii) To delete n Characters from a given position in a given string.

Week 9

Tutorial 10: Recursion, structure of recursive calls

Lab 10: Recursive functions

1) Write the following recursive CFunction

i)Factorial of a givennumber

ii)Nth Fibonaccinumber

iii)Reverse of a givenString

iv)Reverse of a givenNumber

Week10

Tutorial 11: Pointers, structures and dynamic memory allocation

Lab 11: Pointers and structures

1. Write a C program to maintain a record of "n" student detailsusing an array of structures with four fields (Roll number, Name, Marks, and Grade). Assume appropriate data type for each field. Print the marks of the student, given the student name asinput.
2. Define structure called cricket that will describe the information player name, team name,batting aveg.Using cricket ,declare an array player with 10 elements and write program to read information about all 10 players and print team wise list containing names of the player with their battingavg

3. Write a program using pointers to compute the sum of all elements sorted in anarray
4. Write a program to print the elements of a structure usingpointers.

Week11

Tutorial 12: File handling

Lab 12: File operations

1. Write a C program that creates an Employee text file? RecordsAre empid, empname, designation, qualification, salary, experience, Research work, address, cityphone?

2. Write a C program that manipulates the above text file. The program must implements the operation to modify a record, delete a record and append newrecords

Course Outcomes

- Choose appropriate data type for implementing programs in Clanguage.
- Design and implement modular programs involving input output operations,decision making and loopingconstructs.
-
- Implement search and sort operations onarrays.
- Apply the concept of pointers for implementing programs on dynamic memory management and stringhandling.
- Design and implement programs to store data in structures andfiles.

Suggested Books:

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
2. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill Suggested Reference Books
3. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

II SEMESTER

EE1002 **BASIC ELECTRICAL ENGINEERING**

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **3-1-0-4**

Course Objectives

1. To explain the basic concepts and laws of DC and AC electrical networks and solve them using mesh and nodal analysis techniques.
2. To introduce students with the fundamental concepts in graph theory.
3. To analyse circuits in time and frequency domain.
4. To explain concepts of driving point and transfer functions, poles and zeroes of network function and their stability.
5. To synthesize the network using passive elements.
6. To analyse the transformers and coupled circuits.
7. To analyse the DC and AC generators & motors with applications.

UNIT-1

Introduction of Networks: Mechanism of electrical energy flow through the conductor and basic ohm's law, passive lumped R, L, C's and ohm's law, types of elements, sources, Kirchhoff's laws, Nodal and Mesh Analysis Techniques, Equivalent circuits with respect to passive R, L, C's, equivalent circuits with respect to active sources, source transformation technique, Power calculation by tellegen's theorem.

Network theorems: Superposition, reciprocity, Thevenin's, Norton's, Maximum power Transfer, compensation, Duality, Milliman's and Tellegen's theorem as applied to AC & DC circuits. Graph Theory: Complete graph or standard graph, connected graph, sub graph, tree of a graph, co-tree (complemented tree), planar graph etc. Incidence matrix, Fundamental loop matrix or tie set matrix, cut set matrix and its properties.

UNIT-2

Introduction to Transient Analysis: Classification of transients, DC transients: source free circuits (source free RL, RC, RLC circuits), with sources, initial and final conditions, Laplace transform approach (LTA) for solving transient problems. AC transients: steady state response and transient free condition for RL, RC, and RLC circuits.

AC circuit analysis: Sinusoidal steady state analysis by using phasors, phasor diagrams, concept of resonance or frequency domain analysis of RLC circuits. Average and RMS values of periodic

signals, power calculations, locus or circle diagrams. Filters (LPF, HPF, BPF, BSF, APF) or frequency domain analysis of RL, RC, RLC circuits, state equations for networks, transmission criteria.

UNIT-3

Two-Port networks: Symmetric and reciprocal networks. Z, Y, h, g, ABCD, A'B'C'D' parameters and it's equivalent circuit representations. Cascade connection of 2-two port networks, Two port network representation for ideal transformer. Inter relationships between parameters of two port network, proofs for symmetry and reciprocity conditions. Inter connection of two port networks (series and parallel two port networks). T and π representations, lattice networks, image parameters, ladder networks

Network Synthesis: Network functions, pole and zero's, one port network, driving point impedance and driving point admittance functions. Realizations or synthesis: Foster Form-I, Foster Form-II, Cauer Form-I, Cauer Form-II, properties of driving point immittance function, Properties of RC DP, RL DP functions & necessary conditions for PR (Positive Real) function, properties of Hurwitz polynomial function.

UNIT-4

Coupled circuits: Analysis of coupled circuits, self-inductance, mutual inductance, coefficient of coupling, series connection of coupled coils, modelling of coupled circuits, dot convention in coupled coils. Electrical equivalent of magnetically coupled circuits, tuned coupled circuits (single tuned and double tuned coils), example problems.

Transformers: Working Principle, construction, classification: core and shell types, theory on no load, e.m.f. equation, turns ratio, voltage ratio and current ratio, losses and efficiency, equivalent resistance, reactance and impedance, voltage regulation, constants of transformer, open circuit and short circuit tests, predetermination of efficiency and regulation, all-day efficiency, auto-transformer: saving of copper, practical applications.

UNIT-5:

DC Generator: Basic principle, construction, rectifying action of commutator, armature windings: LAP and WAVE, classification of generators: shunt, series and compound, E.M.F. equation, generator on load, operating characteristics, critical resistance, concepts of armature reaction and commutation, practical applications. **DC Motor:** Principle of operation, back e.m.f. speed and torque equations, mechanical power developed, classification of motors: series, shunt and compound, operating characteristics, speed control, practical applications, motor starter: its necessity, 3-point starter, losses and efficiency.

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction and working of synchronous generators.

Course Outcomes

1. apply the knowledge of basic circuital law and simplify the network using reduction techniques.
2. Analyse the circuit using Kirchhoff's law and Network simplification theorems
3. Infer and evaluate transient response, Steady state response, network functions
4. Obtain the maximum power transfer to the load, and Analyse the series resonant and parallel resonant circuit.
5. evaluate two-port network parameters, design attenuators and equalizers
6. Synthesize one port network using Foster and Cauer Forms.
7. Analyse the transformers and coupled circuits.
8. Analyse the DC and AC generators & motors with applications.

Text Books:

1. Van, Valkenburg.; "Network analysis" ; Prentice hall of India, 2000.
2. A William Hayt, "Engineering Circuit Analysis" 8th Edition, McGraw-Hill Education.
3. "A Textbook of Electrical Technology" by B L Theraja and A K Theraja.
4. "Basic Electrical and Electronics Engineering" by S K Bhattacharya.

Reference Books:

1. Sudhakar, A., Shyammohan, S. P.; "Circuits and Network"; Tata McGraw-Hill NewDelhi, 1994.
2. Kuo F. F., "Network Analysis and Synthesis", 2nd Ed., Wiley India., 2008.
3. "Principles of Electrical Engineering and Electronics" by Mehta V K and Mehta Rohit.
4. Electrical Technology by Yoganarasimhan.

MA1201 **MATHEMATICS-II**

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **3-1-0-4**

Course Objectives:

- Methods of solving the differential equations of first and higher order.
- To study the methods of solving improper integrals and the concepts of multiple integrals
- The basic properties of vector valued functions and their applications to line, surface and volume integrals
- To study numerical methods to analyze an experimental data.

Course Outcomes:

At the end of the course student will be able to

- Solve first order linear differential equations and special non linear first order equations like Bernouli , Riccati &Clairaut's equations
- Compute double integrals over rectangles and type I and II" regions in the plane
- Explain the concept of a vector field and make sketches of simple vector fields in the plane.
- Explain concept of a conservative vector field, state and apply theorems that give necessary and sufficient conditions for when a vector field is conservative, and describe applications to physics.
- Recognize the statements of Stokes' Theorem and the Divergence Theorem and understand how they are generalizations of the Fundamental Theorem of Calculus.
- Able to solve the problems in diverse fields in engineering science using numerical methods.

UNIT-I

Ordinary Differential Equations of first order: Exact first order differential equation, finding integrating factors, linear differential equations, Bernoulli's , Riccati , Clairaut's differential equations, finding orthogonal trajectory of family of curves, Newton's Law of Cooling, Law of Natural growth or decay.

UNIT-II

Ordinary Differential Equations of higher order:

Second order linear differential equations with constant coefficients: Non-Homogeneous terms of the type $e^{ax}, \sin(ax), \cos(ax)$, polynomials in$x, e^{ax}V(x), xV(x)$; method of variation of parameters; Equations reducible to linear ODE with constant coefficients: Legendre's equation, Cauchy-Euler equation.

UNIT-III

Integral Calculus:

Evaluation of the double integrals (Cartesian and Polar), change of order of integration (only Cartesian form), Evaluation of Triple integrals. Change of variables (Cartesian to polar) in case of double integrals (Cartesian to spherical and cylindrical) in case of Triple Integrals-Jacobians of transformations. Differentiation of integrals with variable limits - Leibnitz rule.

Applications: Finding Areas (using double integrals) and volumes (using double and Triple Integrals), Centre of mass, Centre of gravity for constant and variable densities by double and triple integrals (applications involving cubes, Sphere and rectangular parallelepiped)

UNIT-IV

Vector Differentiation: Vector point functions and scalar point functions. Gradient, Divergence and Curl. Directional derivatives, Tangent plane and normal line. Vector Identities. Scalar potential functions. Solenoidal and Irrotational vectors.

UNIT-V

Vector Integration: Line, Surface and Volume Integrals. Theorems of Green, Gauss and Stokes (without proofs) and their applications.

Numerical Methods: Introduction and motivation about numerical methods, True value, approximate value, error, error percentage, algebraic equations, transcendental equations, Newton-Raphson method, Bisection method.

Text Books:

1.Advanced Engineering Mathematics (3rd Edition) by R. K. Jain and S. R. K. Iyengar, Narosa Publishing House, New Delhi

References Books

1. Advanced Engineering Mathematics (8th Edition) by Erwin Kreyszig, Wiley-India.

2. Dr. M.D. Raisinghania,Ordinary andPartialdifferentialequations,S.CHAND,17thEdition2014.

PH1001 PHYSICS

Internals: 40 Marks **L - T - P - C**

Externals: 60 Marks **3 - 1 - 0 - 4**

Total Number of Modules: 41 (One Module ~ 1 to 1.5 hours of Lecture hours)

UNIT I: Vectors and Mathematical Physics (5)

Gradient, Divergence, Curl and its applications .Line, surface and volume integrals, Stokes and Gauss theorem, Curvilinear Coordinates: Polar, Cylindrical and spherical polar co-ordinates, Problems.

UNIT II: Quantum Mechanics (6)

Introduction to Quantum Mechanics, De-Brogile waves and uncertainity principle, Time dependant Schrodinger wave equation, Significance of Wave Function, Time independent Schrodinger wave equation and solution of generalized potential, Particle in a box, Quantized energies, Problems.

UNIT III:Electron Structure of solids (6)

Introduction to Crystallography, Bravais Lattices, Basis, Unit Cell, Miller Indices, Electron Theory, Kronig Penny model (E vs K), Band theory of solids.

UNIT -IV :Conductive Materials and Dielectrics (10 + 4)

Electrical Conductivity

Free electron Theory of metals, Joule's Law, Relaxation Time, Collision time, Mean free path, Factors effecting electrical conductivity, Applications of conducting materials

Thermal Conductivity

Thermal conductivity of metals, Wiedemann-Franz Law, Thermoelectric phenomenon

Superconductors

Superconductivity, Properties of Superconductors, Types of Super conductors, Applications of Superconductors.

Dielectrics

Introduction to Dielectrics, Homogentity, Isotropy, Linearity, Types of Polarisation, Internal fields, Classification of dielectric materials based on dielectric behaviour and special feautures.

UNIT V:Semiconductor Materials (10)

Electrical conductivity of metals, semiconductors and insulators, Electrons and holes in an Intrinsic semiconductor (Pure), Extrinsic materials, Mechanism of current flow in a semiconductor, Charge densities, Electrical properties of semiconductors, Hall Effect,

Thermistors, Photoconductors, Generation and recombination of carriers, Recombination and Diffusion, Total current (Diffusion and Drift), Electrical properties of semiconductor.

Reference books:

1. Arfken, Mathematical Physics

2. David Griffiths, Quantum Mechanics

3. Wahab, Solid State Physics

4. S M Sze, Semiconductor Devices: Physics and Technology, Wiley (2008)

5. P.K.Palaniswamy, Applied Physics

CE1001 **ENGINEERING GRAPHICS**

Externals: 60Marks **L-T-P-C**
Internals: 40Marks **1-0-4-3**

Course Objectives:

- To introduce the students to the "Universal Language of Engineers" for effective communication through drawing.
- To understand the basic concepts of drawing through modern techniques.
- To impart knowledge about standard principles of projection of objects.
- To provide the visual aspects of Engineering drawing using Auto-CAD.

UNIT-I:(15 Hours)

Introduction to Engineering Drawing: Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, types of lines and Dimensioning.
Over view of Auto-CAD: Theory of CAD software (The Menu System, Tool Bars, drawing area, Dialogue boxes, Shortcut Menu, the command lines, Select and erase objects, Introduction to layers etc.), Drawing simple figures- lines, planes, solids.

UNIT-II: (10 Hours)

Geometrical constructions: Construction of regular polygons.
Conic sections: Construction of Ellipse, Parabola, Hyperbola (General method only), Cycloid, Epicycloid, Hypocycloid and Involutes.
Scales: Construction of Plain, Diagonal and Vernier scales.

UNIT-III: (20 Hours)

Orthographic projections: Principles of Orthographic Projections
Projections of Points: Projections of Points placed in different quadrants
Projection of lines: lines parallel and inclined to both the planes (Determination of true lengths and true inclinations and traces)
Projection of planes: Planes inclined to both the reference planes

UNIT-IV: (15 Hours)

Projection of Solids: Projection of solids whose axis is parallel to one of the reference planes and inclined to the other plane, axis inclined to both the planes

Projection of sectioned solids: Sectioning of simple solids like prism, pyramid, cylinder and cone in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section.

UNIT-V: (12 Hours)

Development of surfaces: Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone

Isometric Projections: Principles of Isometric projection – Isometric Scale, Isometric Views of planes and simple solids

Perspective projections: Basic concepts of perspective views.

Course Outcomes:

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

- Use Engineering principles and techniques to understand and interpret engineering drawings.
- Understand the concepts of Auto-CAD.
- Draw orthographic projections of lines, planes and solids using Auto-CAD.
- Use the techniques, skills and modern engineering tools necessary for engineering practices.

Text/Reference Books:

1. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
2. Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Stores, Bangalore, 2007.
3. Shah, M.B. &Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
4. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age publications
5. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
6. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers
7. (Corresponding set of) CAD Software Theory and User Manuals

HS1001 **ENGLISH**

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **2-0-0-2**

INTRODUCTION:

In view of the growing importance of English as a tool for global communication and the consequent emphasis on training students to acquire language skills, the syllabus of English has been designed to develop linguistic, communicative and critical thinking competencies of Engineering students. In English classes, the focus should be on the skills development in the areas of vocabulary, grammar, reading and writing. For this, the teachers should use the prescribed text for detailed study. The students should be encouraged to read the texts leading to reading comprehension and different passages may be given for practice in the class. The time should be utilized for working out the exercises given after each excerpt, and also for supplementing the exercises with authentic materials of a similar kind, for example, newspaper articles, advertisements, promotional material etc. *The focus in this syllabus is on skill development, fostering ideas and practice of language skills in various contexts and cultures.*

Course Objectives: The course will help to

- Improve the language proficiency of students in English with an emphasis on Vocabulary, Grammar, Reading and Writing skills.
- Equip students to study academic subjects more effectively and critically using the theoretical and practical components of English syllabus.
- Develop study skills and communication skills in formal and informal situations.

Unit –I: 'The Raman Effect' from the prescribed textbook 'English for Engineers' published byCambridge University Press.

Vocabulary Building: The Concept of Word Formation --The Use of Prefixes and Suffixes.**Grammar:** Identifying Common Errors in Writing with Reference to Articles andPrepositions.**Reading:** Reading and Its Importance- Techniques for Effective Reading.**Basic Writing Skills:** Sentence Structures -Use of Phrases and Clauses in Sentences Importance of Proper Punctuation- Techniques for writing precisely – **Paragraph writing** –Types, Structures and Features of a Paragraph - Creating Coherence-Organizing Principles ofParagraphs in Documents.

Unit –II: 'Ancient Architecture in India' from the prescribed textbook 'English for Engineers'published by Cambridge University Press.

Vocabulary: Synonyms and Antonyms.**Grammar:** Identifying Common Errors in Writing with Reference to Noun-pronounAgreement and Subject-verb Agreement.**Reading:** Improving Comprehension Skills – Techniques for Good Comprehension**Writing:** Format of a Formal Letter-**Writing Formal Letters** E.g.., Letter of Complaint,Letter of Requisition, Job Application with Resume.

Unit –III: 'Blue Jeans' from the prescribed textbook 'English for Engineers' published by Cambridge University Press.

Vocabulary: Acquaintance with Prefixes and Suffixes from Foreign Languages in English toform Derivatives-Words from Foreign Languages and their Use in English.**Grammar:** Identifying Common Errors in Writing with Reference to Misplaced Modifiersand Tenses.**Reading:** Sub-skills of Reading- Skimming and Scanning**Writing**: Nature and Style of Sensible Writing- **Defining- Describing** Objects, Places andEvents – **Classifying**- Providing Examples or Evidence

Unit –IV: 'What Should You Be Eating' from the prescribed textbook 'English for Engineers'published by Cambridge University Press.

Vocabulary: Standard Abbreviations in English**Grammar:** Redundancies and Clichés in Oral and Written Communication.**Reading**: Comprehension- Intensive Reading and Extensive Reading**Writing: Writing Practices**--Writing Introduction and Conclusion - Essay Writing-PrécisWriting.

Unit –V: 'How a Chinese Billionaire Built Her Fortune' from the prescribed textbook 'Englishfor Engineers' published by Cambridge University Press.

Vocabulary: Technical Vocabulary and their usage**Grammar:** Common Errors in English**Reading:** Reading Comprehension-Exercises for Practice**Writing: Technical Reports**-Introduction – Characteristics of a Report – Categories ofReports Formats- Structure of Reports (Manuscript Format) -Types of Reports - Writing a Report.

Course Outcomes: Students should be able to
Use English Language effectively in spoken and written forms.

- Comprehend the given texts and respond appropriately.
- Communicate confidently in various contexts and different cultures.
- Acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

Prescribed Textbook:

1. Sudarshana, N.P. and Savitha, C. (2018). English for Engineers. Cambridge University Press.

References:

1. Swan, M. (2016). Practical English Usage. Oxford University Press.
2. Kumar, S and Lata, P.(2018). Communication Skills. Oxford University Press.

3. Wood, F.T. (2007).Remedial English Grammar. Macmillan.
4. Zinsser, William. (2001). On Writing Well. Harper Resource Book.
5. Hamp-Lyons, L. (2006).Study Writing. Cambridge University Press.
6. Exercises in Spoken English. Parts I –III. CIEFL, Hyderabad. Oxford University Press.

BM0005 CONSTITUTION OF INDIA

Externals: 60Marks **L-T-P-C**
Internals: 40Marks **2-0-0-0**

8.1 Constitution of India – Basic features and fundamental principles

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

The Constitution of India is not only a legal document but it also reflects social, political and economic perspectives of the Indian Society. It reflects India's legacy of "diversity". It has been said that Indian constitution reflects ideals of its freedom movement, however, few critics have argued that it does not truly incorporate our own ancient legal heritage and cultural values. No law can be "static" and therefore the Constitution of India has also been amended more than one hundred times. These

amendments reflect political, social and economic developments since the year 1950. The Indian judiciary and particularly the Supreme Court of India has played an historic role as the guardian of people. It has been protecting not only basic ideals of the Constitution but also strengthened the same through progressive interpretations of the text of the Constitution. The judicial activism of the Supreme Court of India and its historic contributions has been recognized throughout the world and it gradually made it "as one of the strongest court in the world".

Course content

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

HS1201 **Communication Skills II**

Externals: 60 Marks **L-T-P-C**
Internals: 40 Marks **2-0-0-0**

Objectives:

- To develop the learners ability to read fluently and critically.
- To make awareness of the common punctuation marks and the importance of it in writing
- To build academic vocabulary of the learners
- To offer the learners opportunity to practice creative writing
- To make the learners apply the skills and strategies of a successful listener

Unit I – Reading

Reading Skills – Importance - Definition –Types -Techniques and strategies

Unit II – Punctuation and Capitalization

Punctuation - Use of Capital Letters

Unit III – Vocabulary

1. Antonyms
2. Synonyms
3. Affixation
4. Vocabulary in context
5. Proverbs /Collocations
6. One word substitutes
7. Idioms and Phrasal verbs

Unit IV – Writing Skills
Creative writing – Story Writing – Precise - Letter writing

Unit V - Listening
Listening Skills – Academic Listening – Listening to Talks and Presentations – Note Taking

Course Outcomes:

The learners will be able to:

- Make use of contextual clues to infer meanings of unfamiliar words from context and make inferences and predictions based on comprehension of a text
- Punctuate simple sentences correctly
- Produce appropriate vocabulary and correct word forms;

- Write creatively and accurately. They will also have a critical awareness of their writing in terms of unity, content, coherence and linguistic accuracy (grammatical structure and choice of vocabulary).
- Comprehend the talks and presentations, take organized notes on lectures and listening passages

References:

1. Meenakshi Raman and Sangeeta Sharma ***"Communication skills"*** Oxford University press, 2013
2. Wren and Martin, NDV Prasad Rao. *"**High School English Grammar and Composition***" S. Chand& Compay Ltd, 2012
3. Michael Swan, ***"Practical English Usage"*** 3rd edition: guide to problems in English, Oxford University press, 2011
4. Edgar Thorpe and Showick Thorpe, ***"Objective English"*** 3rd Edition, Pearson, 2010

EE1602 BASIC ELECTRICAL ENGINEERING LAB

External:60 Marks **L-T-P-C**
Internal:40 Marks **0-0-3-1.5**

COURSE OBJECTIVES: To provide practical exposure to

- Prepare the students to have a basic knowledge in the analysis of Electric Networks.
- Solve the given circuit with various theorems and methods.
- Relate various two port parameters and transform them.
- Common electrical components, their ratings and applications.
- Common electrical measuring instruments and their usage.
- Transformers and electrical machines.

LIST OF EXPERIMENTS

NT LAB EXPERIMENTS:

1. Verify KCL and KVL for DC circuits.

2. Verify mesh and nodal analysis for DC circuits.

3. Determine and verify superposition theorem.

4. Determine and verify Thevenin's and Norton's theorem.

5. Determine and verify Maximum power transfer theorem.

6. Calculate and verify 'Z' ,'Y', h' and 'g' parameters of two-port network.

ET LAB EXPERIMENTS:

1.Introduction to Lab:

(a).Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.

(b).Demonstration of cut-out sections of machines: dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winging - slip ring arrangement) and single-phase induction machine.

(c).Demonstration of Components of LT switchgear.

2.Transformers: Observation of the no-load current waveform on an oscilloscope (non sinusoidal wave-shape due to B-H curve nonlinearity should be shown along with a discussion about harmonics).Loading of a transformer: measurement of primary and secondary voltages and currents, and power.

3.Three-phase transformers: Star and Delta connections. Voltage and Current relationships(line-line voltage, phase-to-neutral voltage, line and phase currents). Phase-shifts between the primary and secondary side. Cumulative three-phase power in balanced three-phase circuits.

4. Series Resonance in R-L-C circuits.

5. Study and plot the transient Response of RL, RC circuit.

COURSE OUTCOMES:

At the end of the course student will have ability to

- Articulate in working of various components of a circuit.
- Familiar with ac and dc circuits solving.
- Ready with the most important concepts like mesh and nodal analysis.
- Express given Electrical Circuit in terms of A,B,C,D and Z,Y Parameter model and solve the circuits.
- Understand principles of measuring instruments of voltage, current and power
- Analyze the characteristics and evaluate performance of DC Motor, induction motor and transformers

PH1601 **PHYSICS LAB**

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **0-0-3-1.5**

List of Experiments:

1. Band Gap of a semiconductor
2. Hall effect
3. Frank Hertz experiment
4. Photoelectric effect
5. Seebeck and Peltier effect
6. Dielectric constant
7. Solar Cell
8. Compton effect

HS1601 **ENGLISH LANGUAGE LAB**

Orals (Written): 50Marks **L-T-P-C**
Written (Externals): 50Marks **0-0-2-1**

The **Language Lab** focuses on the production and practice of sounds of language and familiarizes the students with the use of English in everyday situations both in formal and informal contexts.

Course Objectives:

- To facilitate computer-assisted multi-media instruction enabling individualized and independent language learning.
- To sensitize students to the nuances of English speech sounds, word accent, intonation and rhythm.
- To bring about a consistent accent and intelligibility in students' pronunciation of English by providing an opportunity for practice in speaking
- To improve the fluency of students in spoken English and neutralize their mother tongue influence
- To train students to use language appropriately for public speaking and interviews

Syllabus of English Language Lab (Computer Assisted Language Learning (CALL) Lab):

Listening Skills:

Objectives:

1. To enable students, develop their listening skills so that they may appreciate its role in the LSRW skills approach to language and improve their pronunciation
2. To equip students with necessary training in listening so that they can comprehend the speech of people of different backgrounds and regions.

Students should be given practice in listening to the sounds of the language, to be able to recognize them and find the distinction between different sounds, to be able to mark stress and recognize and use the right intonation in sentences.

- Listening for general content
- Listening to fill up information
- Intensive listening
- Listening for specific information

Speaking Skills:

Objectives:

1. To involve students in speaking activities in various contexts
2. To enable students express themselves fluently and appropriately in social and

professional contexts

- Oral practice: Just A Minute (JAM) Sessions
- Describing objects/situations/people
- Role play – Individual/Group activities

The following course content is prescribed for the English Language and based on AICTE Model Curriculum 2018 for B.Tech First year. As the syllabus is very limited, it is required to prepare teaching/learning materials by the teachers collectively in the form of handouts based on the needs of the students in their respective colleges for effective teaching/learning and timesaving in the Lab.

Unit – I:

Understand: Listening Skill- Its importance – Purpose- Process- Types- Barriers of Listening - Communication at Work Place- Spoken vs. Written language.

Practice: Introduction to Phonetics – Speech Sounds – Vowels and Consonants -Ice-Breaking Activity and JAM Session- Situational Dialogues – Greetings – Taking Leave – Introducing Oneself and Others.

UNIT – II

Understand: Structure of Syllables – Word Stress and Rhythm– Weak Forms and Strong Forms in Context- Features of Good Conversation – Non-verbal Communication.

Practice: Basic Rules of Word Accent - Stress Shift - Weak Forms and Strong Forms in Context-Situational Dialogues – Role-Play- Expressions in Various Situations –Making Requests and Seeking Permissions - Telephone Etiquette.

UNIT - III

Understand: Intonation-Errors in Pronunciation-the Influence of Mother Tongue (MTI)- How to make Formal Presentations.
Practice: Common Indian Variants in Pronunciation – Differences in British and American Pronunciation- Formal Presentations.

UNIT – IV

Understand: Listening for General Details-Public Speaking – Exposure to Structured Talks.
Practice: Listening Comprehension Tests- Making a Short Speech – Extempore

UNIT – V

Understand: Listening for Specific Details- Interview Skills.
Practice: Listening Comprehension Tests- Mock Interviews.

Learning Outcomes: Students will be able to attain

- Better understanding of nuances of English language through audio- visual experience and group activities
- Neutralization of accent for intelligibility
- Speaking skills with clarity and confidence which in turn enhances their employability skills

Suggested References:

1. Clarity English Success - Software
2. Connected Speech- Software
3. Issues in English 2- Software
4. http://www.clarityenglish.com/program/practicalwriting/
5. http://www.clarityenglish.com/program/roadtoielts/
6. http://www.clarityenglish.com/program/clearpronunciation1/
7. http://www.clarityenglish.com/program/resultsmanager/

III SEMESTER

EC2101 **DIGITAL ELECTRONIC CIRCUITS**
(for ECE and CSE)

Externals: 60Marks **L-T-P-C**
Internals: 40Marks **3-0-0-3**

UNIT-I: Introduction

Digital & analog signals, Number System, BCD & its arithmetic, Binary, Decimal, Octal, Hexadecimal, Negative numbers& its arithmetic, Number base conversions,

Unit II: Logic Realization & Simplification:

Boolean Algebra and De Morgan's Theorem, SOP & POS forms, Canonical forms, Karnaugh maps up to 6 variables, Binary codes,Code Conversion. Logic Gates and its realization.

Unit III:Combinational Logic Design:

MSI devices like Comparators, Multiplexers, Encoder, Decoder, Driver & Multiplexed Display, Half and Full Adders, Subtractors, Serial and Parallel Adders, BCD Adder, Barrel shifter and ALU, parity generator, checker

Unit IV: Sequential Logic Design:

Building blocks like S-R, JK and Master-Slave JK FF, T-FF, D-FF and Flip-Flop conversions. Shift Registers (SISO, SIPO, PISO, PIPO), universal shift register.Synchronous and Asynchronous counters and it's realization.Programmable logic Families: PAL, PLA.PROM.

Unit V:Finite State Machines:

Design ofsynchronous FSM, Mealy model, Moore model, state diagrams and state reduction method, overlapping & Non-overlapping models.Designing synchronous circuits like Pulse train generator, Pseudo Random Binary Sequence generator.

Course outcomes:
At the end of this course students will demonstrate the ability to

- A basic understanding of Boolean algebra and theorems for optimization
- Design and developing of combinational logic circuits, storage cells for sequential circuit realization
- Dissemination of sequential circuits for high end applications and FSM realizations
- A glimpse on various logic families and their impacts in circuit realizations

TEXTBOOKS:

1. Switching & Finite Automata theory – Zvi Kohavi, TMH,2nd Edition.

2. Digital Design – Morris Mano, PHI, 3rd Edition, 2006.

3. Switching Theory and Logic Design-A.Anand kumar, 2008.

REFERENCES:

1. An Engineering Approach to Digital Design – Fletcher, PHI.

2. Fundamentals of Logic Design – Charles H. Roth, 5th Edition, 2004, Thomson Publications.

3. Digital Logic Applications and Design – John M. Yarbrough, 2006.

EC2102 **ELECTRONIC DEVICES AND CIRCUITS**

Externals: 60Marks **L-T-P-C**
Internals: 40Marks **3-1-0-4**

Course Objectives:

1. To introduce the fundamental concepts of semiconductor materials and its characteristics.
2. Identify the whether the semiconductor material is p-type or n-type by using Hall Effect.
3. To understand the basic structure of p-n junction diode and Tunnel diode it's working principles.
4. To understand the applications of Bipolar Junction Transistor and Unipolar Junction Transistor and its different modes of operation.
5. To understand the basics of optical electronics like Photo detectors, Photoluminescence, Electroluminescence, Led and laser.
6. To understand the basic IC fabrications & Logic families.

UNIT-1

Semiconductor Physics: Review of semiconductor physics. Energy bands in intrinsic and extrinsic silicon; Carrier transport: diffusion current, drift current, mobility and resistivity; Generation and recombination of carriers; Poisson and continuity equation, Hall effect.

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

UNIT-2

Rectifiers and Filters: The P-N junction as a Rectifier, Half wave Rectifier, Full wave Rectifier, Bridge Rectifier, Harmonic components in a Rectifier Circuit, Inductor Filters, Capacitor Filters, L- Section Filters, π- Section Filters, Comparison of Filters.

Opto-Electronics: Optical sources: LED, LASER. Direct & Indirect band gap semiconductors. Optical detectors: Photo diode, Pin diode, Avalanche Photo Diode (APD), Solar cell, LCD.

UNIT-3

Bipolar Junction Transistor: The Junction Transistor, Transistor Current Components, Transistor as an Amplifier, Transistor Construction, *non-ideal effects of BJT: Base width modulation, Emitter band gap narrowing, non-uniform base doping, breakdown voltage.* BJT

Operation, Common Base, Common Emitter and Common Collector Configurations, Limits of Operation, BJT Specifications.

Transistor Biasing and Stabilization: Operating Point, The DC and AC Load lines, Need for Biasing, Fixed Bias, Collector Feedback Bias, Emitter Feedback Bias, Collector - Emitter Feedback Bias, Voltage Divider Bias, Bias Stability, Stabilization Factors, Stabilization against variations in V_{BE} and β, Bias Compensation using Diodes and Transistors, Thermal Runaway, Thermal Stability.

UNIT-4

Field Effect Transistor: The Junction Field Effect Transistor (Construction, principle of operation, symbol) – Pinch-off Voltage - Volt-Ampere characteristics, The JFET Small Signal Model, MOSFET (Construction, principle of operation, symbol), MOSFET Characteristics in Enhancement and Depletion modes.

FET Amplifiers: FET Common Source Amplifier, Common Drain Amplifier, Generalized FET Amplifier, Biasing FET, FET as Voltage Variable Resistor, Comparison of BJT and FET.

UNIT-5

Special Purpose Electronic Devices: Principle of Operation and Characteristics of Tunnel Diode (with the help of Energy Band Diagram), Varactor Diode, Schottky Barrier diode, Point contact diode.

Power Switching Devices: Introduction to: SCR, UJT, DIAC, TRIAC and its applications.

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Students will be good at fundamental concepts of semiconductor materials and its characteristics.
2. Students will be ability to identify the whether the semiconductor material is p-type or n-type by using Hall Effect.
3. Students will be good at the basic structure of p-n junction diode and Tunnel diode it's working principles.
4. Students will know the applications of Bipolar Junction Transistor and Unipolar Junction Transistor and its different modes of operation.
5. Students will be good at the basics of optical electronics like Photo detectors, Photoluminescence, Electroluminescence, Led and laser.
6. Students will be having knowledge on basic IC fabrications & logic families.

Text Books:

1) G. Streetman, and S. K. Banerjee, "Solid State Electronic Devices," 7th edition, Pearson,2014.
2) D. Neamen , D. Biswas "Semiconductor Physics and Devices," McGraw-Hill Education.
3) Jacob Millman, Christos C Halkias and Satyabrata JIT, " Electronics Devices and Circuits", 3rd Edition.

Reference Books:

1) S. M. Sze and K. N. Kwok, "Physics of Semiconductor Devices," 3rd edition, John Wiley&Sons, 2006.
2) C.T. Sah, "Fundamentals of solid state electronics," World Scientific Publishing Co. Inc, 1991.
3) Y. Tsividis and M. Colin, "Operation and Modeling of the MOS Transistor," Oxford Univ.Press, 2011.

EC2103 **SIGNALS AND SYSTEMS**
(only for ECE)

Externals: 60Marks **L-T-P-C**
Internals: 40Marks **3-1-0-4**

UNIT I: Introduction to Signals and Systems

Signals and systems as seen in everyday life, and in various branches of engineering and science. Continuous and discrete time signals, Analog and Digital signals and some special signals of importance: the unit step, the unit impulse, the sinusoid, the complex exponential, some special time-limited signals; Signal properties: periodicity, absolute integrability, determinism and stochastic character, energy and power, odd and even, Operations on independent variables of the signal: Time shifting, reversal, scaling; System properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, realizability with examples.

Unit II: Behavior of continuous and discrete-time LSI systems

Impulse response and step response, convolution with examples, cascade interconnections. Characterization of causality and stability of LSI systems. System representation through differential equations and difference equations. Periodic inputs and semi periodic inputs to an LSI system, the notion of a frequency response and its relation to the impulse response. notion of eigen functions of LSI systems, a basis of eigen functions.

Unit III: Fourier Transform

The idea of signal space and orthogonal bases, Fourier series representation of periodic signals with examples, Waveform Symmetries. Continuous Time Fourier Transform and it's properties including Parseval's Theorem and Duality, magnitude and phase response, The DiscreteTime Fourier Transform (DTFT). Ideal Filters, R-C first order LPF, HPF, BPF circuits and its frequency domain analysis using transfer function.

Unit IV: Laplace Transform

Review of the Laplace Transform for continuous time signals and systems, Region of Convergence, system functions, poles and zeros of system functions and signals, Laplace domain analysis, solution to differential equations and system behavior. Butterwoth LPF, HPF and BPF and its realization.

Unit V: Sampling and Reconstruction

The Sampling Theorem and its implications. Spectra of sampled signals. Reconstruction: ideal interpolator, zero-order hold, first-order hold. Aliasing and its effects. Relation between continuous and discrete time systems.

Course outcomes:

At the end of this course students will demonstrate the ability to

- Analyze different types of signals
- Represent continuous and discrete systems in time and frequency domain using different transforms
- Investigate whether the system is stable

- Sampling and reconstruction of a signal

Text/Reference books:

1. A.V. Oppenheim, A.S. Willsky and I.T. Young, "Signals and Systems", Prentice Hall, 1983.
2. R.F. Ziemer, W.H. Tranter and D.R. Fannin, "Signals and Systems - Continuous and Discrete", 4th edition, Prentice Hall, 1998.
3. Papoulis, "Circuits and Systems: A Modern Approach", HRW, 1980.
4. B.P. Lathi, "Signal Processing and Linear Systems", Oxford University Press, c1998.
5. Douglas K. Lindner, "Introduction to Signals and Systems", McGraw Hill International Edition: c1999.
6. Simon Haykin, Barry van Veen, "Signals and Systems", John Wiley and Sons (Asia) Private Limited, c1998.
7. Robert A. Gabel, Richard A. Roberts, "Signals and Linear Systems", John Wiley and Sons, 1995.
8. M. J. Roberts, "Signals and Systems - Analysis using Transform methods and MATLAB", TMH, 2003.
9. J. Nagrath, S. N. Sharan, R. Ranjan, S. Kumar, "Signals and Systems", TMH New Delhi, 2001.
10. Ashok Ambardar,"Analog and Digital Signal Processing", 2nd Edition, Brooks/ Cole Publishing Company (An international Thomson Publishing Company), 1999.

EC2901 ELECTRONICS MINI PROJECT-I

L-T-P-C
0-0-2-1

Topics:

Analog Filter Design:

1. Butterwoth, Chebyschev, Elliptic filter design for LPF, HPF, BPF, BSF (Need to verify with MultiSim software and realize the same using passive components)
2. Concepts related to Instrumentation and Measurements

MA2101 MATHEMATICS-III
(Linear Algebra and Complex Analysis)

Externals: 60Marks **L-T-P-C**
Internals: 40Marks **3-1-0-4**

Course objectives: To make Students learn concepts and methods described in the syllabus, so that they will be able to solve their engineering problem using linear algebra, functions of complex variable wherever applicable. They will come to know a number of applications of linear algebra, and especially they will learn about SVD and applications to image processing.

Also make them learn fair amount of calculus of functions of complex variables, like complex differentiation and integration and residue calculus which is will become a handy tool for definite integration for them.

To Solve the Differential & integral equations using Laplace Transform.
To know the Applications of Laplace Transforms.

Learning Outcomes: At the end of the course the student will be able to

- Use shifting theorems to compute the Laplace transform and inverse Laplace transform
- Solve Differential equations and Partial differential equations using Laplace Transforms.
- Write the LU, QR, SVD decompositions for given matrices.
- Finding the Orthogonal basis for a given Inner Product space.
- Evaluate improper real integrals using Residue theorem.

Unit-I:

Vector space and Subspaces,Linear Independence and Basis and Dimension, The Four Fundamental Subspaces of matrix. Fundamental theorem of Linear algebra. *LU* and *LDU* factorization of Matrices. Solving the system of equations using LU decomposition. Inner product space on $\mathbb{R}^n$, Cauchy Schwartz inequality, Orthogonality.Projections and Least squares solution.

Unit-II:

Orthogonal basis and Orthonormal basis, Gram-Schmidt Orthogonalization, QR Factorization. Review of Eigen values and Eigen vectors, Diagonalization and Diagonalizing symmetric matrix, application of diagonalization (power of matrices), and Spectral theorem. Positive definite Matrices, and properties. Singular value decomposition, Applications in Signal processing: Image compression

UNIT-III
Complex Variable – Differentiation

Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding

Harmonic conjugate; Elementary analytic functions (exponential, trigonometric, logarithm) andtheir properties; Conformal mappings, Mobius transformations and their properties

Unit-IV

Complex Variable-Integration

Contour integrals, Cauchy-Goursat theorem (without proof), and Cauchy Integral formula (withoutProof), Liouville's theorem and Maximum-Modulus theorem (without proof); Taylor's series,Zeros of analytic functions, singularities, Laurent's series; Residues, Cauchy Residue theorem(Without proof), Evaluation of definite integral involving sine and cosine functions .Evaluation of certainimproper integrals using the Bromwich contour

Unit-V:

Laplace Transform: Definition of Laplace Transform, linearity property, conditions for existence of Laplace Transform. First and second shifting properties, Laplace Transform of derivatives and integrals, unit step functions, Dirac delta-function, error function. Differentiation and integration of transforms, convolution theorem,

Inverse Laplace Transform, periodic functions. Evaluation of integrals by Laplace Transform. Solution of initial and boundary value problems and solving Differential Equations & Integral Equations.

Text Books:

- Introduction to Linear Algebra ,Gilbert Strang fourth edition
- Advanced Engineering Mathematics (3rd Edition) by R. K. Jain and S. R. K. Iyengar, Narosa Publishing House, New Delhi
- B.S. Grewal and J.S. Grewal, "Higher Engineering Mathematics",(40th Edition), Khanna Publishers,2007

References Books:

- Advanced Engineering Mathematics (8th Edition) by Erwin Kreyszig, Wiley-India.
- Dr. M.D. Raisinghania,Ordinary and Partialdifferentialequations,S.CHAND,17thEdition2014.
- R.V.Churchill, " Complex Variables & its applications",Mc Graw-Hill Company,INC.

HS2101 ESSENCE OF INDIAN KNOWLEDGE TRADITION

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **2-0-0-0**

Unit –I

Basic Structure Of Indian Knowledge System:

Veda (Ayurveda, Dhanurveda, Gandharva Veda, Sthapatya Aati(Shilpa Veda), Artha Veda, Veedanga (Shiksha, Kalpa, Chhanda, Niruktha, Vyakarana, Jyothishya) Darma Shastra, Mimasha, Purana, Tarkashastra

Unit – II

Modern Science And Indian Knowledge System

Yoga Holistic Health Care

Unit – III

Indian Philosophical Tradition:

A) Orthodox (Hindu) School: Samkya, Yoga, Nyaya, Vaisheshika, Purva Mimamsa, Vedhanta,

B) Hetorodox (Non-Hindu) Schools: Carvaka, Jain, Buddha

Unit-IV

Indian Linguistic Tradition:

Phonology, Morphology, Syntax And Semantics

Unit –V

Indian Artistic Tradition:

Chitra Kala, Mantra Kala, Vaastu Kala, Sangeetha Kala, Nruthyu Evam Sahityam

BS2101 **ENVIRONMENTAL SCIENCE**

Externals: 60Marks **L-T-P-C**
Internals: 40Marks **3-0-0-0**

UNIT 1:MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES

Definition, scope and importance, need for public awareness.

UNIT 2: NATURAL RESOURCES:

Renewable and non-renewable resources: Natural resources and associated problems.

a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people.

b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

d) Food resources: World food problems, changes caused by agriculture and over-grazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

e) Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources.

f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

- .Role of an individual in conservation of natural resources.
- Equitable use of resources for sustainable lifestyles.

UNIT 3: ECOSYSTEMS & BIODIVERSITY

Concept of an ecosystem. Structure and function of an ecosystem. Producers, consumers and decomposers. Energy flow in the ecosystem. Ecological succession. Food chains, food webs and ecological pyramids.

Introduction, types, characteristic features, structure and function of the following ecosystems:-

a. Forest ecosystem, b. Grassland ecosystem, c. Desert ecosystem, d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).
b. Biodiversity- Definition : genetic, species and ecosystem diversity. Biogeographical classification of India Value of biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values.

c. Biodiversity at global, National and local levels. Inida as a mega-diversity nation Hot-sports of biodiversity.
d. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Endangered and endemic species of India Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT 4: ENVIRONMENTAL POLLUTION

Definition, Cause, effects and control measures of :- Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards

- Solid waste Management: Causes, effect s and control measures of urban and industrial wastes.
- Role of an individual in prevention of pollution
- Disaster management: floods, earthquake, cyclone and landslides.
- Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies.
- Environment Protection Act., Air (Prevention and Control of Pollution) Act. Water Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act .

UNIT 5 : SOCIAL ISSUES & THE ENVIRONMENT

Human Rights. Value Education. HIV/AIDS. Women and Child Welfare. Role of Information Technology in Environment and human health.

Field work : Visit to a local area to document t environmental assets river/ forest/grassland/hill/mountain Visit to a local polluted site-Urban/Rural/Industrial/Agricultural . Study of common plants, insects, birds. Study of simple ecosystems-pond, river, hill slopes, etc.

REFERENCES :

a). Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
b). Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad- 380 013, India, Email:mapin@icenet.net (R)
c). Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p
d) Clark R.S., Marine Pollution, Clanderson Press Oxford (TB)
e). Cunningham, W.P. Cooper, T.H. Gorhan i, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumabai, 1196p
f). De A.K., Environmental Chemistry, Wiley Eastern Ltd.
g). Down to Earth, Centre for Science and Environment (R)
h). Gleick, H.P. 1993. Water in Crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute Oxford Univ. Press. 473p

i). Hawkins R.E., Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay (R) j) Heywood, V.H & Waston, R.T. 1995. Global Biodiversity Assessment. Cambridge Univ. Press 1140p.
k). Jadhav, H & Bhosale, V.M. 1995. Environm ental Protection and Laws. Himalaya Pub. House, Delhi 284 p.
l). Mckinney, M.L. & School, R.M. 1996. Environmental Science Systems & Solutions, Web enhanced edition. 639p.
m). Mhaskar A.K., Matter Hazardous, Techno-Science Publication (TB)
n). Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co. (TB)
o). Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA, 574p
p). Rao M N. & Datta, A.K. 1987. Waste Wate r treatment. Oxford & IBH Publ. Co. Pvt. Ltd. 345p.
q). Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut
r). Survey of the Environment, The Hindu (M)
s). Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science.
t). Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines, Compliances and Standards, Vol I and II, Enviro Media (R).
u). Trivedi R. K. and P.K. Goel, Introduction to air pollution, Techno-Science Publication (TB).
v). Wanger K.D., 1998 Environmental Management. W.B. Saunders Co. Philadelphia, USA 499p (M) Magazine (R) Reference (TB) Textbook Members of the Expert Committee on Environmental Studies

1. Prof. Erach Bharucha, Director
Bharati Vidyapeeth, Institute of Environment Education & Research, Pune

2. Prof. C. Manoharachary
Department of Botany
Osmania University Hyderabad

3. Prof. S. Thayumanavan
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5. Shri R. Mehta
Director EE Division
Ministry of Environment & Forest
Prayavaran Bhawan, CGO Complex
Lodhi Road, New Delhi-110 003

UGC OFFICIALS

6. Dr. N. K. Jain
Joint Secretary UGC, New Delhi

EC2701 DIGITAL ELECTRONIC CIRCUITS LAB
(for CSE and B16 regular ECE only)

Externals: 60Marks **L-T-P-C**
Internals: 40Marks **0-0-2-1**

Course Objectives:

- To learn differences between analog systems and digital systems.
- To learn basic techniques for the design of digital circuits.
- To understand fundamental concepts used in the design of digital systems.
- To understand the concepts of various combinational and sequential circuits.
- To learn various techniques for logic circuit reduction.

LIST OF EXPERIMENTS:

1. I/O characteristics of a Universal, Basic, Arithmetic gates
2. Design of a digital comparator
3. Check the functionality of a 1bit full adder circuit and subtractor
4. Develop 4bit RCA
5. Realize the functionalities of encoders and decoders
6. Design sr-latch and flip flop
7. Design jk-latch and flip flop
8. Functioning of shift register, master slave flip flop, ALU
9. Design of asynchronous and synchronous counters
10. Verify the functionality of a n*1multiplexer and 1*n demultiplexer
11. Design of a 7-segment LED display

Course Outcomes:

- Design, Analysis, Implementation and testing of logic gates and functions.
- An ability to analyze, implement and testing of combinational circuits.
- Design, Analysis, Implementation and testing of flip-flops and registers.
- An ability to analyze, implement and testing of counters.
- Design, Analysis, Implementation of application level projects.

19EC2702 ELECTRONIC DEVICES AND CIRCUITS LAB

Externals: 60Marks **L-T-P-C**
Internals: 40Marks **0-0-2-1**

Section 1: Basics of Electronic Circuits

Section 2: Electronic Device Characteristics

Course Objective:

- To understand usage of basic electronic equipments like Oscilloscope, Function generator, Multimeter ..etc.
- To understand the basic electronic components like passive components, active components, bread board, etc.
- To design the basic circuits by using diodes, zener diode etc.
- To understand the characteristics of the diodes, Transistors.

Lab 1: Basics of Electronic Circuits

1. Familiarization of electrics components and usage of multimeter.
2. Familiarization with Oscilloscope and function generator.
3. Frequency response and square wave rectifying of RC, CR and RL networks.
4. Half wave and full wave rectifiers, Rectification with capacitance filters, Zener diode and IC regulation.
5. Study of CE, CB, CC amplifier on kit.

Lab 2: Device Characteristics

1. Characteristics of Diodes
   a. PN Junction Diode
   b. Zener Diode
   c. Light Emitting Diode
   d. Tunnel Diode
   e. Schottky Diode
   f. Varactor Diode
2. Characteristics of Transistor
   a. Bipolar Junction Transistor (Common Base, Common Collector, Common Emitter)
   b. Unipolar Junction Transistor (p-channel JFET, n-channel JFET)
   c. MOSFET (p-channel enhancement mode MOSFET, n-channel enhancement mode MOSFET, p-channel depletion mode MOSFET, n-channel depletion mode MOSFET)
3. Characteristics of Silicon Controlled Rectifier

Course Outcomes: After completion of this lab

- Students get the ability for usage of basic electronic equipment like Oscilloscope, Function generator, Multimeter ..etc.
- Students will be having knowledge on the basic electronic components like passive components, active components, bread board, etc.
- Students can design the basic circuits by using diodes, zener diode etc.
- Students having the knowledge on characteristics of the diodes, Transistors.

Text /Reference Books:

1. Electronic Devices and Circuit Theory – Robert L.Boylestad, Louis Nashelsky, 9th edition, 2008 PE.
2. Electronic Devices and Circuits- David A. Bell- 5th Edition, Oxford University Press.
3. Jacob Millman, Christos C Halkias and Satyabrata JIT, " Electronics Devices and Circuits", 3rd Edition.
4. G. Streetman, and S. K. Banerjee, "Solid State Electronic Devices," 7th edition, Pearson,2014.
5. D. Neamen , D. Biswas "Semiconductor Physics and Devices," McGraw-Hill Education.
6. S. M. Sze and K. N. Kwok, "Physics of Semiconductor Devices," 3rd edition, John Wiley&Sons, 2006.
7. C.T. Sah, "Fundamentals of solid state electronics," World Scientific Publishing Co. Inc, 1991.
8. Y. Tsividis and M. Colin, "Operation and Modeling of the MOS Transistor," Oxford Univ.Press, 2011.

IV SEMESTER

EC2201 **ANALOG CIRCUITS**
(only for ECE)

Externals: 60Marks **L-T-P-C**
Internals: 40Marks **3-0-0-3**

Course Objectives:

- The concepts of small signal equivalent circuits of BJT, FET and it's frequency response.
- The concept of multistage amplifiers, differential amplifiers and current mirrors for high input impedance.
- The fundamental concepts of positive and negative feedback and their applications.
- The performance analysis of Operational amplifiers and it's applications.
- The concept of large signal amplifiers and radio frequency amplifiers.

UNIT-I

Diode Applications: Diode Circuits (diode equivalent circuit, clippers, clampers)

Small Signal Analysis: Amplifier models: Voltage amplifier, current amplifier, trans conductance amplifier and trans-resistance amplifier. Biasing schemes for BJT and FET amplifiers, bias stability, various configurations (such as CE/CS, CB/CG, CC/CD) and their features, small signal analysis, low frequency transistor models, estimation of voltage gain, input resistance, output resistance etc., design procedure for particular specifications, low frequency analysis of multistage amplifiers.

UNIT-II:

High Frequency Analysis: High frequency transistor models, frequency response of single stage and multistage amplifiers, cascode amplifier.

Power Amplifiers: Various classes of operation (Class A, B, AB, C etc.), their power efficiency and linearity issues.

Feedback topologies: Voltage series, current series, voltage shunt, current shunt, effect of feedback on gain, bandwidth etc., calculation with practical circuits.

UNIT-III:

Oscillators: Review of the basic concepts, Barkhausen criterion, RC oscillators (phase shift, Wien bridge etc.), LC oscillators (Hartley, Colpitt, Clapp etc.), non-sinusoidal oscillators.

Current mirror: Basic topology and its variants, V-I characteristics, output resistance and minimum sustainable voltage (VON), maximum usable load. **Differential amplifier:** Basic

structure and principle of operation, calculation of differential gain, common mode gain, CMRR and ICMR. OP-AMP design: design of differential amplifier for a given specification, design of gain stages and output stages, compensation.

UNIT-IV:

OP-AMP: Introduction of op-amp and its internal circuit diagram. Ideal and practical op-amp with transfer characteristics.

OP-AMP applications: Review of inverting and non-inverting amplifiers, virtual ground concept. Linear op-amps (Adders, Subtractors, V-V, V-I, I-V, I-I amplifiers, Instrumentation amplifier); Non-linear op-amps (Rectifiers, Peak detector, Clipper, Clamper, Logarithmic amplifier) and multipliers; Open loop op-amps (Comparator, Detector); Positive Feedback op-amps (Schmitt trigger, Multivibrators)

Active filters Design: Low pass, high pass, band pass and band stop, design guidelines.

UNIT-V:

Digital-to-analog converters (DAC): Weighted resistor, R-2R ladder, resistor string etc.

Analog-to- digital converters (ADC): Single slope, dual slope, successive approximation, flash etc.

Switched capacitor circuits: Basic concept, practical configurations, application in amplifier, integrator, ADC etc.

Course outcomes:

- An ability to design and analyze the BJT & FET amplifiers at low frequency, mid frequency and high frequency regions.
- An ability to design and perform the cascade amplifiers (i.e. multistage amplifiers) and its frequency response.
- An ability to analyze a given differential amplifier or design a differential amplifier to meet the given specifications with constant current bias circuit.
- An ability to design and analyze the positive feedback and negative feedback amplifiers for a given specifications.
- An ability to design and perform op-amp based circuits and it's applications for a given specifications.
- An ability to understand the large signal amplifiers (i.e. power amplifiers) and its efficiency calculations.
- An ability to understand the waveform generators, timers and analog to digital converters & digital to analog convertors, switched capacitor.

Text Books :

1. Electronics Devices and Circuit Theory Boylestad, Robert & Louis, Nashelsky Pearson, 10th Edition
2. Microelectronic Circuits-Theory and applications by Adel S. Sedra and Kenneth C.Smith, Fifth Edition , (Oxford International Student Edition)
3. Electronic Devices and Circuits- Millman and Halkias, TMH
4. Op-Amps and Linear Integrated Circuits Gayakwad , Ramakant A PHI, Learning,4 th Edition Electronic Devices and Circuits Dr. Sharma, Sanjay KATSON,2012

Reference books:

1. Fundamentals of Electronic Devices and Circuits David, A Bell Oxford Press, 5thEdition, 2008
2. Electronic Principles - with simulation CD Malvino, A.P. Tata McGraw- Hill , Education,7 thEdition
3. Basic Electronics and Linear Circuits Bhargava, N.,Kulshreshtha D., S.Gupta Tata McGraw-Hill Education, 2011
4. Electronics Devices and Circuits Mottershead, Allen PHI Learning,2011
5. Electronic Devices and Circuits- David A Bell - PHI 4th edition

MOOCs:

1. https://www.mooc-list.com/course/electronic-systems-and-digitalelectronics-uninettuno?static=true
2. http://ocw.mit.edu/courses/electrical-engineering-and-computerscience/6-012-microelectronic-devices-and-circuits-spring-2009
3. Introductory Analog Electronics Laboratory (Spring 2007) by MIT Open Courseware | Reviews and Ratings

EC2202 **CONTROL SYSTEMS**

Externals: 60Marks **L-T-P-C**
Internals: 40Marks **3-0-0-3**

Course Objectives:

1. To familiarize the students with the need for modelling of systems and to represent the system in various ways mathematically.
2. To teach them the various well-established techniques to analyze the stability of systems and related issues.
3. Ability to find time response of given control system model &plot Root Locus and Bode plots for given control system model
4. Ability to design Lead, Lag, Lead-Lag systems in control system & Ability to design PID controllers for given control system model.
5. Ability to learn state space analysis and optimal control system.

UNIT-I: INTRODUCTION

Concepts of Control Systems- Open Loop and closed loop control systems and their differences- Examples of control systems- Classification of control systems, Feed-Back Characteristics, Effects of Feedback, Mathematical modeling of physical systems: Differential equation and Transfer functions, Examples of modeling different types (e.g. electrical, mechanical, chemical, biological, social etc.) of systems, Equivalence between the elements of different types of systems. Block diagram algebra –Signal flow graph -Reduction using Mason ‘s gain formula. Translational and rotational mechanical systems.

UNIT-II*:* TIME DOMAIN ANALYSIS

Standard test signals - Time response of first order systems –Characteristic Equation of Feedback control systems, Transient response of second order systems - Time domain specifications. Steady state response - Steady state errors and error constants, Frequency domain response -- Transfer function and its interpretation in terms of frequency responses peak and peaking frequency, bandwidth and cut-off rate; Link between time and frequency domain response features. Advantages of closed loop operation: Sensitivity and complementary sensitivity, Disturbance and noise reduction.

UNIT-III: STABILITY ANALYSIS IN S-DOMAIN

The concept of stability – Routh ‘s stability criterion – qualitative stability and conditional stability – limitations of Routh ‘s stability. The root locus concept - construction of root loci- and relative stability using root-locus approach, effects of adding poles and zeros to G(s)H(s) on the root loci.

UNIT-IV: FREQUENCY DOMAIN ANALYSIS

Polar Plots-Nyquist Plots-Stability Analysis. Bode diagrams- Determination of Frequency domain specifications and transfer function from the Bode Diagram-Phase margin and Gain Margin-Stability Analysis from Bode Plots. P, PD, PI, PID Controllers and Compensation techniques – Lag, Lead, Lead-Lag Controllers design in frequency Domain.

UNIT-V: STATE VARIABEL ANALYSIS

State variable Analysis- Concepts of state, state variable, state model, state models for linear continuous time functions, diagonalization of transfer function, solution of state equations, concept of controllability & observability. Introduction to Optimal control & Nonlinear control, Optimal Control problem, Regulator problem, Output regulator, treking problem. Nonlinear system – Basic concept & analysis.

Course Outcomes:

At the end of this course students will demonstrate the ability to

- Characterize a system and find its study state behaviour
- Investigate stability of a system using different tests
- Design various controllers
- Solve liner, non-liner and optimal control problems

Text Books:

1. Automatic Control Systems– by B. C. Kuo and Farid Golnaraghi – John wiley and son‘s, 8th edition, 2003.
2. Control Systems Engineering – by I. J. Nagrath and M. Gopal, New Age International (P) Limited, Publishers, 5th edition, 2007.

Reference Books:

1. Modern Control Engineering – by Katsuhiko Ogata – Prentice Hall of India Pvt. Ltd., 5th edition, 2010.
2. Control Systems Engineering - by NISE 5th Edition – John wiley.

EC2203 ELECTROMAGNETIC WAVES

Externals: 60Marks **L-T-P-C**
Internals: 40Marks **3-0-0-3.**

Unit I: INTRODUCTION TO TRANSMISSION LINES:

Concept of distributed elements, equations of voltage and current, standing waves and impedance transformation, lossless and low loss transmission lines, power transfer on a transmission line, short circuit and open circuit lines, parameters of transmission line.

SMITH CHART: applications, applications of transmission line, impedance matching using transmission lines.

Unit II: BASIC LAWS OF ELECTROMAGNETICS:

Gauss's law, Ampere's circuital law, Faraday's law of electromagnetic induction.

Maxwell's equations: Surface charge and Surface current, Displacement current and continuity equation, Boundary conditions at media interface.

Unit III: UNIFORM PLANE WAVES I:

Wave equation for time harmonic fields, Solution of the wave equation, Uniform plane wave, Wave polarization, Wave propagation in conducting medium, Phase velocity and Poynting vector

Uniform plane waves ii: Plane wave in arbitrary direction, Reflection and refraction of waves at dielectric and conducting interface, Total internal reflection, Brewster angle.

Unit IV: WAVE GUIDES:

Parallel plane wave guide, TE mode, TM mode, TEM mode,

Rectangular wave guides: Group velocity and dispersion, Analysis of rectangular wave guides.

Unit V: ANTENNAS:

Introduction,Radiation parameters of antenna, potential functions and their solutions.

FIELDS: Near and far fields, Radiation resistance and radiation pattern of Hertz dipole, total power radiated by a dipole.

Course Outcomes: At the end of this course students will demonstrate the ability to

- Understand characteristics and wave propagation on high frequency transmission lines
- Carryout impedance transformation on TL
- Use sections of transmission line sections for realizing circuit elements
- Characterize uniform plane wave
- Calculate reflection and transmission of waves at media interface

- Analyze wave propagation on metallic waveguides in modal form
- Understand principle of radiation and radiation characteristics of an antenna

Text Books:

1. R.K. Shevgaonkar, "Electromagnetic Waves", Tata McGraw Hill, 2005.
2. D. K. Cheng, "Field and Wave Electromagnetics", Addison-Wesley, 1989.
3. M.N.O. Sadiku, "Elements of Electromagnetics", Oxford University press, 2007.
4. C.A. Balanis, "Advanced Engineering Electromagnetics" , John Wiley and sons, 2012.
5. C. A. Balanis, "Antenna Theory: Analysis and Design" , John Wiley and sons,2005

EC2204 PROBABILITY THEORY AND STOCHASTIC PROCESSES

Externals: 60Marks **L-T-P-C**
Internals: 40Marks

3-1-0-4

Unit I

Sets and set operations; Probability space; Conditional probability and Bayes theorem; Independent events, Combinatorial probability and sampling models.

Unit II

Discrete random variables, probability mass function, probability distribution function, example random variables and distributions;Uniform, Geometric and it's memoryless property, Bernouli, Binomial, Poisson distributions.

Continuous random variables, probability density function, probability distribution function, example distributions; Uniform, Exponential and it's memoryless property, Gaussian distribution, Standard Normal distribution, Q(.) function, Heavy tailed Pareto distribution.

Unit III

Joint distributions, Jointly Gaussian random variables, Marginal distributions, Independent random vatiable, functions of one and two random variables, Sum of random variables, minimum, maximum of random variables, log normal distribution, Rayleigh distribution, Chi-square distribution, Square of Rayleigh random variable, moments of random variables;

Conditional distribution, densities and moments; Mean, Variance, Covariance, Correlation, Correlation coefficient, Covariance Matrix. Uncorrelated random variables. Conditional expectation. Characteristic functions of a random variable; Markov, Chebyshev and Chernoff bounds; Cauchy Schwarz inequality. Use of MATLAB for generating: random Gaussian samples, Rayleigh distributed samples generation using two IID Gaussian samples. Transformation of random variables: Generating Exponential distributed samples using Uniform distributed samples.

Unit IV

Random sequences and modes of convergence (everywhere, almost everywhere, probability, distribution and mean square); Limit theorems; Strong and weak laws of large numbers, central limit theorem.

Unit V

Random process, Stationary processes: Strict sense stationary, Wide sense stationary processes. Gaussian Random process, Mean and covariance functions. Ergodicity. Transmission of random process through LTI. Power spectral density.

Course Outcomes:

At the end of this course students will demonstrate the ability to

- Understand representation of random signals
- Investigate characteristics of random processes
- Make use of theorems related to random signals
- To understand propagation of random signals in LTI systems.

Text/Reference Books:

2. H. Stark and J. Woods, ``Probability and Random Processes with Applications to Signal Processing," Third Edition, Pearson Education

3. A.Papoulis and S. Unnikrishnan Pillai, ``Probability, Random Variables and Stochastic Processes," Fourth Edition, McGraw Hill.

4. K. L. Chung, Introduction to Probability Theory with Stochastic Processes, Springer International

5. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability, UBS Publishers,

6. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Stochastic Processes, UBS Publishers

7. S. Ross, Introduction to Stochastic Models, Harcourt Asia, Academic Press.

CS2205 OBJECT ORIENTED PROGRAMMING

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **3-0-0-3**

Objectives:

- The course will introduce standard tools and techniques for software development, using object oriented approach, use of a version control system, an automated build process, an appropriate framework for automated unit and integration tests.
- To understand Object oriented programming concepts, and apply them in Problem solving.
- To learn the basics of Java Console and GUI based programming

Detailed Contents:

UNIT-1:

Introduction to OOPS: Paradigms of Programming Languages, Basic concepts of Object Oriented Programming, Differences between Procedure Oriented Programming and Object Oriented Programming, Objects and Classes, Data abstraction and Encapsulation, Inheritance, Polymorphism, benefits of OOP , application of OOPs.

Java : History, Java features, Java Environment, JDK, API.

Introduction to Java : Types of java program, Creating and Executing a Java program, Java Tokens, Keywords, Character set, Identifiers, Literals, Separator, Java Virtual Machine (JVM), Command Line Arguments, Comments in Java program.

UNIT -2:

Elements: Constants, Variables, Data types, Scope of variables, Type casting, Operators: Arithmetic, Logical, Bit wise operator, Increment and Decrement, Relational, Assignment, Conditional, Special operator, Expressions – Evaluation of Expressions

Decision making and Branching: Simple if statement, if, else statement, Nesting if, else, else if Ladder, switch statement, Decision making and Looping: While loop, do-While loop, for loop, break, labelled loop, continue Statement, Simple programs

Arrays: One Dimensional Array, Creating an array, Array processing, Multidimensional Array, Vectors, Wrapper classes, Simple programs

UNIT-3:

Strings: Exploring String class, String Class Methods, String Buffer Class, Simple programs

Class and objects: Defining a class, Methods, Creating objects, Accessing class members, Constructors, Static members, Nesting of Methods, this keyword, Command line input.

Polymorphism – Static Polymorphism, Dynamic Polymorphism, Method overloading, Polymorphism with Static Methods, Private Methods and Final Methods.

Inheritance: Defining a sub class, Deriving a sub class, Single Inheritance, Multilevel Inheritance, Hierarchical Inheritance, Overriding methods, Final variables and methods, Final classes, Finalizer methods, Abstract methods and classes, Visibility Control: Public access, Private access, default and protected. Abstract classes.

Interfaces - Interfaces vs Abstract classes, defining an interface, implementing interfaces, accessing implementations through interface references, extending interfaces. Inner classes - uses of inner classes, local inner classes, anonymous inner classes, static inner classes, examples.

UNIT- 4:

Packages: Java API Packages, System Packages, Naming Conventions, Creating & Accessing a Package, Adding Class to a Package, Hiding Classes, Programs

Exception Handling: Limitations of Error handling, Advantages of Exception Handling, Types of Errors, Basics of Exception Handling, try blocks, throwing an exception, catching an exception, finally statement

Multi threading: Creating Threads, Life of a Thread, Defining & Running Thread, Thread Methods, Thread Priority, Synchronization, Implementing runnable interface, Thread scheduling.

I/O Streams: File, Streams, Advantages, The stream classes, Byte streams, Character streams.

JDBC, ODBC Drivers, JDBC ODBC Bridges, Seven Steps to JDBC, Importing java SQL Packages, Loading & Registering the drivers, Establishing connection. Creating & Executing the statement.

UNIT-5:

AWT Components and Event Handlers: Abstract window tool kit, Event Handlers, Event Listeners, AWT Controls and Event Handling: Labels, TextComponent, ActionEvent, Buttons, CheckBoxes, ItemEvent, Choice, Scrollbars, Layout Managers- Input Events, Menus, Programs

Design patterns - Introduction to Creational design patterns, Structural design patterns and Behavioral design patterns.

GUI Programming with Java - Introduction to Swing, limitations of AWT, Swing vs AWT, MVC architecture, Hierarchy for Swing components, Containers - JFrame, JApplet, JDialog, Jpanel. Overview of some swing components Jbutton, JLabel, JTextField, JtextArea, simple swingapplications.

TEXT BOOKS:

1. Java the complete reference, 7 th edition, Herbert Schildt, TMH.

2. Understanding OOP with Java, updated edition, T. Budd, Pearson Education.

REFERENCE BOOKS:

1. An Introduction to programming and OO Design using Java, J.Nino and F.A.

   Hosch, John wiley & Sons.

2. Introduction to Java Programming, Y. Daniel Liang, Pearson Education

3. An Introduction to Java programming and Object Oriented Application

   Development, R.A. Johnson-Thomson

4. Programming with Java - E. Balagurusamy

5. Object oriented Programming in Java - Dr. G.Thampi

6. Let us Java – Yashavant Kanetkar - BPB Publications, New Delhi - First Edition

   2012

7. Core Java, An Integrated Approach, Dr. R. Nageswara Rao

8. An Introduction to Oops with Java - C Thomas WU - TataMc-Graw Hill, New

   Delhi - 4th Edition

9. Object oriented Programming through Java - ISRD Group - TataMc-Graw Hill,

   New Delhi - Eight Reprint 2011

Outcomes:

After taking the course, students will be able to:

- Specify simple abstract data types and design implementations, using abstraction functions to document them.
- Recognise features of object-oriented design such as encapsulation, polymorphism, inheritance, and composition of systems based on object identity.
- Name and apply some common object-oriented design patterns and give examples of their use.

  Design applications with an event-driven graphical user interface.

EC2902 ELECTRONICS MINI PROJECT-II

L-T-P-C
0-0-2-1

Topics:

1. Need to implement any hardware for specific application by using analog, digital components and also microcontrollers.

BM0007 MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **3-0-0-3**

Course Objective:

- Enable the students to learn managerial economics principles applied in industries and equip them to handle the tasks in their career by making a real sense of what is happening economically in the organization.
- The course describes the Nature and Scope of Managerial Economics. It gives complete study on the demand and elasticity of demand and methods of demand forecasting.
- It provides a detailed structure on the pricing strategies and shows clear picture methods and sources of raising finance.
- It gives clear cut information of preparing final accounts and capital Budgeting techniques.

Course Outcome:

After the successful completion of this course, the learner will be able to know:

1. The dynamic game of demand and supply, and how the trinity of Economics i.e. Demand, Supply and Scarcity make the things move around the globe.
2. Principles of Microeconomics applied to industries.
3. Concept of forecasting and applying forecasting techniques to address the challenges and opportunities in the organization they work.
4. Cost and Production analysis, Break-Even analysis, Opportunity Cost, how to optimize organizational resources and how to minimize cost and maximize production, revenue and profit
5. Different pricing structure and discount mechanism suitable for business firms.
6. Market structure and how to exploit market structure for optimizing the benefits of organization.
7. Capital requirements and sources of capital.

UNIT I: Introduction to Managerial Economics:

Definition, Nature and Scope of Managerial Economics-Demand Analysis: Demand Determinants, Law of Demand and its exceptions. Definition, Types, Measurement and Significance of Elasticity of Demand. Demand Forecasting, Factors governing demand forecasting, methods of demand forecasting.

UNIT II: Theory of Production and Cost Analysis:

Production Function - Isoquants and Isocosts, MRTS, Least Cost Combination of Inputs. Cobb-Douglas Production function, Laws of Returns, Internal and External Economies of Scale.

Cost Analysis: Cost concepts, Opportunity cost. Fixed vs. Variable costs, Explicit costs Vs. Implicit costs. Out of pocket costs vs. Imputed costs. Break-even Analysis (BEA)-Determination of Break-Even Point (simple problems)- Managerial Significance and limitations of BEA.

UNIT III: Markets & Pricing Policies:

Market structures: Types of competition, Features of Perfect competition, Monopoly and Monopolistic Competition. Price-Output Determination in case of Perfect Competition and Monopoly. Objectives and Policies of Pricing- Methods of Pricing: Cost Plus Pricing. Marginal Cost Pricing, Sealed Bid Pricing, Going Rate Pricing, Limit Pricing, Market Skimming Pricing, Penetration Pricing.

UNIT IV: Introduction to Financial Accounting: Introduction to Financial Accounting: Double entry Book Keeping, Journal, Ledger, Trail Balance and Final Accounts (Trading account, Profit and Loss Account and Balance sheet with simple adjustments).

UNIT V: Capital and Capital Budgeting:

Capital and Capital Budgeting: Capital and its significance. Types of Capital. Estimation of Fixed and Working capital requirements. Methods and sources of raising finance. Nature and scope of capital budgeting, features of capital budgeting proposals. Methods of Capital Budgeting: Payback Method. Accounting Rate of Return (ARR) and Net Present Value Method, Internal Rate of Return (IRR).

Reference Books:

1. Aryasri: Managerial Economics and Financial Analysis, TMH,2009.
2. Varshney &Maheswari : Managerial Economics, Sulthan Chand,2009.
3. Raghunatha Reddy & Narasimhachary: Managerial Economics& Financial Analysis, Scitech. 2009.
4. V.Rajasekarn &R.Lalitha. Financial Accounting, Pearson Education. New Delhi. 2010
5. Suma Damodaran, Managerial Economics, Oxford University Press. 2009.

EC2801 **ANALOG CIRCUITS LAB**
(only for ECE)

Externals: 60Marks **L-T-P-C**
Internals: 40Marks **0-0-2-1**

Course Objectives

1. To design and Characterize of small signal equivalent circuits of BJT, FET and its frequency response.
2. To design differential amplifiers & differential amplifier with active load and its frequency response.
3. To design of simple current mirror circuit using BJT and MOSFET.
4. To design of cascode current mirror circuit using BJT and MOSFET.
5. To design the positive feedback amplifiers for a given specifications and tuned amplifiers & timers.

List of Experiments:
SECTION-A
1. Clipping and Clamping circuits.

2. LC, CLC filters
3. Voltage Regulators.
4. RC-coupled amplifier (single stage & two-stage).
5. Darlington Emitter follower & Tuned voltage amplifier.
6. Power amplifiers (Class-B push pull power amplifier).
7. Feedback amplifiers:
   (i) Voltage series feedback amplifier
   (ii) Voltage shunt feedback amplifier
   (iii)Current shunt feedback amplifier
   (iv)Current series feedback amplifier
8. Oscillators:
   (i) RC-phase shift oscillator
   (ii) Wein-bridge oscillator
   (iii)Hartley oscillator
   (iv)Colpits oscillator

SECTION-B
Operational Amplifiers
1. Parameters of Operational Amplifiers.
   (i) Input bias current, Input Offset current, Input Offset voltage
   (ii) Common Mode Rejection Ratio (CMRR)
2. Applications of Operational Amplifiers.
   (i) Inverting op-amp & Non-Inverting op-amp
   (ii) Voltage follower, Summing amplifier
   (iii)ZCD, Schmitt trigger
   (iv)Full wave precision rectifier etc.
3. Wave form generators by using op-amp

(i) Monostable Multi vibrator
(ii) Astable Multi vibrator

Data Converters

4. Digital to Analog converters.
   (i) Weighted Resistor Type D/A converter
   (ii) R-2R ladder Type D/A converter
5. Analog to Digital converter.
   (i) Single slope & Dual slope A/D converters
   (ii) Flash type & Successive Approximation Type A/D converters
6. Switched capacitor circuit.

Course Outcomes:

- An ability to design and Characterize of small signal equivalent circuits of BJT, FET and its frequency response.
- An ability to design differential amplifiers & differential amplifier with active load and it's frequency response.
- An ability to design of simple current mirror circuit using BJT and MOSFET.
- An ability to design of cascode current mirror circuit using BJT and MOSFET.
- An ability to design the positive and negative feedback amplifiers for a given specifications and tuned amplifiers & timers.

Text Books for AC Lab:

1. Electronics Devices and Circuit Theory Boylestad, Robert & Louis, Nashelsky Pearson, 10th Edition
2. Microelectronic Circuits-Theory and applications by Adel S. Sedra and Kenneth C.Smith, Fifth Edition , (Oxford International Student Edition)
3. Electronic Devices and Circuits- Millman and Halkias, TMH
4. Op-Amps and Linear Integrated Circuits Gayakwad , Ramakant A PHI, Learning,4 th Edition Electronic Devices and Circuits Dr. Sharma, Sanjay KATSON,2012

Reference Books for AC Lab:

1. Fundamentals of Electronic Devices and Circuits David, A Bell Oxford Press, 5thEdition, 2008
2. Electronic Principles - with simulation CD Malvino, A.P. Tata McGraw- Hill , Education,7 thEdition
3. Basic Electronics and Linear Circuits Bhargava, N.,Kulshreshtha D., S.Gupta Tata McGraw-Hill Education, 2011
4. Electronics Devices and Circuits Mottershead, Allen PHI Learning,2011
5. Electronic Devices and Circuits- David A Bell - PHI 4th edition

MOOCs for AC lab:

1. https://www.mooc-list.com/course/electronic-systems-and-digitalelectronics-uninettuno?static=true
2. http://ocw.mit.edu/courses/electrical-engineering-and-computerscience/6-012-microelectronic-devices-and-circuits-spring-2009/
3. Introductory Analog Electronics Laboratory (Spring 2007) by MIT Open Courseware | Reviews and Ratings.

CS2804 OBJECT ORIENTED PROGRAMMING LAB

Externals: 60Marks **L-T-P-C**
Internals: 40Marks **0-0-2-1**

OBJECTIVES:

- To model a object oriented programming using abstract data types, encapsulation, inheritance and polymorphism
- Practical exposure in Fundamental features of an object oriented language like Java: object classes and interfaces, exceptions and libraries of object collections
- How to take the statement of a business problem and from this determine suitable logic for solving the problem; then be able to proceed to code that logic as a program written in Java.
- How to test, document and prepare a professional looking package for each business project using javadoc.

Detailed Contents:

Week-I

1. Write a Java program print "Hello World"

2. Write a Java program that prints all real and imaginary solutions to the quadratic equation

   ax2 + bx + c = 0. Read in a, b, c and use the quadratic formula

3. Write a Java program to implement calculator operations

4. Write a java program to find prime factors of given number

5. Write a java program to find whether given number is Palindrome or not

6. Write an application that declares 5 integers, determines and prints the largest and smallest in the group.

Week-II

1. Write a Java program to sort given list of numbers.

2. Write a Java program to implement linear search.

3. Write a Java program to implement binary search.

4. Write a java program to add two given matrices.

5. Write a java program to multiply two given matrices.

6. Write a java program for sorting a given list of names.

7. Write a Java program to give an example for command line arguments.

Week-III

1. Write a program to display details of the required employee based on his Id. The details of employee includes, Emp_name, Emp_age, Emp_gender, Emp_designation, Emp_salary, Emp_Address etc.,

2. A mail-order house sells five products whose retail prices are as follows : Product 1 : Rs. 99.90 , Product 2 : Rs. 20.20 , Product 3 : Rs. 6.87 , Product 4 : Rs. 45.50 and Product 5 : Rs. 40.49 . Each product has Prdouct_Id, Product_Name, Product_Quantity, Product_Price. Write an application that reads a series of pairs of numbers as follows :

a) product Id

b) quantity sold your program use a switch statement to determine the retail price for each product. it should calculate and display the total retail value of all products sold.

3. Write java program that inputs 5 numbers, each between 10 and 100 inclusive. As each number is read display it only if it's not a duplicate of any number already read display the complete set of unique values input after the user enters each new value

4. Write a java program : rolling a pair of dices 10 times [each attempt should be delayed by 10000 ms] and count number Successful attempts. successful attempt : If the pair of Dice results in same values.

5. Implement the following case study using OOP concepts in Java. E-Book stall : Every book has Properties which includes : Book _Name, Book_Author, Book_Count ; Every Customer is having properties as : Customer_Id, Customer_Name, Customer_Address and he can buy Books from E-Book stall. Write a Program which will display the text book name and the remaining count of text books when a customer buys a text book.

Week-IV

1. Write an application that uses String method compareTo to compare two strings defined by the user.

2. Write an application that uses String method equals and equalsIgnoreCase to tests any two string objects for equality.

3. Write an application that uses String method indexOf to determine the total number of occurrences of any given alphabet in a defined text.

4. Write an application that uses String method concat to concatenate two defined strings.

5. Write a Java program to print all vowels in given string and count number of vowels and consonants present in given string

6. Write an application that finds the length of a given string.

7. Write an application that uses String method charAt to reverse the string.

8. Write an application that finds the substring from any given string using substring method and startsWith & endsWith methods.

9. Write an application that changes any given string with uppercase letters, displays it, changes it back to lowercase letters and displays it.

Week-V

1. Write a Java Program to implement Wrapper classes and their methods.

2. Write an application that prompts the user for the radius of a circle and uses a method called circleArea to calculate the area of the circle and uses a method circlePerimeter to calculate the perimeter of the circle.

3. Write a JAVA program for the following a. Call by value b. Call by object

4. Create a class Account with an instance variable balance (double). It should contain a constructor that initializes the balance, ensure that the initial balance is greater than 0.0. Acct details: Acct_Name, Acct_acctno, Acct_Bal, Acct_Address.

Create two methods namely credit and debit, getBalance. The Credit adds the amount (passed as parameter) to balance and does not return any data. Debit method withdraws money from an Account. GetBalance displays the amount. Ensure that the debit amount does not exceed the Account's balance. In that case the balance should be left unchanged and the method should print a message indicating "Debit amount exceeded account balance".

5. Write Java program for the following

a. Example for this operator and the use of this keyword.

b. Example for super keyword.

c. Example for static variables and methods.

Week-VI

1. Write a Java program to find Area and Circle of different shapes using polymorphism concept

2. Write a Java program which can give example of Method overloading and overriding

3. Write an application to create a super class Employee with information first name & last name and methods getFirstName(), getLastName() derive the sub-classes ContractEmployee and RegularEmployee with the information about department, designation & method displayFullName() , getDepartment(), getDesig() to print the salary and to set department name & designation of the corresponding sub-class objects respectively.

4. Derive sub-classes of ContractEmployee namely HourlyEmployee & WeeklyEmployee with information number of hours & wages per hour, number of weeks& wages per week

respectively & method calculateWages() to calculate their monthly salary. Also override getDesig () method depending on the type of contract employee.

5. Write an application to create a super class Vehicle with information vehicle number,insurance number,color and methods getConsumption() displayConsumption(). Derive the sub-classes TwoWheeler and FourWheeler with method maintenance() and average() to print the maintenance And average of vehicle.

6. Extend the above TwoWheeler class with methods getType() and getName() which gives the information about the type and the name of the company.Create sub-classes Geared and NonGeared with method average() to print the average of a geared and non-geared two wheeler.

Week-VII

1. Create an abstract class Shape which calculate the area and volume of 2-d and 3-d shapes with methods getArea() and getVolume(). Reuse this class to calculate the area and volume of square ,circle ,cube and sphere.

2. Create an abstract class Employee with methods getAmount() which displays the amount paid to employee. Reuse this class to calculate the amount to be paid to WeeklyEmployeed and HourlyEmployee according to no. of hours and total hours for HourlyEmployee and no. of weeks and total weeks for WeeklyEmployee.

3. Create an Interface payable with method getAmount ().Calculate the amount to be paid to Invoice and Employee by implementing Interface.

4. Create an Interface Vehicle with method getColor(),getNumber(), getConsumption() calculate the fuel consumed, name and color for TwoWheeler and Four Wheeler By implementing interface Vehicle.

5. Create an Interface Fare with method getAmount() to get the amount paid for fare of travelling. Calculate the fare paid by bus and train implementing interface Fare.

6. Create an Interface StudentFee with method getAmount(),getFirstName(),getLastName(), getAddress(), getContact(). Calculate the amount paid by the Hostler and NonHostler student by implementing interface Student Fee

Week-VIII

1. Write a Program to create your own package. Package should have more than two classes. write a Program that uses the classes from the package.

2. Create a package named org.shapes. Create some classes in the package representing some common geometric shapes like Square, Triangle, Circle and so on. write a Program that uses the classes from the package.

3. Write a Java program to create package called dept. Create four classes as CSE, ECE, ME and CE add methods in each class which can display subject names of your respect year. access this package classes from main class

4. Write a Calculator program : Include all calculator operations in as classes in a Package "Calculator" and import in to main class.

5. Write a program for the following

a. Example to use interfaces in Packages. b. Example to create sub package in a package.

Week-IX

1. Program for demonstrating the use of throw, throws & finally - Create a class with a main( ) that throws an object of class Exception inside a try block. Give the constructor for Exception a String argument. Catch the exception inside a catch clause and print the String argument. Add a finally clause and print a message to prove you were there.

2. Write a program that shows that the order of the catch blocks is important. If you try to catch a superclass exception type before a subclass type, the compiler should generate errors.

3. Write a program to rethrow an exception – Define methods one() & two(). Method two() should initially throw an exception. Method one() should call two(), catch the exception and rethrow it Call one() from main() and catch the rethrown

4. Exception Handling program for ClassNotFoundException--thrown if a program can not find a class it depends at runtime (i.e., the class's ".class" file cannot be found or was removed from the CLASSPATH).

5. Exception Handling program for NumberFormatException--thrown if a program is attempting to convert a string to a numerical datatype, and the string contains inappropriate characters (i.e. 'z' or 'Q').

6. Create your own exception class using the extends keyword. Write a constructor for this class that takes a String argument and stores it inside the object with a String reference. Write a method that prints out the stored String. Create a try- catch clause to exercise your new exception.

Week-IX

1. Write a program to create MyThread class with run() method and then attach a thread to this MyThread class object.

2. Write a program where the consumr thread checks the data production status [is over or not] for every 10 ms.

3. Write a Program using Threads to simulate a traffic light. The Signal lights should glow after each 10 second, one by one. For example: Firstly Red, then after 10 seconds, red will be put to off and yellow will start glowing and then accordingly green.

4. Write a Program using Threads for the following case study: Movie Theatre To watch a movie the following process is to be followed, at first get the ticket then show the ticket. Assume that N persons are trying to enter the Theatre hall all at once, display their seuence of entry into theater. Note: The person should enter only after getting a ticket and showing it to the boy.

5. Write a Program using Threads for the following case study: Train Reservation system To reserve a berth the following process need to be followed, at first check the number of available berths with the requested berths, if the number of requested berths are less than or equal to availabe berths then allot berth and print ticket or else display no berths are available. Assume that N persons are trying to reserve the berth, display their sequence of reservation status along with the number of available berths. Note : The person can print ticket only if berth is confirmed.

Week-X

1. Write a program for the following a. display a frame with title MyFrame b. draw a horizontal line. c. Draw one line perpendicular to other. One line parallel to other.

2. Create an application to display a circle within rectangle and fill different colors in the circle & rectangle

3. Write an application that displays any string. Choose color from combo box to change the color of this displayed string and choose its size & type respectively from another two combo boxes.

4. Create a GUI with title STUDENT which has labels roll no., name, course, gender, class, address with textboxes for taking input from the user(without any functionality) and checkboxes for selecting the course, radio buttons for selecting gender with appropriate background color.

Week-XI

1. Write a program to create a frame by creating an object to Jframe class and include close button to terminate the application of the frame.

2. Write a program to create a push button , when the button is clicked an image is displayed in the frame.

3. Write a program to create a menu with several menu items.

4. Create an application Form for University Enroll ment with the following Fields.

a. Check box b. Text area c. List box d. Display text e. Push buttons f. Combo box. g. Radio buttons. h. Back ground color

Week-XII

1. Write a program to insert data into Student Table.

2. Write a program to retrieve the data from the table Student.

OUTCOMES:

CO 1: Be able to analyze and design a computer program to solve real world problems based on object-oriented principles.

CO 2: Be able to write simple GUI interfaces for a computer program to interact with users, and to understand the event-based GUI handling principles.

CO 3: A competence to design, write, compile, test and execute straightforward programs using a high level language.

CO 4: Demonstrate the ability to employ various types of selection constructs in a Java program. Be able to employ a hierarchy of Java classes to provide a solution to a given set of requirements.

CO 5: Become familiar with the fundamentals and to acquire programming skills in the Java language.

V SEMESTER

EC3101 ANALOG AND DIGITAL COMMUNICATIONS

Externals: 60Marks **L-T-P-C**
Internals: 40Marks **3-0-0-3 .**

UNIT-I: Analog Communications:
Amplitude Modulation schemes: AM, DSBSC, SSBSC and VSB modulation and demodulation. Angle Modulation schemes: FM and PM, Spectral characteristics of angle modulated signals. Super hetrodyne receivers, Frequency Division Multiplexing.

UNIT-II: Noise in analog communication systems:
Gaussian and White noise characteristics, Noise in Amplitude modulation and Angle modulation systems, and SNR calculations. Pre-emphasis and De-emphasis. Threshold effect in angle modulation.

UNIT-III: Pulse modulation:
Sampling process and Quantization, SQNR, A-law and μ-law companding. PAM, PCM, DPCM, DM, ADM, Time Division Multiplexing.

Digital modulation schemes:
ASK, PSK, FSK, QAM and their constellations.

UNIT-IV: Detection Theory:
Gram-Schmidt Orthogonalization, Optimal detection of signals in the presence of noise: MAP rule, ML rule. Matched filter receiver. BER calculations for PCM, ASK, PSK,FSK, QAM in AWGN channel.

UNIT-V: Information theory and coding:
Entropy, Mutual information, Source coding theorem, Channel coding theorem, Huffman code, Repetition code, Hamming code.

Course Outcomes:
At the end of this course students will demonstrate the ability to
- Analyze and compare different analog modulation schemes for their efficiency and bandwidth
- Analyze the behavior of a communication system in presence of noise
- Investigate pulsed modulation system and analyze their system performance
- Analyze different digital modulation schemes and can compute the bit error performance

Text Books:
1. Simon Haykin, ―Communication Systems, Wiley-India edition, 3 rd edition, 2010
2. B.P. Lathi, & Zhi Ding, ―Modern Digital & Analog Communication Systems , Oxford

University Press, International 4th edition, 2010.

Reference Books:

1. John G.Proakis& M. Salehi --- Digital Communications, 5th edition, Mc Graw Hill education, 2014.
2. A. Bruce Carlson, & Paul B. Crilly, ―Communication Systems – An Introduction to Signals & Noise in Electrical Communication , McGraw-Hill International Edition, 5th Edition, 2010.
3. Herbert Taub & Donald L Schilling, ―Principles of Communication Systems , Tata McGraw-Hill, 3rd Edition, 2009.
4. George Kennedy and Bernard Davis, ―Electronics & Communication System , TMH, 2004

EC3102 COMPUTER ARCHITECTURE

Externals: 60Marks **L-T-P-C**
Internals: 40Marks **3-0-0-3.**

Unit I: Basic Structure of Computers:

Functional units, software, performance issues software, machine instructions and programs, Types of instructions, Instruction sets: Instruction formats, addressing mode, Assembly language, Stacks, Queues, Subroutines.

Unit II: Information representation:

Number formats. Multiplication & division, ALU design, Floating Point arithmetic, IEEE 754 floating point formats.

Unit III: Control Design:

Instruction sequencing, Interpretation, Hard wired control - Design methods, and CPU control unit. Microprogrammed Control - Basic concepts, minimizing microinstruction size, multiplier control unit.

Unit IV: Memory organization:

Device characteristics, RAM, ROM, Memory management, Concept of Cache & associative memories, Virtual memory.

Unit V: I/O organization:

Input - Output systems, Interrupt, DMA, Standard I/O interfaces Concept of parallel processing, Pipelining, Forms of parallel processing.

Course Outcomes: At the end of this course students will demonstrate the ability to

- Learn how computers work
- Know basic principles of computer's working
- Analyze the performance of computers
- Know how computers are designed and built
- Understand issues affecting modern processors (caches, pipelines etc.)

Text Books:

1. V.Carl Hammacher, "Computer Organisation", Fifth Edition.
2. A.S.Tanenbum, "Structured Computer Organisation", PHI, Third edition
3. Y.Chu, "Computer Organization and Microprogramming", II, Englewood Chiffs, N.J., Prentice Hall Edition
4. M.M.Mano, "Computer System Architecture", Edition
5. C.W.Gear, "Computer Organization and Programming", McGraw Hill, N.V. Edition
6. Hayes J.P, "Computer Architecture and Organization", PHI, Second edition

EC3103 DIGITAL SIGNAL PROCESSING

Externals: 60Marks **L-T-P-C**
Internals: 40Marks **3-0-0-3**

UNIT I

PART A: Discrete time signals and Systems:

Introduction to DSP, Applications of DSP, Sequences; representation of signals on orthogonal basis; Sampling and reconstruction of signals;

PART B

Discrete systems attributes, Representation of system with Difference equations and Impulse response calculation, LSI systems, Circular Convolution with examples

UNIT II

PART A: Frequency domain analysis

Review of DTFT, Discrete Fourier Transform (DFT) with Properties, Computation of Linear and circular convolution using DFT, Fast Fourier Transform Algorithm,

PART B

Z transform, ROC, Properties, System description in the frequency domain.

UNIT III

PART A:Digital filters and finite word length effects

Linear Phase filters, Analysis of simple digital filters,Comb filters, all-pass functions, Procedure for stability criteria of discrete systems

PART B:

Effect of finite register length in FIR filter design.

Unit IV

PART A:Digital Filter Structures:

Direct, parallel, cascade, ladder and lattice for Infinite Impulse Response (IIR) filters

PART B

Possible realizations for FIR or Finite Impulse Response filters, including poly phase.

UNIT V

PART A: Design of Digital filters:

Design of IIR Digital Filters: Butterworth, Chebyshev and Elliptic Approximations; Lowpass, Bandpass, Bandstop and High pass filters, invariant and bilinear transformations

PART B:

Design of FIR Digital filters: Windowmethod, and frequency response sampling techniques

Course Outcomes:

At the end of this course students will demonstrate the ability to

- Represent signals mathematically in continuous and discrete time and frequency domain
- Get the response of an LSI system to different signals
- Design of different types of digital filters for various applications

Text/Reference Books:

5. S.K.Mitra, Digital Signal Processing: A computer based approach.TMH
6. A.V. Oppenheim and Schafer, Discrete Time Signal Processing, Prentice Hall, 1989.
7. John G. Proakis and D.G. Manolakis, Digital Signal Processing: Principles, Algorithms And Applications, Prentice Hall, 1997.
8. L.R. Rabiner and B. Gold, Theory and Application of Digital Signal Processing, Prentice Hall, 1992.
9. J.R. Johnson, Introduction to Digital Signal Processing, Prentice Hall, 1992
10. D.J.DeFatta, J. G. Lucas andW.S.Hodgkiss, Digital Signal Processing, John Wiley& Sons, 1988.

EC3104 RF AND MICROWAVE ENGINEERING

Externals: 60Marks **L-T-P-C**
Internals: 40Marks **3-0-0-3**

Course Objectives:

- To prepare students to understand basic principle of microwave and its applications.
- To prepare students to understand different microwave components and analyzing different type of junctions used in microwave engineering.
- To teach the students about various microwave solid state devices and their characteristics.
- To understand and gain complete knowledge about RF basic concepts, RF filter design.
- To understand and gain complete knowledge about RF amplifier design.

UNIT-I: Introduction to Microwaves:
History of Microwaves, Microwave Frequency bands; Applications of Microwaves: Civil and Military, Medical, EMI/ EMC.

Mathematical Model of Microwave Transmission: Concept of Mode, Features of TEM, TE and TM Modes, Losses associated with microwave transmission, Concept of Impedance in Microwave transmission.

UNIT-II: Analysis of RF and Microwave Transmission Lines:
Coaxial line, Rectangular waveguide, Circular waveguide, Resonator, Strip line, Micro strip line.

Microwave Network Analysis: Equivalent voltages and currents for non-TEM lines, Network parameters for microwave circuits, Scattering Parameters.

UNIT-III: Passive and Active Microwave Devices:
Microwave passive components: Directional Coupler, Power Divider, Magic Tee, Attenuator.

Microwave active components: Diodes, Transistors, Oscillators, Mixers. Microwave Semiconductor Devices: Gunn Diodes, IMPATT diodes, Schottky Barrier diodes, PIN diodes. Microwave Tubes: Klystron, TWT, Magnetron.

UNIT-IV: Microwave Design Principles:
Impedance transformation, Impedance Matching, Microwave Filter Design, RF and Microwave Amplifier Design, Microwave Power Amplifier Design, Low Noise Amplifier Design, Microwave Mixer Design, Microwave Oscillator Design.

Microwave Antennas: Antenna parameters, Antenna for ground based systems, Antennas for airborne and satellite borne systems, Planar Antennas.

UNIT-V: Microwave Measurements:
Power, Frequency and impedance measurement at microwave frequency, Network Analyser and measurement of scattering parameters, Spectrum Analyser and measurement of spectrum of a microwave signal, Noise at microwave frequency and measurement of noise figure. Measurement of Microwave antenna parameters.

Microwave Systems: Radar, Terrestrial and Satellite Communication, Radio Aidsto Navigation, RFID, GPS. Modern Trends in Microwaves Engineering- Effect of Microwaves on human body, Medical and Civil applications of microwaves, Electromagnetic interference and Electromagnetic Compatibility (EMI & EMC), Monolithic Microwave ICs, RFMEMS for microwave components, Microwave Imaging.

Course Outcomes:

- Able to calculate cut off frequency, identify possible modes and obtain mode characteristics of Reflex Klystron and Gunn oscillator.
- understand the principles of operation of waveguide, gyrator, isolator attenuator etc. and obtain scattering matrix for various junctions like E-plane, H plane, Circulator, Direction Coupler.
- Analyze and deign basic microwave amplifiers, particularly klystrons, magnetron, and RF filters, basic RF oscillator and mixer models.
- Become proficient with microwave measurement of power, frequency and VSWR, impedance for the analysis and design of circuits.
- Analyze T-R Module, microwave systems and microwave antennas.

Text Books:

1. Microwave devices and circuits-Samuel Y. Liao, Pearson, 3rd Edition, 2003.
2. Microwave principles-Herbert J.Reich, J.G.Skalnik, P.F.Ordung andH.L.Krauss, CBS publishers and distributors, New Delhi, 2004.

References:

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

EC3105 **VLSI ENGINEERING**

Externals: 60Marks **L-T-P-C**
Internals: 40Marks **3-0-0-3**

Course Objectives:

- To study the MOS transistors with their characteristics succeeded by the fabrication process.
- Making aware of VLSI design flow and gaining knowledge on its basic micron constraints for a panoramic view of transistors
- Understanding various subsystem design concepts and its internal schematics.
- Comparison of various programmable logic devices in terms of applications
- To understand the need for testing a VLSI chip by applying the Engineering skills to meet the challenges in semiconductor industries.

UNIT I: INTRODUCTION

Introduction to IC Technology – MOS, PMOS, NMOS, CMOS & BiCMOS technologies-Oxidation, Lithography, Diffusion, Ion implantation, Metallization

Basic Electrical Properties of MOS and BiCMOS Circuits: Ids-Vds relationships, MOS transistor threshold Voltage, gm, gds, figure of merit o; Pass transistor, NMOS Inverter, Various pull ups, CMOS Inverter analysis and design, Bi-CMOS Inverters.

UNIT II: VLSI CIRCUIT DESIGN PROCESSES

VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layout, 2 μm CMOS Design rules for wires, Contacts and Transistors Layout Diagrams for NMOS and CMOS Inverters and Gates, Scaling of MOS circuits, Limitations of Scaling.

UNIT III: GATE LEVEL DESIGN

Logic Gates and Other complex gates, Switch logic, Alternate gate circuits, Basic circuit concepts, Sheet Resistance RS and its concept to MOS, Area Capacitance Units, Calculations – Delays, Driving large Capacitive Loads, Wiring Capacitances, Fan-in and fan-out,Choiceoflayers

Data path subsystem : Subsystem Design, Shifters, Adders, ALUs, Multipliers, Parity generators, Comparators, Zero/One Detectors, Counters,.

UNIT IV: SEMICONDUCTOR INTEGRATED CIRCUIT DESIGN

Logic Families: characteristics of digital circuit (Fan-in, Fan-out, power dissipation, propagation delay, noise margin, Figure of Merit etc., Saturated logic families: DCTL, RTL, DTL, HTL, TTL, I2L etc., non-saturated logic families: STTL, ECL. PMOS, NMOS, CMOS.

Array Sub Systems: SRAM, DRAM.

UNIT V: CMOS TESTING

CMOS Testing, Need for testing, Test Principles, Design Strategies for test, Chip level Test Techniques, System-level Test Techniques, Layout Design for improved Testability.

Course Outcomes:

- Students will be Analyzed with various processing steps involved in IC on monolithic devices followed by understanding MOSFETS electrical properties.
- Applying the knowledge of layout, stick diagrams, static and switching characteristics of inverters by CMOS technology for designing a sequential circuit.
- Students will be good at Realizing CMOS as a switch and its technology for designing a combinational circuit by implementing it using transmission gate/PLD's.
- Students will be knowing the ability to identify, formulate, and analyze by creating an ability to use the techniques, skills and modern EDA tools necessary for design and test of VLSI circuits by keeping aware of contemporary issues.
- Students will be good at designing VLSI systems by keeping a view on the design for testability concepts.

TEXTBOOKS :

1. Essentials of VLSI circuits and systems – Kamran Eshraghian, EshraghianDougles and A. Pucknell, PHI, 2005 Edition.
2. Principles of CMOS VLSI Design – Weste and Eshraghian, Pearson Education, 1999.

REFERENCES::

1. Chip Design for Submicron VLSI: CMOS Layout & Simulation, – John P. Uyemura, Thomson Learning.
2. Introduction to VLSI Circuits and Systems – John .P. Uyemura, JohnWiley, 2003.
3. Digital Integrated Circuits – John M. Rabaey, PHI, EEE, 1997.
4. Modern VLSI Design – Wayne Wolf, Pearson Education, 3rd Edition, 1997.
5. VLSI Technology – S.M. SZE, 2nd Edition, TMH, 2003.

MAOE **NUMERICAL METHODS**

Externals: 60Marks **L-T-P-C**
Internals: 40Marks **3-0-0-3**

Unit 1: Error in numerical calculations (14 hours)

Sources of errors, significant digits and numerical instability. Solutions of non linear equations: Bisection method, Method of false position, Newton-Raphson method, Fixed-point iteration, Rates of convergence of these methods. Iteration based on second degree equation: Muller method, Chebyshev method, Graeffe's root squaring method for polynomials, Bairstow's method for extracting quadratic factor in the case of polynomial equations.

Unit-II Solution of system of linear algebraic equations: (14 hours)

Direct methods: Gauss and Gauss– Jordan methods. Crout's triangularization method. Iterative methods: Gauss-Jacobi and Gausss-Seidel methods, Relaxation method, Newton's method for nonlinear simultaneous equations, Power method for determination eigen values, convergence of Power method.

Unit –III

Interpolation: Polynomial Interpolation: Lagrange's interpolation, Newton's divided difference interpolation polynomial, Gregory-Newton Forward and Back ward difference interpolation formulae, Piecewise and Spline interpolation.
Numerical integration: Trapezoidal and Simpson rules, Gaussian integration, Errors of integration formulas

Unit-IV

Differentiation formulas in the case of equally spaced points.. Numerical solution of ordinary differential equations: Single step methods: Taylor series method, Picard's Method, Euler and Modified Euler methods, Runge – Kutta methods of 2^{nd} and 4^{th} order. Multi-step methods: Miline's Predictor-Corrector formulas, Adam-Bashforth and Adam-Moulton formulas.

Unit-V:

Solution of Linear difference equations with constant coefficients, Solutions of boundary value problems in ordinary differential equations, Approximate solution of eigen value problems, Finite difference methods for solving two dimensional Laplace's equation for a rectangular region, Finite difference method of solving heat equation and wave equation with given initial and boundary conditions.

References:

1. Froberg C. E., Introduction to Numerical Analysis 2^{nd} edition, Addison Wesley, 1970.
2. Gerald C. F. , Wheatley P.O., Applied Numerical Analysis, 6^{th} edition, Pearson Asia,2002.
3. Jain M.K., IyengarS.R.K., Numerical methods for Scientific and Engineering Computation, 3^{rd} edition, New Age International (P) Ltd, 1996.
4. Phillips G.M., Taylor P.J., Theory and Applications of Numerical Analysis, 2^{nd} edition Academic Press,

EC3701 ANALOG AND DIGITAL COMMUNICATION LAB

Externals: 60Marks **L-T-P-C**
Internals: 40Marks **0-0-2-1.**

List of Experiments:

1. Amplitude Modulation and Demodulation
2. DSB-SC Modulation and Demodulation
3. Frequency Modulation
4. Frequency division multiplexing
5. PAM, PWM, PPM
6. Automatic Gain Control circuit
7. Carrier recovery circuit
8. Mixer circuit
9. Verification of Sampling theorem
10. Quantizer design
11. PCM implementation
12. ASK,PSK,FSK,QPSK modulation demodulation
13. Decoding of corrupted repetition code
14. Time division multiplexing
15. Using MATLAB, plot the constellation of BPSK, QPSK, without noise and with AWGN (under different SNR values) and draw the decision boundaries. Observe the symbol errors, bit errors.
16. Using MATLAB monte-carlo simulations, to find the BER versus SNR curves for ASK, BPSK, FSK, QPSK, 16 PSK, 16-QAM with AWGN channel.
17. Using MATLAB program, find the Huffman code for given set of samples.

Course Outcomes:

At the end of this lab course, students will able to learn the following:

- Basic level circuit design for AM, DSBSC, FM, modulator and demodulators
- Basic level receiver circuit design for analog receivers
- Digitization of analog signals
- Various modulation techniques used for digital signal transmission and BER performance
- Demonstration of Frequency division multiplexing and Time division multiplexing
- Source coding and Channel coding demonstration

EC3702 DIGITAL SIGNAL PROCESSING LAB

Externals: 60Marks **L-T-P-C**
Internals: 40Marks **0-0-2-1**

Course Objectives:

- To implement Linear and Circular Convolution
- FFT algorithm using MATLAB.
- To implement FIR and IIR filters
- Design of digital filters using MATLAB.
- To study the architecture of DSP processor
- Implementation of digital filters on DSP Processor.

List of Experiments

(A) Experiments on signal processing using MATLAB.

1. Basic matrix operations and Generation of test signals.
2. Even and odd parts of the given sequence
3. Linear Convolution, circular convolution.
4. Interpolation and Decimation
5. Discrete Fourier Transform(DFT) and Fast Fourier Transform(FFT)
6. Filter Analysis and Implementation.
7. Analog Filter Design
8. IIR filter design: Butter worth, Chebyshev type 1 and 2: LPF, HPF, BPF & BSF filter.
9. FIR filter design using different windows
10. Adaptive equalizer, LS, MMSE
11. Bayesian, ML estimators

(B) Experiments on DSK and CCS

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

Course Outcomes:

Students will be able to:

- Design and analyze the digital filters using MATLAB.
- Implement FFT algorithms for linear filtering using MATLAB.
- implement FIR and IIR filters using MATLAB.
- Design and Implement the digital filters on DSP processor.

References:

1. Digital Signal Processing – A Computer Based Approach By Sanjay K. Mitra, Tata McGraw Hill
2. Vinay K. Ingle and John G. Proakis, "Digital Signal Processing using MATLAB", 4/e, Cengage learning, 2011.
3. B. Venkataramani and M. Bhaskar,"Digital Signal Processor architecture, programming and application", 6/e, TMH, 2006.

EC3703 RF AND MICROWAVE ENGINEERING LAB

Externals: 60Marks **L-T-P-C**
Internals: 40Marks **0-0-2-1**
Course Objectives:

- The goal of this course is to introduce students to the concepts and principles of the advanced microwave engineering.
- To study the characteristics of RKO and Gunn oscillator.
- Measurement of frequency and wavelengths would be learnt by the student.
- VSWR various TEES, MHD and Circulator would be understood by the student.
- Radiation pattern would be learnt by the student for horn antenna.
- To study the usage of hand held Vector Network Analyzer, Spectrum Analyzer, Advanced Microwave Integrated Circuits.

List of Experiments:

SECTION-A

1. Study of standing wave pattern.
2. Measurement of guide wavelength and frequency.
   (i) By using Frequency meter i.e. Direct Method
   (ii) By using Slotted line method i.e. Indirect Method
3. Repeller mode characteristics of Reflex klystron.
4. I-V characteristics of Gunn Diode.
5. Measurement of VSWR.
   (i) By using Slotted line method (S<10)
   (ii) By using Double minimum method (S>10)
6. Calibration of Crystal detector.
7. Calibration of Attenuator (Fixed attenuation i.e. Power Ratio method).
8. Measurement of attenuator (Variable attenuation i.e. RF substitution method)
9. Measurement of unknown impedance.
   (i) By using Load impedance formula
   (ii) By using Smith Chart
10. Radiation pattern of horn antenna and parabolic dish antenna.

SECTION-B

Resonant Microwave components

1. Introduction regarding S-parameters (Study Experiment).
2. Characteristics of Magic-Tee with the help of S-matrix and observe the phase difference with the help of CRO.
3. Characteristics of Directional Coupler.
   (i) Directivity
   (ii) Isolation
   (iii)Insertion loss
   (iv)Coupling Factor
   (v) S-matrix

(vi) And Prove $P^2 + q^2 = 1$.

Non-Resonant Microwave components

4. Characteristics of Circulator (3-port).
   (i) Find S-matrix
   (ii) Find VSWR
5. 4-port Circulator by using two magic tees and one gyrator.
6. Characteristics of Isolator (By using Y-circulator)
   (i) Find S-matrix
   (ii) Find VSWR

.

Course Outcomes:

1. Gain knowledge and understanding of microwave analysis methods.
2. Be able to apply analysis methods to determine circuit properties of passive/active microwave devices.
3. Analyze the characteristics of RKO and Gunn oscillator.
4. Measure the frequency and guided wavelength.
5. Estimate the VSWR for various loads and S-Matrix for various microwave devices.
6. Obtain the horn antenna radiation pattern.

Text Books:

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. Microwave engineering- David M. Pozar, fourth edition, john wiley & Sons Inc. publications.

References:

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 and Radar engineering- Dr. M. Kulakarni, Umesh publications, fifth edition, 2015

EC3901 **TECHNICAL SEMINAR**

L-T-P-C

Total 100 Marks **0-0-2-1**

1. Need to present a seminar topic on recent technologies of Electronicsand Communication Engineering

VI SEMESTER

EC3201 **DIGITAL SYSTEM DESIGN**
Externals: 60Marks **L-T-P-C**
Internals: 40Marks **3-0-0-3**

UNIT-I: Introduction to Verilog : Evolution of CAD tools,Overview of Design Flow, Modeling Concepts, Modules and Ports, Different Abstractions-Gate level, Dataflow, Behavioral, Tasks and Functions, Useful Modeling Techniques

.

UNIT-II: Advanced Verilog: Timings and Delays, clocking of Flip Flops- effect of Propagation delay by considering timing constraints, clock skew, Global setup and Hold time.

UNIT-III: Basic systems design
Review of FSM- Meelay, Moore Machines, State graphs, State tables, Design of pattern identification, Hardware realizations- Sequential logic, combinational logic and Verilog Modeling, One hot controller-vending machine, Hardware realizations and Verilog Modeling.

UNIT-IV: Sophisticated designs
ASM-components, Meelay ,Moore ASM, Bus Arbiter, Traffic Light Controller, Dice Game, Micro programming techniques-SQDA,SQSA for Dice Game

UNIT-V: **CPLD, FPGA architectures** –Programmable logic devices –FPGA, configurable blocks- LUT.CPLD, functional blocks -Macro cells, Overview of various CPLD, FPGA's.

Text Books:

1. Verilog HDL: A Guide to Digital Design and Synthesis, Second Edition By Samir Palnitkar
2. Jon F Wakerly, Digital Design: Principles and Practices, Prentice Hall.
3. Digital Systems Engineering - E-bok - William J Dally, John W Poulton

References:

1. IIT Madras –Prof S Srinivasan- Nptel Lectures
2. CPLD, FPGA Families .
3. Design & analyze synchronous sequential logiccircuits
4. william i fletcher an engineering approach to digital design

EC3202 MICRO–CONTROLLERS AND INTERFACING

Externals: 60Marks **L-T-P-C**
Internals: 40Marks **3-0-0-3**

Unit 1: Architecture of Microprocessors:

General definitions of mini computers, microprocessors, micro controllers and digital signal processors. CISC Vs RISC and ARM processors, Overview of 8085 microprocessors.

Unit 2: Architecture and Assembly language of 8086:

Architecture, memory segmentation, signals and pins of 8086 microprocessors. Assembly directives, Addressing modes, Description of Instructions and Assembly software programs with algorithms.

Unit 3: Interfacing with 8086:

Interfacing with peripheral ICs like 8255-PPI, 8237-DMA controller, 8259- Programmable Interrupt Controller, Interfacing with key boards, LEDs, LCDs, ADCs, and DACs etc.

Unit 4: Micro-controller 8051:

Overview of the architecture of 8051 microcontroller, Description of Instructions. Assembly directives. Assembly software programs with Algorithms.

Unit 5: Interfacing with 8051:

Interfacing with keyboards, LEDs, 7 segment LEDs, LCDs, Interfacing with ADCs and DACs, stepper motor etc.

Course Outcomes: At the end of this course students will demonstrate the ability to

- Do assembly language programming.
- Do interfacing design of peripherals like, I/O, A/D, D/A, timer etc.
- Develop systems using microcontrollers

Text Books:

1. R. S. Gaonkar, Microprocessor Architecture: Programming and Applications with the 8085/8080A, Penram International Publishing, 1996
2. D A Patterson and J H Hennessy, "Computer Organization and Design The hardware and software interface. Morgan Kaufman Publishers.
3. Douglas Hall, Microprocessors Interfacing, Tata McGraw Hill, 1991.
4. Kenneth J. Ayala, The 8051 Microcontroller, Penram International Publishing, 1996.

ECPE1_ **PATTERN RECOGNITION**

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **3-0-0-3**

Introduction to pattern recognition with some real world applications, Supervised, unsupervised, Reinforcement learning introduction. Data Pre-processing, Different types of Distance measures and similarity measures. Classification: Bayes Classifier, ML, MAP estimators, Naive Bayes classifier. K-Nearest Neighbor classifier, Support Vector Machines, Kernel Machines, Over-fitting problem, Artificial Neural Networks: Perceptron learning rule, Gradient Descent learning rule. Limitations and where to apply these classification rules. Multi layered perceptron, Back propagation, logic gates using Perceptron, Sigmoid function, Decision trees. Association rules, Apriori algorithm, Rule generation. Clustering, Anomaly Detection, Regression, Dimensionality Reduction techniques: Feature selection, Principle Component analysis, Independent component analysis, Singular Value Decomposition. Evaluating results: Classification metrics, Regression metric, validation, cross- validation.

Course Outcome:

At the end of this course, students will get the ability to
Do preprocessing task and applying suitable classification algorithm for a given classification task.
Apply clustering algorithm for a given data.
Apply regression analysis technique for prediction.
Work with association algorithms.
Represent the data with less number of features.

Reference books:

R.O.Duda, P.E.Hart and D.G.Stork, Pattern Classification, John Wiley, 2002.
C.M.Bishop, Neural Networks and Pattern Recognition, Oxford University Press (Indian Edition), 2003.
Pang-Ning Tan, Michael steinbach and Vipin kumar, Introduction to Data mining, Pearson, 2016.
B.Yegnanarayana, Artificial Neural Networks, PHI, 1999.

CS3203 **OPERATING SYSTEMS**

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **3-0-0-3**

OBJECTIVES:

To learn the fundamentals of Operating Systems.

1. To learn the mechanisms of OS to handle processes and threads and their communication

2. To learn the mechanisms involved in memory management in contemporary OS

3. To gain knowledge on distributed operating system concepts that includes architecture,

Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols

4. To know the components and management aspects of concurrency management

Unit 1:

Introduction: Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, OS Services, System Calls, Structure of an OS – Layered, Monolithic, Microkernel Operating Systems, Concept of Virtual Machine.

Unit 2:

Processes: Definition, Process Relationship, Different states of a Process, Process State

transitions, Process Control Block (PCB), Context switching

Thread: Definition, Various states, Benefits of threads, Types of threads, Concept of

multithreads,

Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling

criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time;

Scheduling algorithms: Pre-emptive and Non pre-emptive, FCFS, SJF, RR

Unit 3:

Inter-process Communication: Critical Section, Race Conditions, Mutual Exclusion,

Hardware Solution, Strict Alternation, Peterson's Solution, The Producer\

Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing,

Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem etc.

Deadlocks: Definition, Necessary and sufficient conditions for Deadlock, Deadlock

Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.

Unit 4: Memory Management: Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation – Fixed and variable partition– Internal and External fragmentation and Compaction; Paging: Principle of operation – Page allocation – Hardware support for paging, Protection and sharing, Disadvantages of paging.

Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault , Working Set , Dirty page/Dirty bit – Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used (LRU).

Unit 5: I/O Hardware: I/O devices, Device controllers, Direct memory access Principles of I/O Software: Goals of Interrupt handlers, Device drivers, Device independent I/O software, Secondary-Storage Structure: Disk structure, Disk scheduling algorithms

File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency and performance.

Disk Management: Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks

Suggested books:

1. Operating System Concepts Essentials, 9th Edition by AviSilberschatz, Peter Galvin, Greg Gagne, Wiley Asia Student Edition.
2. Operating Systems: Internals and Design Principles, 5th Edition, William Stallings, Prentice Hall of India.

Suggested reference books:

1. Operating System: A Design-oriented Approach, 1st Edition by Charles Crowley, Irwin Publishing
2. Operating Systems: A Modern Perspective, 2nd Edition by Gary J. Nutt, Addison-Wesley

3. Design of the Unix Operating Systems, 8th Edition by Maurice Bach, Prentice-Hall

of India

4. Understanding the Linux Kernel, 3rd Edition, Daniel P. Bovet, Marco Cesati, O'Reilly

and Associates

Outcomes:

1. Create processes and threads.

2. Develop algorithms for process scheduling for a given specification of CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time.

3. For a given specification of memory organization develop the techniques for optimally allocating memory to processes by increasing memory utilization and for improving the access time.

4. Design and implement file management system.

5. For a given I/O devices and OS (specify) develop the I/O management functions in OS as part of a uniform device abstraction by performing operations for synchronization between CPU and I/O controllers.

BM0003 **OPERATIONS RESEARCH**

Externals: 60Marks **L-T-P-C**
Internals: 40Marks **3-0-0-3**

Course Objectives:

To provide knowledge and training in using optimization techniques under limited resources for the engineering and business problems.

Unit I: Linear Models

The phase of an operation research study – Linear programming – Graphical method– Simplex algorithm – Duality formulation – Sensitivity analysis.

Unit II : Transportation Models And Network Models

Transportation Assignment Models –Traveling Salesman problem-Networks models – Shortest route – Minimal spanning tree – Maximum flow models –Project network – CPM and PERT networks – Critical path scheduling – Sequencing models.

Unit III : Inventory Models

Inventory models – Economic order quantity models – Quantity discount models – Stochastic inventory models – Multi product models – Inventory control models in practice.

Unit IV : Queueing Models

Queueing models – Queueing systems and structures – Notation parameter – Single server and multi server models – Poisson input – Exponential service – Constant rate service – Infinite population – Simulation.

Unit V: Decision Models

Decision models – Game theory – Two person zero sum games – Graphical solution- Algebraic solution– Linear Programming solution – Replacement models – Models based on service life – Economic life– Single / Multi variable search technique – Dynamic Programming – Simple Problem.

Course Outcomes:

Upon completion of this course, the students can able to use the optimization techniques for engineering and Business problems

Text Books:

1. Taha H.A., “Operations Research”, Sixth Edition, Prentice Hall of India, 2003. REFERENCES: 1. Shennoy G.V. and Srivastava U.K., “Operation Research for Management”, Wiley Eastern, 1994.
2. Bazara M.J., Jarvis and Sherali H., “Linear Programming and Network Flows”, John Wiley, 1990.
3. Philip D.T. and Ravindran A., “Operations Research”, John Wiley, 1992.
4. Hillier and Libeberman, “Operations Research”, Holden Day, 1986
5. Budnick F.S., “Principles of Operations Research for Management”, Richard D Irwin, 1990.
6. Tulsian and Pasdey V., “Quantitative Techniques”, Pearson Asia, 2002

EC3801 **DIGITAL SYSTEM DESIGN LAB**

Externals: 60Marks **L-T-P-C**
Internals: 40Marks **0-0-2-1**

Course Objective:

- Familiarize with VLSI CAD tools like Xilinx14.4 and Mentor Graphics tool.
- Gives Basic concepts of Verilog HDL code to write a code for digital circuits.
- To have hands on experience to design digital circuits, simulate and synthesis the design with Xilinx 14.4 VLSI CAD tool with timing diagrams and RTL diagrams.
- To have hands on experience for transistor level design and simulate it with transient and dc analysis using mentor Graphics tool.
- FPGA implantation of the Verilog code written in the VLSI CAD tool.

LIST OF EXPERIMENTS:

1. Familiarization with Xilinx14.4 tool.
2. Simulate and Synthesis of all basis gates.
3. Simulate and synthesis of multiplexers, decoders and code converters.
4. Simulate and synthesis of all flipflops.
5. Simulate and synthesis of Universal shift register.
6. Simulate and synthesis of the binary counter, MOD counters.
7. FPGA implementation of basic gates and binary counter.
8. Familiarization of the mentor Graphic tool for transistor level design.
9. Design and synthesis of a CMOS amplifier
10. Transient and DC analysis of CMOS inverter.
11. Transient, DC and power analysis of the NAND and NOR gates using CMOS implementation.
12. Transient, DC and power analysis of the XOR gates using NAND gates cells.
13. Transient, DC and power analysis of the 2x1 MUX using NAND gates cell

Course Outcomes:

- Able to write a Verilog HDL code for the digital systems.
- Able to use the VLSI CAD tools to design digital systems and get synthesis the design to get RTL level diagram.
- Able to simulate the digital system to check the functionality with the timing diagrams.
- Able to do transient and dc analysis of the CMOS Inverter, Logic gates and analog circuits.
- Able to do FPGA Implementation of the combinational and sequential circuits.

EC3802 **MICRO – CONTROLLERS LAB**

Externals: 60Marks **L-T-P-C**
Internals: 40Marks **0-0-2-1**

List of Experiment:

Familiarization with TITAN II Kit's hardware and usage of Triton IDE along with Flash Magic for dumping the code to the controller by blinking on board LEDs.

1. Interface simple seven segment LED display with controller.
2. To Display "DEPT OF ECE" on LCD in 8-bit as well as 4-bit mode
3. Interface Keyboard and LCD with controller.
4. Interface Stepper Motor by controlling its direction and make it spin faster or slower.
5. Interface DC motor and control its speed using PWM technique.
6. Design, program and implementTraffic Light system using microcontroller. (prefer the design on breadboard)
7. Design, program and implement Elevatorsystem using microcontroller.
   (prefer the design on breadboard)
8. Interfacing ADC to Microcontroller.
9. Interface DAC with Microcontroller and generate multiple waveforms.
10. Interface Temperature Sensor to ADC and measure it on LCD with microcontroller.

Course Outcomes:

Upon completion of the course the students will have

- Ability to understand the hardware kits and way of dumping the program in IC.
- Gain the knowledge of various input and display output devices and their interfacing to µc-8051.
- Understanding of various motors and ability to interface with microcontrollers in various modes.
- Ability to design and demonstrate various applications such as traffic light controller and elevator control.
- Understanding the interfacing of ADCs and DACs, and various analog sensors.

ECP01 **MINI PROJECT**

Externals: 60Marks **L-T-P-C**
Internals: 40Marks **0-0-4-2**

ECCV-I **Comprehensive Viva-I**
Externals: 100Marks **L-T-P-C**
0-0-2-0

ECP02 **Summer Internship**
Externals: 60Marks **L-T-P-C**
Internals: 40Marks **0-0-2-1**

VII SEMESTER

EC_ Preferable Signal Processing Stream Elective

Externals: 60Marks **L-T-P-C**
Internals: 40Marks **3-0-0-3**

EC_ Preferable Communication Stream Elective

Externals: 60Marks **L-T-P-C**
Internals: 40Marks **3-0-0-3**

EC_ Preferable Embedded Systems Stream Elective

Externals: 60Marks **L-T-P-C**
Internals: 40Marks **3-0-0-3**

BM0010 Professional Law and Ethics

Externals: 60Marks **L-T-P-C**
Internals: 40Marks **3-0-0-3**

Course Objective: To understand the Legal and Regulatory Framework for doing business in India.
Course Outcome: Students will be able to understand a) Business Laws related to contracts b) Importance of Ethics in Business c) IPR and Legal Aspects.

UNIT - I : Business Ethics Definition - Importance of Ethics in Business - Distinction between Values and Ethics -Characteristics of Ethical Organization - Morality and Professional Ethics - Ethical Dilemmas- How to create an ethical working environment-Ethical Decision making in Business- Role of corporate Governance in ensuring ethics in workplace - Indian Ethical Traditions.

UNIT – II: ETHICS IN FUNCTIONAL AREAS OF BUSINESS- Ethics in Marketing: Ethical practices in product packaging and labeling - Pricing - Advertising -Direct marketing – Green marketing - Ethical vs. Unethical marketing behavior. Ethics in HRM: Ethical implications of Privacy – Harassment – Discrimination – Whistle blowing. Ethics in Finance: Accountability – Window dressing and disclosure practices – Insider trading.

UNIT –III: Law of Contract: Nature of Contract and Essential elements of valid contract, Offer and Acceptance, Consideration, Capacity to contract and Free Consent, Legality of Object, Performance and discharge of Contracts, Remedies for breach of contract.

Unit-IV

Contracts-II: Indemnity and guarantee, Contract of Agency, Sale of goods Act -1930: General Principles, Conditions & Warranties, Performance of Contract of Sale.

Unit- V: Law relating to Intellectual Property: Introduction – meaning of intellectual property, main forms of IP, Copyright, Trademarks, Patents and Designs, Secrets;

Suggested readings:

1. Maheshwari & Maheswari - A Manual of Business Laws, Himalaya Publishing House.
2. D. Chandra Bose - Business Law PHI-Private Limited, New Delhi.
3. A.C. Fernando - Business Ethics An Indian Perspective Pearson Education 4.Manuel G. Velasquez - Business Ethics Concepts and Cases Prentice-Hall of India Pvt.Ltd, 2008.
5. S.S. Gulshan - Business Laws Excel Books, New Delhi

ECP03 **Project Stage-I**

Externals: 60Marks **L-T-P-C**
Internals: 40Marks **0-0-6-3**

CS4101 **COMPUTER NETWORKS**

Externals: 60Marks **L-T-P-C**
Internals: 40Marks **3-0-0-3**

Objectives:

1. To Introduce The Fundamental Various Types Of Computer Networks.
2. To Demonstrate The TCP/IP And OSI Models With Merits And Demerits.
3. To Introduce UDP And TCP Models.

Detailed Contents:

UNIT - I:

Introduction- Hardware And Software, Data Communication, Networking, Protocol, Layering Scenario, TCP/IP Protocol Suite: The OSI Model,Internet History Standards And Administration; Comparioson Of The OSI And TCP/IP Reference Model, Digital And Analog Data And Signals.

Physical Layer: Guided Transmission Media, Wireless Transmission Media.

Data Link Layer: Design Issues, CRC Codes, Elementary Data Link Layer Protocols, SlidingWindow Protocol, Flow Control. Error Detection And Error Control. HDLC And other Data Link Protocols.

UNIT - II:

Band Width Utilization: Multiplexing – Frequency-Division, Synchronous Time-Division, And Statistical Time-Division Multiplexing.

Multi Access Protocols: ALOHA, CSMA, Collision Free Protocols, Ethernet- Physical Layer,Ethernet Mac Sub Layer, Data Link Layer Switching & Use Of Bridges, Learning Bridges, Spanning Tree Bridges, Repeaters, Hubs, Bridges, Switches, Routers And Gateways.

UNIT-III:

Network Layer: Network Layer Design Issues, Store And Forward Packet Switching ConnectionLess And Connection Oriented Networks-Routing Algorithms-Optimality Principle, Shortest Path, Flooding, Distance Vector Routing, Control To Infinity Problem, Hierarchical Routing, Congestion Control Algorithms, Admission Control.

UNIT-IV:

Internetworking: Tunneling, Internetwork Routing, Packet Fragmentation, Ipv4, Ipv6 Protocol,IP Addresses, CIDR, IMCP, BOOTP, ARP, RARP, DHCP, Network Address Translation(NAT) Internetworking

Transport Layer: TCP Introduction, Reliable/Un- Reliable Transport ,Connection Establishment, Connection Release, Crash Recovery, Intra-Domain Routing: Distance-Vector, Intra-Domain Routing: Link- State, Wireless Networks: 802.11 MAC, Efficiency Considerations

UNIT-V:

The Internet Transport Protocols: UDP-RPC, Real Time Transport Protocols, The InternetTransport Protocols- Introduction To TCP, The TCP Service Model, The TCP Segment Header, The Connection Establishment, The TCP Connection Release, The TCP Connection Management Modeling, The TCP Sliding Window, The TCP Congestion Control, The Future Of TCP.

Application Layer: Introduction, Providing Services, Applications Layer Paradigms, ClientServer Model, Standard Client-Server Application-HTTP, FTP, Electronic Mail, TELNET, DNS, SSH,SNMP,WWW.

Text Books:

1.Computer Networks, by Andrew s Tanenbaum,PHI(2010)

2.Data and Computer Communications,by William Stallings,PHI(2002)

References Books:

1. Data Communications and Networking - Behrouz A. Forouzan, Fifth Edition TMH, 2013.
2. Computer Networks - Andrew S Tanenbaum, 4th Edition, Pearson Education.
3. An Engineering Approach to Computer Networks - S. Keshav, 2nd Edition, Pearson Edication.
4. Understanding communications and Networks, 3rd Edition, W. A. Shay, Cengage Learning.
5. Introduction to Computer Networks and Cyber Security, Chwan-Hwa (John) Wu, J. David Irwin, CRC Press.
6. Computer Networks, L. L. Peterson and B. S. Davie, 4th edition, ELSEVIER.

7. Computer Networking: A Top-Down Approach Featuring the Internet, James F. Kurose, K. W. Ross, 3rd Edition, Pearson Education.

Course Outcomes:

- Students should understand and explore the basics of Computer Networks and Various Protocols. He/She will be in a position to understand the World Wide Web concepts.
- Students will be in a position to administrate a network and flow of information further he/she can understand easily the concepts of network security, Mobile and ad hoc networks.

CS4701 **COMPUTER NETWORKS LAB**

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **0-0-2-1**

Course Objectives

- To understand the working principle of various communication protocols.
- To analyze the various routing algorithms.
- To know the concept of data transfer between nodes

Detailed Contents:

Week-1

1. Study of different types of Network cables and Practically implement the cross-wired cable and straight through cable using clamping tool.
2. Study of Network Devices in Detail.

Week-2

3. Study of network IP.
4. Connect the computers in Local Area Network.

Week-3

5. Study of basic network command and Network configuration commands.
6. Socket Program for Echo/Talk commands.

Week-4

7. Configure a Network topology using packet tracer software.

Week-5

8. Configure Network using Link State Vector Routing protocol.
9. Configure a Network using Distance Vector Routing protocol.

Week-6

10. Write a program to implement RPC (Remote Procedure Call)
11. Write a code simulating PING and TRACEROUTE commands

Week-7

12. Implementation of STOP & WAIT protocol and sliding window protocol
13. Write a program to implement sub netting and find the subnet masks.

Week-8

14. Create a socket for HTTP for web page upload and download.
15. Create a socket (UDP)

Week-9

16. Using TCP/IP sockets, write a client server program to make client sending the file name and the server to send back the contents of the requested file if present.

Week-10

17. Simulation of ARP/RARP

Week-11

18. TCP Module Implementation

Week-12

19. Applications using TCP and UDP Sockets like d. DNS and SNMP

Course Outcomes

- Identify and use various networking components Understand different transmission media and design cables for establishing a network
- Implement any topology using network devices
- Analyze performance of various communication protocols.
- Compare routing algorithms
- Understand the TCP/IP configuration for Windows and Linux
- Implement device sharing on network
- Learn the major software and hardware technologies used on computer networks

VIII SEMESTER

EC_	**PROGRAM ELECTIVE**	
Externals: 60Marks		**L-T-P-C**
Internals: 40Marks		**3-0-0-3**
EC_	**OPEN ELECTIVE**	
Externals: 60Marks		**L-T-P-C**
Internals: 40Marks		**3-0-0-3**
EC_	**OPEN ELECTIVE**	
Externals: 60Marks		**L-T-P-C**
Internals: 40Marks		**3-0-0-3**
EC_	**OPEN ELECTIVE**	
Externals: 60Marks		**L-T-P-C**
Internals: 40Marks		**3-0-0-3**
ECP04	**PROJECT STAGE-II**	
Externals: 60Marks		**L-T-P-C**
Internals: 40Marks		**0-0-16-8**
ECCV-II	**COMPREHENSIVE VIVA-II**	
Externals: 100Marks		**L-T-P-C**
		0-0-2-0

CURRICULUM FOR PROFESSIONAL ELECTIVE SUBJECTS

Credit Distribution for Professional Elective Subjects									
Stream-I									
Sl. No.	Course Code	Course Title	Semester	Course Category	Hours per week			Total contact hours	Credits
					L	T	P		
1	ECPE1_	Digital Image Processing	VII	PEC	3	0	0	3	3
2	ECPE1_	Adaptive Signal Processing	VII	PEC	3	0	0	3	3
3	ECPE1_	Biomedical Signal Processing	VII	PEC	3	0	0	3	3
4	ECPE1_	Pattern Recognition	VII	PEC	3	0	0	3	3
5	ECPE1_	Digital Image and Video Processing	VII	PEC	3	0	0	3	3
6	ECPE1_	Speech and Audio Processing	VII	PEC	3	0	0	3	3
7	ECPE1_	Detection and Estimation Theory	VII	PEC	3	0	0	3	3
8	ECPE1_	Wavelets	VII	PEC	3	0	0	3	3
9	ECPE1	Machine Learning Techniques	VII	PEC	3	0	0	3	3
10	ECPE1	Deep Learning	VII	PEC	3	0	0	3	3
11	ECPE1	Multimedia Communication	VII	PEC	3	0	0	3	3
12	ECPE1	DIGITAL SIGNAL PROCESSORS AND ARCHITECTURES	VII	PEC	3	0	0	3	3
13	ECPE1	Data Mining	VII	PEC	3	0	0	3	3

Stream-II									
1	ECPE2_	Wireless Communications	VII	PEC	3	0	0	3	3
2	ECPE2_	Satellite Communication	VII	PEC	3	0	0	3	3
3	ECPE2_	Wireless Sensor Networks	VII	PEC	3	0	0	3	3
4	ECPE2_	Large MIMO Systems	VII	PEC	3	0	0	3	3
5	ECPE2_	Applied Optimization for Wireless, Signal Processing, Machine Learning	VII	PEC	3	0	0	3	3
6	ECPE2_	Principles of Signal Estimation for MIMO – OFDM Communications	VII	PEC	3	0	0	3	3
7	ECPE2_	Error Correcting Codes	VII	PEC	3	0	0	3	3
8	ECPE2_	Information Theory and Coding	VII	PEC	3	0	0	3	3
9	ECPE2_	Radar Systems	VII	PEC	3	0	0	3	3
10	ECPE2_	Adhoc Wireless Sensor Networks	VII	PEC	3	0	0	3	3
Stream-III									
1	ECPE3_	IoT and Applications + (Lab for 1 credit)	VII	PEC	3 0	0 0	0 2	3 2	3 1
2	ECPE3_	Embedded Systems	VII	PEC	3	0	0	3	3
3	ECPE3_	Nano Electronics	VII	PEC	3	0	0	3	3
4	ECPE3_	Introduction to MEMS	VII	PEC	3	0	0	3	3
5	ECPE3_	Mixed Signal Design	VII	PEC	3	0	0	3	3
6	ECPE3_	CMOS Design	VII	PEC	3	0	0	3	3

7	ECPE3_	Power Electronics	VII	PEC	3	0	0	3	3
8	ECPE3_	High Speed Electronics	VII	PEC	3	0	0	3	3
9	ECPE3_	Embedded System Design	VII	PEC	3	0	0	3	3
10	ECPE3_	Analog VLSI and Mixed Signal Design	VII	PEC	3	0	0	3	3
11	ECPE3_	CMOS Analog VLSI Design	VII	PEC	3	0	0	3	3
12	ECPE3_	CMOS Digital VLSI Design	VII	PEC	3	0	0	3	3
13	ECPE3_	REAL TIME OPERATING SYSTEMS	VII	PEC	3	0	0	3	3
14	ECPE3_	CAD for VLSI Circuits	VII	PEC	3	0	0	3	3
15	ECPE3_	RF Integrated Circuits	VII	PEC	3	0	0	3	3
Stream-IV									
1	ECPE4_	Fiber Optic Communication	VIII	PEC	3	0	0	3	3
2	ECPE4_	Antennas and Propagation	VIII	PEC	3	0	0	3	3
3	ECPE4_	Microwave Theory and Techniques	VIII	PEC	3	0	0	3	3
4	ECPE4_	Electronic Measurement and Instrumentation	VIII	PEC	3	0	0	3	3

ECPE1_ **DIGITAL IMAGE PROCESSING**

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **3-0-0-3**

Course Objectives:

Learn and understand the representation of Two Dimensional Linear shift invariant Systems using Matrices

To understand the acquisition of digital images.

Learn and implement the algorithms for basic image processing applications such as image enhancement

Formulate and solve the optimization problems to achieve image restoration from degraded images

To implement, analyze, and asses the performance of the image processing algorithms.

Unit-I: INTRODUCTION:

Mathematical Preliminaries and Two dimensional Systems

Introduction to image Processing and applications of image processing in different fields, Fundamentals of Linear algebra, and Probability, one dimensional and two dimensional Linear shift invariant systems and their representation using matrices, one dimensional and Two Dimensional Convolution, Separable operations using matrices, Two dimensional Discrete time Fourier transform, Two dimensional Z transform and Properties.

Unit-II: Image sampling and Quantization

Sampling of One dimensional signals, Sampling of Two dimensional signals, Anti-aliasing filter, Quantization: Liyod Max quantizer, Uniform quantizer, Signal to quantization noise ratio.

Unit-III: Image Transforms

Unitary transforms and properties, 1D & 2D Discrete Fourier transform, 1D & 2D Discrete cosine transform, 1D & 2D Discrete sine transform, 1D & 2D Discrete Walsh transform, 1D & 2D Discrete Hadamard transform, 1D & 2D Discrete Haar transform, 1D & 2D Discrete KLT transform, Application of KLT for Face recognition.

Unit-IV: Image Enhancement

Point operations: contrast stretching, digital negative, Power law correction, dynamic range compression, intensity level slicing, Thresholding, Bit plane extraction; Histogram equalization and histogram specification; spatial operations:Linear and non linear filtering in spatial domain using spatial masks, Unsharp masking; Transform Operations: Filtering in transform domain; Psuedo coloring

Unit – V: Image Restoration

Classification of restoration methods, Characteristic metrics for Image restoration, Linear and non linear degradation models, Inverse filtering, Pseudo inverse filtering, Wiener filtering: Least squares approach.

Course Outcomes:

To Introduce the applications of the Digital image processing in different research fields, and learn the Mathematical preliminaries required for analyzing two dimensional systems.

Learn the acquisition process of a Digital images

Demonstrated understanding of Image transforms such as Discrete Fourier Transform, Cosine Transform, Hadamard Transform, and KLT.

Demonstrated understanding of image enhancement techniques

Understanding of formulation and solution of image restoration techniques

REFERENCES:

A.K Jain , Fundamentals of Digital Image Proceessing, Prentice Hall.

R. C. Gonzalez, R.E. Woods, Digital Image Processing, Pearson.

ECPE1_ ADAPTIVE SIGNAL PROCESSING

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **3-0-0-3**

Unit I:

General concept of adaptive filtering and estimation, applications and motivation, Review of probability, random variables and stationary random processes, Correlation structures, properties of correlation matrices.

Unit II:

Optimal FIR (Wiener) filter, Method of steepest descent, extension to complexvalued The LMS algorithm (real, complex), convergence analysis, weight errorcorrelation matrix, excess mean square error and mis-adjustment

Unit III:

Variants of the LMS algorithm: the sign LMS family, normalized LMSalgorithm, block LMS and FFT based realization, frequency domain adaptive filters, Sub-band adaptive filtering. Signal space concepts - introduction to finite dimensional vectorspace theory, subspace, basis, dimension, linear operators, rank and nullity, inner product space, orthogonality, GramSchmidt orthogonalization, concepts of orthogonal projection,orthogonal decomposition of vector spaces.

Unit IV:

Vector space of random variables, correlation as inner product, forward andbackward projections, Stochastic lattice filters, recursive updating of forward and backward prediction errors, relationship with AR modeling, joint process estimator, gradient adaptive lattice.

Unit V:

Introduction to recursive least squares (RLS), vector space formulation of RLSestimation, pseudo-inverse of a matrix, time updating of inner products, development of RLS lattice filters, RLS transversal adaptive filters. Advanced topics: affine projection and subspace based adaptive filters, partial update algorithms, QR decomposition and systolic array.

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

Understand the non-linear control and the need and significance of changing the control parameters w.r.t. real-time situation.

Mathematically represent the ‘adaptability requirement’.

Understand the mathematical treatment for the modeling and design of the signal processing systems.

Text/Reference Books:

S. Haykin, Adaptive filter theory, Prentice Hall, 1986.

C.Widrow and S.D. Stearns, Adaptive signal processing, Prentice Hall, 1984.

EC4435 **BIOMEDICAL SIGNAL PROCESSING**

Externals: 60Marks **(L-T)-P-C**

Internals: 40Marks **4-0-3**

Course Outcomes:

1. To understand the origin, acqusition and processing of Bio signals and their application for diagnosis, and different Imaging modalities

2. To understand the cardiac and brain signal processing for various applications

3. To learn fundamentals of digital images, and 2 D systems, and various image transforms

4. To learn image enhancement and image restoration methods

5. To learn different classification techniques

Chapter 1:Introduction to bio Signals and Bio images

The Nature of Biomedical SignalsExamples of Biomedical Signals,Origin of bio potenials, The action potential of a cardiac myocyte,The action potential of a neuron,The electroneurogram (ENG),The electromyogram (EMG),The electrocardiogram (ECG).The electroencephalogram (EEG),Event-related potentials (ERPs),The electrogastrogram (EGG),The phonocardiogram (PCG),The carotid pulse,Signals from catheter-tip sensors,The speech signal,The vibromyogram (VMG),The vibroarthrogram (VAG),Otoacoustic emission (OAE) signals,Bioacoustic signals. Biomedical images: Different imaging modalities, Computer aided Tomography

Chapter 2: Cardiac and Brain signal Processing

Acqusition of ECG: Standard 12 lead system, ambugulatory ECG signal, Fundamental Prolems of Cardiac signal Processing, Pre processing techniques, QRS detection: Categorisation, Pam Tompkins technique, Automatic heart beat classification, AAMI standard, Review of methods of heart beat classification,

Chapter 3:

Digital image acquisition, sampling and quantization, Response of 1D LSI system for non-periodic and periodic inputs (Using matrix method), Response of Two dimensional LSI systems for non periodic and periodic inputs using row ordered vector form of images, Image transforms: Unitary transforms and properties, Discrete Fourier transform, Discrete Cosine transform, Discrete sine transform, Walsh transform, Hadmard transform, Haar transform, KL transform

Chapter 4:

Image enhancement: Point processing techniques: Contrast stretching, dynamic range compression, Power law correction, Bit plane slicing, Gray level slicing, thresholding, Hisogram equalization, Histogram matching, Neighbour hood processing: LSI filtering, Low pass filters,

High pass filters: First order and second order derivative filtes, High boost filtering, Frequency domain processing

Image Restoration: Difference between Image restoration and Image enhancement, Performance metrics, Simplifies model for degradation using LSI approximation, methods of estimation of degradation function, Models for different degradations, Inverse filtering, effect of noise on inverse filtering: Least sqaures filtering, Constrained Least squares filtering, Weiner filtering

Chapter 5:

Data preprocessing, Feature extraction methods, Regression, Classification: Supervised and Unsupervised learning, Nearest neighbour classification, Bayesian classifier, K Nearest neighbour classification, Support vector machine, Artifical neural networks, K means clustering,

Reference Books:

1. "BIOMEDICAL SIGNAL ANALYSIS", RANGARAJ M. RANGAYYAN, IEEE press, Wiley

2. "Fundamentals of Digital image processing" by A.K Jain, PhI

3. "Digital image processing", R. Gonzalez and Woods

ECPE1_ **PATTERN RECOGNITION**

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **3-0-0-3**

Introduction to pattern recognition with some real world applications, Supervised, unsupervised, Reinforcement learning introduction. Data Pre-processing, Different types of Distance measures and similarity measures. Classification: Bayes Classifier, ML, MAP estimators, Naive Bayes classifier. K-Nearest Neighbor classifier, Support Vector Machines, Kernel Machines, Over-fitting problem, Artificial Neural Networks: Perceptron learning rule, Gradient Descent learning rule. Limitations and where to apply these classification rules. Multi layered perceptron, Back propagation, logic gates using Perceptron, Sigmoid function, Decision trees. Association rules, Apriori algorithm, Rule generation. Clustering, Anomaly Detection, Regression, Dimensionality Reduction techniques: Feature selection, Principle Component analysis, Independent component analysis, Singular Value Decomposition. Evaluating results: Classification metrics, Regression metric, validation, cross- validation.

Course Outcome:

At the end of this course, students will get the ability to
Do preprocessing task and applying suitable classification algorithm for a given classification task.
Apply clustering algorithm for a given data.
Apply regression analysis technique for prediction.
Work with association algorithms.
Represent the data with less number of features.

Reference books:

R.O.Duda, P.E.Hart and D.G.Stork, Pattern Classification, John Wiley, 2002.
C.M.Bishop, Neural Networks and Pattern Recognition, Oxford University Press (Indian Edition), 2003.
Pang-Ning Tan, Michael steinbach and Vipin kumar, Introduction to Data mining, Pearson, 2016.
B.Yegnanarayana, Artificial Neural Networks, PHI, 1999.

ECPE1_ DIGITAL IMAGE AND VIDEO PROCESSING

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **3-0-0-3**

Unit I:

Digital Image Fundamentals-Elements of visual perception, image sensing andacquisition, image sampling and quantization, basic relationships between pixels – neighborhood, adjacency, connectivity, distance measures.

Unit II:

Image Enhancements and Filtering-Gray level transformations, histogramequalization and specifications, pixel-domain smoothing filters – linear and order-statistics, pixel-domain sharpening filters – first and second derivative, two-dimensional DFT and its inverse, frequency domain filters – low-pass and high-pass.

Unit III:

Color Image Processing-Color models–RGB, YUV, HSI; Color transformations– formulation, color complements, color slicing, tone and color corrections; Color image smoothing and sharpening; Color Segmentation.

Image Segmentation- Detection of discontinuities, edge linking and boundarydetection, thresholding – global and adaptive, region-based segmentation.

Unit IV:

Wavelets and Multi-resolution image processing- Uncertainty principles of FourierTransform, Time-frequency localization, continuous wavelet transforms, wavelet bases and multi-resolution analysis, wavelets and Subband filter banks, wavelet packets.

Unit V:

Image Compression-Redundancy–inter-pixel and psycho-visual; Losslesscompression – predictive, entropy; Lossy compression- predictive and transform coding; Discrete Cosine Transform; Still image compression standards – JPEG and JPEG-2000.

Fundamentals of Video Coding- Inter-frame redundancy, motion estimationtechniques – fullsearch, fast search strategies, forward and backward motion prediction, frame classification – I, P and B; Video sequence hierarchy – Group of pictures, frames, slices, macro-blocks and blocks; Elements of a video encoder and decoder; Video coding standards – MPEG and H.26X.

Video Segmentation- Temporal segmentation–shot boundary detection, hard-cutsand soft-cuts; spatial segmentation – motion-based; Video object detection and tracking.

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

Mathematically represent the various types of images and analyze them.

Process these images for the enhancement of certain properties or for optimized use of the resources.

Develop algorithms for image compression and coding

Text/Reference Books:

R.C. Gonzalez and R.E. Woods, Digital Image Processing, Second Edition, Pearson Education 3rd edition 2008

Anil Kumar Jain, Fundamentals of Digital Image Processing, Prentice Hall of India.2nd edition 2004

Murat Tekalp , Digital Video Processing" Prentice Hall, 2nd edition 2015

ECPE1_ **SPEECH AND AUDIO PROCESSING**

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **3-0-0-3**

Unit I:

Introduction- Speech production and modeling - Human Auditory System;General structure of speech coders; Classification of speech coding techniques – parametric, waveform and hybrid ; Requirements of speech codecs –quality, coding delays, robustness. Speech Signal Processing-Pitch-period estimation, all-pole and all-zero filters,convolution; Power spectral density, periodogram, autoregressive model, autocorrelation estimation.

Unit II:

Linear Prediction of Speech- Basic concepts of linear prediction; LinearPrediction Analysis of non-stationary signals –prediction gain, examples; Levinson-Durbin algorithm; Long term and short-term linear prediction models; Moving average prediction.

Unit III:

Speech Quantization- Scalar quantization–uniform quantizer, optimum quantizer,logarithmic quantizer, adaptive quantizer, differential quantizers; Vector quantization – distortion measures, codebook design, codebook types.

Scalar Quantization of LPC- Spectral distortion measures, Quantization based onreflection coefficient and log area ratio, bit allocation; Line spectral frequency – LPC to LSF conversions, quantization based on LSF.

Unit IV:

Linear Prediction Coding- LPC model of speech production; Structures of LPCencoders and decoders; Voicing detection; Limitations of the LPC model.

Unit V:

Code Excited Linear Prediction-CELP speech production model; Analysis-by-synthesis; Generic CELP encoders and decoders; Excitation codebook search – state-save method, zero-input zerostate method; CELP based on adaptive codebook, Adaptive Codebook search; Low Delay CELP and algebraic CELP.

Speech Coding Standards-An overview of ITU-T G.726, G.728 and G.729standards

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

Mathematically model the speech signal

Analyze the quality and properties of speech signal.

Modify and enhance the speech and audio signals.

Text/Reference Books:

"Digital Speech" by A.M.Kondoz, Second Edition (Wiley Students Edition), 2004.

"Speech Coding Algorithms: Foundation and Evolution of Standardized Coders", W.C. Chu, WileyInter science, 2003.

ECPE1_ DETECTION AND ESTIMATION THEORY

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **3-0-0-3**

Course Objectives:

To enable the students to acquire the fundamental concepts of Signal detection and estimation
To expose the conceptual basics of Hypotheses.
To introduce the methods of Detection and estimation of signals in white and non-white Gaussian noise.
To familiarize with the detection of random signals.
To enable the students to understand the time varying waveform detection and its estimation.

UNIT –I: Random Processes

Discrete Linear Models, Markov Sequences and Processes, Point Processes,and Gaussian Processes.

UNIT –II: Detection Theory

Basic Detection Problem, Maximum A posteriori Decision Rule,Minimum Probability of Error Classifier, Bayes Decision Rule, Multiple-Class Problem (Bayes)-minimum probability error with and without equal a priori probabilities, Neyman-Pearson Classifier, General Calculation of Probability of Error, General Gaussian Problem, Composite Hypotheses.

UNIT –III: Linear Minimum Mean-Square Error Filtering

Linear Minimum Mean Squared Error stimators, Nonlinear Minimum Mean Squared Error Estimators. Innovations, Digital Wiener Filters with tored Data, Real-time Digital Wiener Filters, Kalman Filters.

UNIT –IV: Statistics

Measurements, Nonparametric Estimators of Probability Distribution and DensityFunctions,Point Estimators of Parameters, Measures of the Quality of Estimators, Introductionto Interval stimates, Distribution of Estimators, Tests of Hypotheses, Simple Linear Regression,Multiple Linear Regression.

UNIT –V: Estimating the Parameters of Random Processes from Data

Tests for Stationarity andErgodicity, Model-free Estimation, Model-based Estimation of Autocorrelation Functions, Power Special Density Functions.

TEXT BOOKS:

Random Signals: Detection, Estimation and Data Analysis - K. Sam Shanmugan&A.M.Breipohl, Wiley India Pvt. Ltd, 2011.

Random Processes: Filtering, Estimation and Detection - Lonnie C. Ludeman, Wiley India Pvt. Ltd., 2010.

REFERENCES:

Fundamentals of Statistical Signal Processing: Volume I Estimation Theory– Steven.M.Kay,Prentice Hall, USA, 1998.

Fundamentals of Statistical Signal Processing: Volume I Detection Theory– Steven.M.Kay,Prentice Hall, USA, 1998.

Introduction to Statistical Signal Processing with Applications - Srinath, Rajasekaran,Viswanathan, 2003, PHI.

ECPE1_ **WAVELETS**

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **3-0-0-3**

Introduction to time frequency analysis; the how, what and why about wavelets, Short-time Fourier transform, Wigner-Ville transform.;Continuous time wavelet transform, Discrete wavelet transform, tiling of the time-frequency plane and wave packet analysis, Construction of wavelets. Multiresolution analysis. Introduction to frames and biorthogonal wavelets, Multirate signal processing and filter bank theory, Application of wavelet theory to signal denoising, image and video compression, multi-tone digital communication, transient detection.

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

Understand time-frequency nature of the signals.

Apply the concept of wavelets to practical problems.

Mathematically analyze the systems or process the signals using appropriate wavelet functions.

Text/Reference Books:

Y.T. Chan, Wavelet Basics, Kluwer Publishers, Boston, 1993.

I. Daubechies, Ten Lectures on Wavelets, Society for Industrial and Applied Mathematics, Philadelphia, PA, 1992.

C. K. Chui, An Introduction to Wavelets, Academic Press Inc., New York, 1992.

Gerald Kaiser, A Friendly Guide to Wavelets, Birkhauser, New York, 1995.

P. P. Vaidyanathan, Multirate Systems and Filter Banks, Prentice Hall, New Jersey, 1993.

A.N. Akansu and R.A. Haddad, Multiresolution signal Decomposition: Transforms, Subbands and Wavelets, Academic Press, Oranld, Florida, 1992.

B.Boashash, Time-Frequency signal analysis, In S.Haykin, (editor), Advanced Spectral Analysis, pages 418--517. Prentice Hall, New Jersey, 1991.

EC4503 MACHINE LEARNING TECHNIQUES 4L-0-0-3 (3 credits)

Course Objectives:

- To introduce students to the basic concepts and classical techniques of Machine Learning.
- To study optimization algorithms used in Machine learning.
- To study various classification techniques, regression, clustering, ANN.
- To study Deep learning concepts: CNN, RNN and hyper parameter tuning, some case studies.

UNIT-1(Introduction):

Introduction to Machine Learning: Supervised learning, Unsupervised learning, Reinforcement learning. Machine Learning applied to AI examples. Structured data, Unstructured data, training data, test data, cross validation, data collection (Unbiased data), data cleaning, feature extraction, Properties of best features for classification. Linear Regression, Logistic Regression. Over fitting problem. Bias-Variance tradeoff.

UNIT-2(Classical Techniques of ML):

Error metrics, error metrics for skewed classes, Gradient Descent algorithms: Batch, mini-batch, Stochastic Gradient descent.
Classification Techniques: Bayes classifier, Naïve Bayes classifier, K-Nearest neighbor, Perceptron learning algorithm, Multi-layer Perceptron, Regularization, Support Vector Machines, Decision tree algorithm.
Clustering: K-means clustering
Dimensionality Reduction, Anomaly detection.

UNIT-3(Artificial Neural Networks):

Introduction to Neural networks**,** back propagation algorithm. Activation functions: Sigmoid, tanh, ReLU, SoftMax.Regularization techniques.

UNIT-4(CNN)

Deep learning, vanishing gradients problem, Hyper parameters.
CNN and applications to Computer Vision.
Hyper parameters tuning.
Case studies: LeNet-5, AlexNet, VGG-16, ResNets
Self-driving car application.
Generative Adversial Networks (GAN)

UNIT-5(RNN)

RNN and application to sequence modeling. Hyper parameters tuning.

Some Case studies.

Course Outcomes:

At the end of the course, students will learn the various algorithms related to Supervised Learning, Unsupervised learning, Deep learning concepts.

Text Books:

1. Deep Learning, Goodfellow et al, MIT Press
2. and Machine Learning, Christopher Bishop, Springer

Reference MOOCs:

1. "Machine Learning" by Prof.Andrew NG, Coursera (Stanford)
2. "Deep Learning" by Prof.Andrew NG, Coursera (Stanford)

EC4432 **MULTIMEDIA COMMUNICATION**

Externals: 60Marks **(L-T)-P-C**

Internals: 40Marks **4-0-3**

Course Objectives

- The course is designed
- To provide an introduction to the fundamental principles and techniques in Multimedia Signal coding and compression.
- To give an overview of current multimedia standards and technologies.
- To provide techniques related to computer and multimedia networks.
- To provide knowledge related to Multimedia Network Communications and Applications.

Course Outcomes

- Upon completing the course, the student will be able to:
- Understand the fundamentals behind multimedia signal processing.
- Understand the fundamentals behind multimedia compression.
- Understand the basic principles behind existing multimedia compression and communication standards.
- Understand future multimedia technologies.
- Apply the acquired knowledge to specific multimedia related problems and projects at work.
- Take advanced courses in this area.

UNIT -I

Introduction to Multimedia: Multimedia, World Wide Web, Overview of Multimedia Tools, Multimedia Authoring, Graphics/Image Data Types, and File Formats.

Color in Image and Video: Color Science — Image Formation, Camera Systems, Gamma Correction, Color Matching Functions, CIE Chromaticity Diagram, Color Monitor Specifications, Out-of-Gamut Colors, White Point Correction, XYZ to RGB Transform, Transform with Gamma Correction, L*A*B* Color Model. Color Models in Images — RGB Color Model for CRT Displays, Subtractive Color: CMV Color Model, Transformation from RGB to CMV, Under Color Removal: CMYK System, Printer Gamuts, Color Models in Video — Video Color Transforms, YUV Color Model, YIQ Color Model, Ycbcr Color Model.

UNIT -II

Video Concepts: Types of Video Signals, Analog Video, Digital Video.

Audio Concepts: Digitization of Sound, Quantizatiofl and Transmission of Audio.

UNIT -III

Compression Algorithms

Lossless Compression Algorithms: Run Length Coding, Variable Length Coding, Arithmetic Coding, Lossless JPEG, Image Compression.

Lossy Image Compression Algorithms: Transform Coding: KLT And DCT Coding, Wavelet Based Coding.

Image Compression Standards: JPEG and JPEG2000.

UNIT – IV

Video Compression Techniques: Introduction to Video Compression, Video Compression Based on Motion Compensation, Search for Motion Vectors, H.261- Intra-Frame and Inter-Frame Coding, Quantization, Encoder and Decoder, Overview of MPEG 1 and MPEG2.

UNIT -V

Audio Compression Techniques: ADPCM in Speech Coding, G.726 ADPCM, Vocoders Phase Insensitivity, Channel Vocoder, Formant Vocoder, Linear Predictive Coding, CELP, Hybrid Excitation Vocoders, MPEG Audio — MPEG Layers, MPEG Audio Strategy, MPEG Audio Compression Algorithms, MPEG-2 AAC, MPEG-4 Audio.

TEXT BOOKS

Fundamentals of Multimedia — Ze- Nian Li, Mark S. Drew, PHI, 2010.

Multimedia Signals & Systems — Mrinal Kr. Mandal Springer International Edition 1St Edition, 2009

REFERENCE BOOKS

Multimedia Communication Systems — Techniques, Stds&Netwroks KR. Rao, Zorans. Bojkoric, DragoradA.MjIovanj 1st Edition, 2002.

Fundamentals of Multimedia Ze- Man Li, Mark S.Drew, Pearson Education (LPE), 1st Edition, 2009.

Multimedia Systems John F. KoegelBufond Pearson Education (LPE), 1st Edition, 2003.

Digital Video Processing — A. Murat Tekaip, PHI, 1996.

Video Processing and Communications — Yaowang, JornOstermann, Ya-QinZhang, Pearson,2002

EC4433 DIGITAL SIGNAL PROCESSORS AND ARCHITECTURES

Externals: 60Marks **(L-T)-P-C**

Internals: 40Marks **4-0-3**

Course Objectives:

- To introduce architectural features of programmable DSP Processors of TI and AnalogDevices.
- To recall digital transform techniques.
- To give practical examples of DSP Processor architectures for better understanding.
- To develop the programming knowledge using Instruction set of DSP Processors.
- To understand interfacing techniques to memory and I/O devices.

Course Outcomes:

- Student will be able to:
- To distinguish between the architectural features of general purpose processors and DSP processors
- Understand the architectures of TMS 320C54XX and ADSP2100 DSP devices
- Able to write assembly language programs using instruction set of TMS320C54XX
- Can interface various devices to DSP Processors

UNIT-I: Introduction to Digital Signal Processing:

Introduction, A Digital signal-processing system, The sampling process, Discrete time sequences. Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), Linear time-invariant systems, Digital filters, Decimation and interpolationComputational Accuracy in DSP Implementations: Number formats for signals and coefficients in DSP systems, Dynamic Range and Precision, Sources of error in DSP implementations, A/D Conversion errors, DSP Computational errors, D/A Conversion Errors, Compensating filter.

UNIT-II: Architectures for Programmable DSP Devices:

Basic Architectural features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation UNIT, Programmability and Program Execution, Speed Issues, Features for External interfacing.

UNIT-III: Programmable Digital Signal Processors:

Commercial Digital signal-processing Devices, Data Addressing modes of TMS320C54XX DSPs, Data Addressing modes of TMS320C54XX Processors, Memory space of TMS320C54XX Processors, Program Control, TMS320C54XX instructions and Programming, On-Chip Peripherals, Interrupts of TMS320C54XX processors, Pipeline operation of TMS320C54XX Processors.

UNIT-IV: Analog Devices Family of DSP Devices:

Analog Devices Family of DSP Devices – ALU and MAC block diagram, ShifterInstruction,Base Architecture of ADSP 2100, ADSP-2181 high performance Processor. introduction to Blackfin Processor - The Blackfin Processor, Introduction to Micro Signal Architecture, Overview of Hardware Processing Units and Register files, Address Arithmetic Unit, Control Unit, Bus Architecture and Memory, Basic Peripherals.

UNIT-V: Interfacing Memory and I/O Peripherals to Programmable DSP Devices:

Memory space organization, External bus interfacing signals, Memory interface, ParallelI/O interface, Programmed I/O, Interrupts and I/O, Direct memory access (DMA).

TEXT BOOKS:

Digital Signal Processing – Avtar Singh and S. Srinivasan, Thomson Publications, 2004.

A Practical Approach to Digital Signal Processing - K Padmanabhan, R. Vijayarajeswaran, Ananthi. S, New Age International, 2006/2009

Embedded Signal Processing with the Micro Signal Architecture Publisher: Woon-Seng Gan, Sen M. Kuo, Wiley-IEEE Press, 2007

REFERENCES:

Digital Signal Processors, Architecture, Programming and Applications – B. Venkataramani and M. Bhaskar, 2002, TMH.

Digital Signal Processing – Jonatham Stein, 2005, John Wiley.

DSP Processor Fundamentals, Architectures & Features – Lapsley et al. 2000, S. Chand & Co.

Digital Signal Processing Applications Using the ADSP-2100 Family by The Applications Engineering Staff of Analog Devices, DSP Division, Edited by Amy Mar, PHI

The Scientist and Engineer's Guide to Digital Signal Processing by Steven W. Smith, Ph.D.,California Technical Publishing, ISBN 0-9660176-3-3, 1997 6.Embedded Media Processing by David J. Katz and Rick Gentile of Analog Devices, Newnes, ISBN 0750679123, 2005.

EC4502 **DATA MINING**

Externals: 60Marks **(L-T)-P-C**

Internals: 40Marks **4-0-3**

Objectives:

1. To impart an introduction to Data Mining.
2. To develop basic knowledge of how data is transformed to Data Warehouses.

UNIT - I:

Introduction to Data Mining: What is data mining? Related technologies - Machine Learning, DBMS, OLAP and Statistics. Data Mining Goals, Stages of the Data Mining Process , Data Mining Techniques. Knowledge Representation Methods, Applications. Example: weather data
Data Warehouse and OLAP: Data Warehouse and DBMS, Multidimensional data model , OLAP operations, Example:loan data set.

UNIT - II:

Data preprocessing: Data cleaning, Data transformation, Data reduction, Discretization and generating concept hierarchies.
Data mining knowledge representation: Task relevant data, Background knowledge, Interestingness measures, Representing input data and output knowledge
Attribute-oriented analysis: Attribute generalization, Attribute relevance, Class comparison, Statistical measures

UNIT - III:

Data mining algorithms: Association rules - Motivation and terminology, Example: mining weather data, Basic idea: item sets, Generating item sets and rules efficiently, Correlation analysis.
Data mining algorithms: Classification - Basic learning/mining tasks, Bayesian, Naïve Bayes , Decision trees, Covering rules, Random Forest.

UNIT - IV:

Data mining algorithms: Prediction - The prediction task, Statistical (Bayesian) classification, Bayesian networks, Instance-based methods (nearest neighbor), Linear models
Evaluating what's been learned: Basic issues, Training and testing, Estimating classifier accuracy (holdout, cross-validation, leave-one-out), Combining multiple models (bagging, boosting, stacking), Minimum Description Length Principle (MLD)

UNIT - V:

Clustering: Basic issues in clustering, First conceptual clustering system: Cluster/2 , Partitioning methods: k-means, expectation maximization (EM), Hierarchical methods: distance-based agglomerative and divisible clustering
Basics of ANN, Perceptron, MLP

Suggested References:

1. I. H. Witten and E. Frank. Data Mining: Practical Machine Learning Tools and Techniques. Morgan Kaufmann. 2000.
2. J. Han and M. Kamber. Data Mining: Concepts and Techniques, 2nd Ed. Morgan Kaufman. 2006.
3. M. H. Dunham. Data Mining: Introductory and Advanced Topics. Pearson Education. 2001.
4. D. Hand, H. Mannila and P. Smyth. Principles of Data Mining. Prentice-Hall. 2001.
5. Pang-Ning Tan, Michael Steinbach, Vipin Kumar. Introduction to Data Mining. Addison-Wesley Longman Publishing Co.

ECPE1_ **WIRELESS COMMUNICATIONS**

Externals: 60Marks **(L-T)-P-C**

Internals: 40Marks **4-0-3**

Course objectives:

- To provide the students with the fundamental theoretical and practical concepts of wireless communication
- To equip the students with various kinds of wireless networks and its operations.
- To prepare the students to understand the concept of frequency reuse and be able to apply it in the design of mobile cellular system
- To prepare the students to understand various multiple access techniques that are used in wireless communications
- To train the students to understand the basic concepts of OFDM and MIMO.
-

Course outcomes:

- On successful completion of this course, the students should be able to:
- Select appropriate value of C/I to design the Antenna system
- Analyze the characteristics of different setups for the wireless communication using new models for the coverage improvement.
- Select different technologies to solve numerical problems using multiple access technique.
- Demonstrate the technical aspects of diversity for wireless communication.
- Understand the basic PAPR problem in OFDM and understanding basic concepts in SIMO.

UNIT - I

Basic Cellular system and its operation: frequency reuse, channel assignment strategies, Handoffprocess, factors influencing handoffs, handoffs in different Generations, Interference and system capacity, Crosstalk, Enhancing capacity and cell coverage, Trunked radio system, grade of service as per Erlang's B system.

UNIT – II

Propagation models: Free space propagation model, three basic propagation mechanisms, practical linkbudget design using path loss models, outdoor propagation models: Ground reflection (2-ray) Model, log normal shadowing, Okumura model, Hata model and indoor propagation model. Rayleigh fading, BER in Rayleigh fading channel with BPSK transmission,doppler spread, rms delay spread, Coherence time and Coherence bandwidth of wireless channel.

UNIT – III

Basic equalizers: LS, MMSE estimators for channel, Multiple Access Techniques: FDMA, TDMA, CDMA, RAKE receiver, SDMA.

UNIT – IV

SIMO: Diversity, SIMO (multiple receive antennas) model, maximal ratio combining (MRC) receiver, BER with MRC (high SNR approximation), diversity order.

UNIT – V

OFDM: Multicarrier basics, OFDM transmitter and receiver blocks, cyclic prefix in OFDM, PAPR problem in OFDM, SC-FDMA transmitter and receiver blocks.

Text Books:

Theodore.S. Rappaport, "Wireless Communications: Principles and Practice", 2/e, Pearson Education, 2010

Aditya K Jagannatham, "Principles of Modern Wireless Communication Systems", Mc-Graw Hill

Suggested Reading:

David Tse and Pramod Viswanath, "Fundamentals of Wireless Communications",Cambridge University Press.

EC4403 SATELLITE COMMUNICATIONS

Externals: 60Marks **(L-T)-P-C**

Internals: 40Marks **4-0-3**

Course Objectives:

- To prepare the student to excel in basic knowledge of satellite communication principles.
- To provide students with solid foundation in orbital mechanics and launches for the satellite communication
- To train the students with the basic knowledge of link design of satellite with a design examples.
- To provide the better understanding of multiple access systems and earth station technology.
- To prepare the students with knowledge in satellite navigation and GPS and satellite packet communication

Course Outcomes:

- At the end of this course Students will be able to
- Explain, basic concepts and frequency allocations for satellite communications.
- Describe the orbital mechanics, launch vehicles and launchers.
- Design satellite links for specified C/N.
- Visualize satellites sub systems like telemetry, tracking, command and monitoring power systems etc.,
- Explain the different multiple access systems and their need in satellite communications and GPS Receivers,.

UNIT-I: Communication Satellite Orbit and Description

A Brief history of satellite Communication, satellite Frequency Bands, Satellite Systems, Applications, Orbital Period and Velocity, effects of orbital Inclination, Azimuth and Elevation, Coverage angle and slant Range, Eclipse, Orbital Perturbations,Placement of a Satellite in a Geo-Stationary orbit.

UNIT-II: Satellite Sub-Systems

Attitude and Orbit Control system, TT&C subsystem, Attitude Control subsystem,Power systems, Communication subsystems, Satellite Antenna Equipment.Satellite Link: Basic Transmission Theory, System Noise Temperature and G/T ratio, Basic LinkAnalysis, Interference Analysis, Design of satellite Links for a specified C/N, (With and without frequency Re-use), Link Budget

UNIT-III: Propagation Effects

Introduction, Atmospheric Absorption, Cloud Attenuation, Tropospheric and Ionospeheric Scintillation and Low angle fading, Rain induced attenuation, rain induced cross polarization interference. Multiple Access : Frequency Division Multiple Access (FDMA) - Intermodulation, Calculation of C/N, Time Division Multiple Access (TDMA) -Frame Structure, Burst Structure, Satellite switched TDMA, On-board Processing, Demand Assignment Multiple Access (DAMA) –Typesof Demand Assignment, Characteristics, CDMA Spread Spectrum Transmission and Reception.

UNIT-IV: Earth Station Technology

Transmitters, Receivers, Antennas, Tracking Systems, Terrestrial Interface,Power Test Methods, Lower Orbit Considerations. Satellite Navigation and Global Positioning Systems:Radio and Satellite Navigation, GPS Position Location Principles, GPS Receivers, GPS C/A Code Accuracy, Differential GPS.

UNIT-V: Satellite Packet Communications

Message Transmission by FDMA: M/G/1 Queue, Message Transmission by TDMA, PURE ALOHA-Satellite Packet Switching, Slotted Aloha, Packet Reservation, Tree Algorithm.

TEXT BOOKS:

1. Satellite Communications –Timothy Pratt, Charles Bostian, Jeremy Allnutt, 2ndEdition,

2003,john Wiley & Sons.

2. Satellite Communications Engineering –Wilbur, L. Pritchand, Robert A. Nelson and Heuri

G.Suyderhoud, 2ndEd., Pearson Publications.

3. Digital Satellite Communications-Tri.T.Ha, 2ndEdition, 1990, Mc.Graw Hill.

REFERENCES:

1. Satellite Communications-Dennis Roddy, 2ndEdition, 1996, McGraw Hill.

2. Satellite Communications: Design Principles –M. Richcharia, 2ndEd., BSP, 2003.

3.Digital Satellite Communications –Tri. T. Ha, 2ndEd., MGH, 1990.

4. Fundamentals of Satellite Communications –K. N. Raja Rao, PHI, 2004.

ECPE1_ **WIRELESS SENSOR NETWORKS**

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **3-0-0-3**

Unit I:

Introduction to Sensor Networks, unique constraints and challenges, Advantage of Sensor Networks, Applications of Sensor Networks, Types of wireless sensor networks

Unit II:

Mobile Ad-hocNetworks (MANETs) and Wireless Sensor Networks, Enabling technologies for Wireless Sensor Networks. Issues and challenges in wireless sensor networks

Unit III:

Routing protocols, MAC protocols: Classification of MAC Protocols, S-MAC Protocol, B-MAC protocol, IEEE 802.15.4 standard and ZigBee,

Dissemination protocol for large sensor network. Data dissemination, data gathering, and data fusion; Quality of a sensor network; Real-time traffic support and security protocols.

Unit IV:

Design Principles for WSNs, Gateway Concepts Need for gateway, WSN to Internet Communication, and Internet to WSN Communication.

Unit V:

Single-node architecture, Hardware components & design constraints, Operating systems and execution environments, introduction to TinyOS and nesC.

Course Outcomes:

At the end of the course the students will be able to

Design wireless sensor networks for a given application

Understand emerging research areas in the field of sensor networks

Understand MAC protocols used for different communication standards used in WSN

Explore new protocols for WSN

Text/Reference Books:

Waltenegus Dargie , Christian Poellabauer, “Fundamentals Of Wireless Sensor Networks Theory And Practice”, By John Wiley & Sons Publications ,2011

Sabrie Soloman, “Sensors Handbook" by McGraw Hill publication. 2009

Feng Zhao, Leonidas Guibas, “Wireless Sensor Networks”, Elsevier Publications,2004

Kazem Sohrby, Daniel Minoli, “Wireless Sensor Networks”: Technology, Protocols and Applications, Wiley-Inter science

Philip Levis, And David Gay "TinyOS Programming” by Cambridge University Press 2009

ECPE1_ **LARGE MIMO SYSTEMS**

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **3-0-0-3**

Course Objectives:

1. To study the various concepts of MIMO communication.
2. To study Large MIMO systems encoding and decoding techniques.
3. To study MIMO channel models and MIMO channel estimation.

Unit-I:

Introduction: Multi-antenna wireless channels, MIMO system model, MIMO communication with CSIR-only, Slow fading channels, Fast fading channels, MIMO communication with CSIT and CSIR, Increasing spectral efficiency: quadrature amplitude modulation (QAM) vs MIMO, Multiuser MIMO communication.

Large MIMO systems: Opportunities in large MIMO systems, Channel hardening in large dimensions, Technological challenges and solution approaches.

Unit-II:

MIMO encoding: Spatial multiplexing, Space-time coding, Space-time block codes, High-rate NO-STBCs, NO-STBCs from CDAs, Spatial modulation (SM).

MIMO detection: System model, Optimum detection, Linear detection, Interference cancellation, LR-aided linear detection, Sphere decoding

Unit-III:

Detection based on local search, Detection based on probabilistic data association (PDA), Detection/decoding based on message passing on graphical models, Detection based on MCMC techniques.

Unit-IV:

Channel estimation in large MIMO systems, MIMO capacity with imperfect CSI, Point-to-point MIMO training, Multi-user MIMO training, Large multi-user MIMO systems, Iterative channel estimation/detection in frequency-flat fading, Iterative channel estimation/equalization in ISI channels, Equalization using initial channel estimates, Equalization using the MGS-MR algorithm.

Precoding in point-to-point MIMO, Precoding in a multiuser MIMO downlink, Precoding in large multiuser MISO systems, Multicell precoding

Unit-V:

MIMO channel models: Analytical channel models, Spatial correlation based models, Propagation based models, Effect of spatial correlation on large MIMO performance: an

illustration, Pinhole effect, Effect of spatial correlation on LAS detector performance, Standardized channel models, Models in IEEE 802.11 WiFi, Models in 3GPP/LTE, Large MIMO channel measurement campaigns, Compact antenna arrays, PIFAs as elements in compact arrays, MIMO cubes

Text Books:

1. A.Chockalingam and B.Sundar Rajan, "Large MIMO Systems", Cambridge University Press, 2014.

Reference Books:

1. D. Tse and P. Viswanath, Fundamentals of Wireless Communication. Cambridge, UK: Cambridge University, 2005.

2. H. Jafarkhani, Space-Time Coding: Theory and Practice. Cambridge, UK: Cambridge University Press, 2005.

ECPE1_ Applied Optimization for Wireless, Signal Processing, Machine Learning

Externals: 60Marks **L-T-P-C**
Internals: 40Marks **3-0-0-3**

Course Objectives:

1. To study the concepts of local minima and global minima, and study of some Numerical optimization techniques.

2. To study the Convex optimization concepts.

3. To study the formulation and solving various optimization problems related to Wireless communications, signal processing and Machine learning.

Unit-I:
Introduction to properties of Vectors, Norms, Positive Semi-Definite matrices, Gaussian Random Vectors, Local minimum, global minimum, Optimization Problem formulation examples: Bus terminus problem, Transportation problem, regression problem. Steepest Descent algorithm.

Unit-II:
Introduction to Convex Optimization – Convex sets, Hyperplanes/ Half-spaces etc. Application: Power constraints in Wireless Systems, Convex/ Concave Functions, Examples, Conditions for Convexity. Application: Beamforming in Wireless Systems, Multi-User Wireless, Cognitive Radio Systems, Convex Optimization problems, Linear Program, Application: Power allocation in Multi-cell cooperative OFDM

Unit-III:
SOCP Problems, Application: Channel shortening for Wireless Equalization, Robust Beamforming in Wireless Systems, Duality Principle and KKT Framework for Optimization. Application: Water-filling power allocation, Optimization for MIMO Systems, OFDM Systems and MIMO-OFDM systems

Unit-IV:
Optimization for signal estimation, LS, WLS, Regularization. Application: Wireless channel estimation, Image Reconstruction-Deblurring, Application: Convex optimization for Machine Learning, Principal Component Analysis (PCA), Support Vector Machines

Unit-V:
Application: Cooperative Communication, Optimal Power Allocation for cooperative Communication, Application: Compressive Sensing, Sparse Signal Processing, OMP (Orthogonal Matching Pursuit), LASSO (Least Absolute Shrinkage and Selection Operator) for signal estimation

Text Books:

1. Stephen Boyd, Convex Optimization, Cambridge University Press.

Reference Books:

1. Convex Optimization Algorithms, by Dimitri P. Bertsekas, 2015, Athena scientific

Reference NPTEL MOOCs:

Applied Optimization for Wireless, Machine Learning, Big-Data by Prof. Aditya K. Jagannatham

ECPE1_ Principles of Signal Estimation for MIMO/OFDM Wireless Communications

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **3-0-0-3**

Course Objectives:

1. To study the ML estimation concept.

2. To study the MMSE estimation concept.

3. To study the estimation problems related to wireless sensor network, wireless fading channel, channel equalizer, OFDM.

Unit-I:
Basics of Estimation, Maximum Likelihood (ML), Application: Wireless Sensor Network, Reliability of Estimation, Wireless Fading Channel Estimation, Cramer-Rao Bound for Estimation

Unit-II:
Vector Parameter Estimation, Properties of Estimate; Applications: Multi-antenna Wireless Channel Estimation, MIMO Wireless Channel Estimation, Error Covariance of Estimation, Equalization for Frequency Selective Channels

Unit-III:
OFDM Estimation, Sequential Estimation, Minimum Mean-Squared Error (MMSE) Estimate, Gaussian Parameter, Application: Wireless Sensor Network, Wireless Fading Channel Estimation

Unit-IV:
MMSE Estimation for Multi-Antenna Channel, MMSE for MIMO Channel Estimation, Properties of Estimate

Unit-V:
MMSE for Equalization of Wireless Channel, MMSE for OFDM Channel Estimation

Reference NPTEL MOOCs:
1. Principles of Signal Estimation for MIMO/OFDM Wireless Communications by Prof. Aditya K. Jagannatham

EC4402 **ERROR CORRECTING CODES**

Externals: 60Marks **(L-T)-P-C**

Internals: 40Marks **4-0-3**

Course Objectives:

- To study the importance of channel coding techniques in digital communications.
- To learn the mathematical structure of various codes
- To learn the algorithms for various codes
- To study the various application of codes.
- To acquire the knowledge of measurement of information
-

Course Outcomes:

- At the end of this course Students will be able to
- Understand principles of channel Coding techniques.
- Analyze the performance of different codes.
- Design various codes like block codes, cyclic codes, convolution codes, turbo codes etc.
- Generate different codes.
- Estimate the information content and errors

UNIT-I

Coding for Reliable Digital Transmission and Storage: Introduction, Types of codes, Types of errors, Channels models, Modulation and coding, channel coding Theorem, Channel coding gain.

UNIT-II

Linear Block codes: Introduction, encoding, syndrome decoding, error-detecting and correcting

capabilities, Maximum likelihood decoding.Cyclic codes: Description, encoding and syndrome decoding.

UNIT- III

Galois Fields: Groups, Fields, Binary arithmetic, Construction of Galois Fields GF(2m), Basic properties of Galois Fields. RS codes: Introduction, encoding and decoding (Berlekamp-Massey algorithm).

UNIT- IV

Convolution codes: Introduction, Encoding, State diagram, Trellis diagram, Decoding - Maximum-Likelihood decoding, soft decision and hard decision decoding, Viterbi algorithm.

UNIT- V

Turbo codes: Concatenation, Types of Concatenation, interleaving, types of interleavers, Turbo codes: Introduction, encoding and decoding (BCJR Algorithm).

Text books:

Shulin and Daniel J. Costello, Jr. “Error Control Coding,” 2/e, Pearson, 2011.

L.H.Charles LEE “Error control block codes for Communication Engineers”, Artech, 2000.

Suggested readings:

Simon Haykin, “Communication Systems”, 4/e, Wiley, 2000.

K Sam Shanmugum, “Digital and Analog Communication Systems”, Wiley, 2005.

ECPE1_ **INFORMATION THEORY AND CODING**

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **3-0-0-3**

Basics of information theory, entropy for discrete ensembles; Shannon's noiseless codingtheorem; Encoding of discrete sources.

Markov sources; Shannon's noisy coding theorem and converse for discrete channels;Calculation of channel capacity and bounds for discrete channels; Application to continuous channels.

Techniques of coding and decoding; Huffman codes and uniquely detectable codes;Cyclic codes, convolutional arithmetic codes.

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

Understand the concept of information and entropy

Understand Shannon’s theorem for coding

Calculation of channel capacity

Apply coding techniques

Text/Reference Books:

N. Abramson, Information and Coding, McGraw Hill, 1963.

M. Mansurpur, Introduction to Information Theory, McGraw Hill, 1987.

R.B. Ash, Information Theory, Prentice Hall, 1970.

Shu Lin and D.J. Costello Jr., Error Control Coding, Prentice Hall, 1983.

EC4405 RADAR SYSTEMS

Externals: 60Marks **(L-T)-P-C**

Internals: 40Marks **4-0-3**

Course Objectives:

- To learn working principle of Radar Operating frequencies and derive Radar Range Equation,
- To understand the basic concepts of different types of Radars for surveillance & Tracking.
- To learn functioning of MTI radar and its performance limitations.
- To get acquainted with the working principles of CW radar, FM-CW radar.
- To understand concept of a Matched Filter in Radar Receivers gain knowledge of different receiver blocks and understand receiver functioning

Course Outcomes:

- At the end of this course Students will learn:
- Distinguish between thefunctioning of CW FM-CW and MTI radars,
- Apply Doppler principle to radars and hence detect moving targets.
- Distinguish between Sequential Lobing, Conical Scan, Monopulse type 0f Tracking Radars, specify their requirements and compare their characteristic features.
- Derive the matched filter response characteristics for radar applications and account for correlation receivers; to distinguish between different radar displays and duplexers.
- Account for the electronic scanning principle and implement the same through phased array antennas, knowing their requirements and utilities.

UNIT-I: Basics of Radar

Introduction, Maximum Unambiguous Range, Radar Waveforms, Simple form of Radar Equation, Radar Block Diagram and Operation, Radar Frequencies and Applications, Predictionof Range Performance, Minimum Detectable Signal, Receiver Noise, Modified Radar Range Equation, Related Problems. Radar Equation: SNR, Envelope Detector-False AlarmTime and Probability, Integration of Radar Pulses,Radar Cross Section of Targets (simple targets - sphere, cone-sphere), Transmitter Power, PRF and Range Ambiguities, System Losses (qualitative treatment), Related Problems.

UNIT-II: CW and Frequency Modulated RadarDoppler Effect

CW Radar – Block Diagram, Isolation between Transmitter and Receiver, Non-zero IF Receiver, Receiver Bandwidth Requirements, Applications of CW radar, Related Problems.FM-CW Radar: FM-CW Radar, Range and Doppler Measurement, Block Diagram and Characteristics (Approaching/ Receding Targets), FM-CW altimeter, Multiple Frequency CW Radar.

UNIT-III: MTI and Pulse Doppler Radar

Introduction, Principle, MTI Radar with - Power Amplifier Transmitter and Power Oscillator Transmitter, Delay Line Cancellers – Filter Characteristics, Blind Speeds, Double Cancellation, Staggered PRFs. Range Gated Doppler Filters. MTI Radar Parameters, Limitations to MTI Performance, MTI versus Pulse Doppler Radar.Tracking Radar: Tracking with Radar, Sequential Lobing, Conical Scan, Monopulse Tracking Radar –Amplitude Comparison Monopulse (one- and two- coordinates), Angular Accuracy, Tracking in Range, Acquisition and Scanning Patterns, Comparison of Trackers.

UNIT-IV: Detection of Radar Signals in Noise

Introduction, Matched Filter Receiver – Response Characteristics and Derivation, Correlation Function and Cross-correlation Receiver, Efficiency of Non- matched Filters, Matched Filter with Non-white Noise.

UNIT-V: Radar Receivers

Noise Figure and Noise Temperature, Displays – types, Introduction to Phased Array Antennas – Basic Concepts, Radiation Pattern, Beam Steering and Beam Width changes, Applications, Advantages and Limitations.ElectronicWarfare : Introduction to ESM, ECM and ECCM systems.

TEXT BOOKS:

1.Introduction to Radar Systems – Merrill I. Skolnik, TMH Special Indian Edition, 2 nd

Edition, Tata McGraw-Hill, 2007.

REFERENCES:

1. Introduction to Radar Systems – Merrill I. Skolnik, 3 rd Edition Tata McGraw-Hill, 2001.

2. Radar: Principles, Technology, Applications-Byron Edde, Pearson Education, 2004.

3. Principles of Modern Radar: Basic Principles-Mark A. Richards, James A. Scheer, William

A. Holm, Yesdee,2013.

4. ‘Radar Hand Book ‘ Ed. By M.I Skolnik, 2 nd Edition, Tata McGraw Hill.

5. ‘Understanding Radar Systems’ by Simon Kinsley and Shaun Quegan, Scitech Publishing,

McGraw-Hill.

EC4425 ADHOC WIRELESS SENSOR NETWORKS

Externals: 60Marks **(L-T)-P-C**

Internals: 40Marks **4-0-3**

Course Objectives:

- To introduction of fundamentals of Wireless LANS and PANS and its design issues.
- To understand the MAC protocols for Ad Hoc Wireless Networks and its designingissues.
- To introduction of different kinds of Routing algorithms for effective design of Ad HocWireless Networks.
- To introduction and designing issues in Transport Layer Protocol for Ad Hoc WirelessNetworks.
- Introduction of Wireless Sensor Networks and its Architecture.

Course Outcomes:

- At the end of this course Students will learn
- Students will be good at fundamentals of Wireless LANS and PANS and its designissues.
- Students will know the MAC protocols for Ad Hoc Wireless Networks and its
- designing issues.
- Student knows the different kinds of Routing algorithms for effective design of Ad
- Hoc Wireless Networks.
- Student will be ability to overcome the issues in Transport Layer Protocol for Ad Hoc
- Wireless Networks.
- Finally, student will be good at design and architecture of Wireless Sensor Networks.

UNIT -I:

Wireless LANS and PANS: Introduction, Fundamentals of WLANS, IEEE 802.11 Standards,HIPERLAN Standard, Bluetooth, Home RF.AD HOC Wireless Networks: Introduction, Issues in Ad Hoc Wireless Networks.

UNIT -II:

MAC Protocols: Introduction, Issues in Designing a MAC protocol for Ad Hoc Wireless Networks, Design goals of a MAC Protocol for Ad Hoc Wireless Networks, Classifications of MAC Protocols, Contention - Based Protocols, Contention - Based Protocols with reservation

Mechanisms,Contention – Based MAC Protocols with Scheduling Mechanisms, MAC Protocolsthat use Directional Antennas, Other MAC Protocols.

UNIT -III:

Routing Protocols: Introduction, Issues in Designing a Routing Protocol for Ad Hoc WirelessNetworks, Classification of Routing Protocols, Table –Driven Routing Protocols, On – DemandRouting Protocols, Hybrid Routing Protocols, Routing Protocols with Efficient Flooding Mechanisms, Hierarchical Routing Protocols, Power – Aware Routing Protocols.

UNIT –IV:

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

UNIT –V:

Wireless Sensor Networks: Introduction, Sensor Network Architecture, Data Dissemination, Data Gathering, MAC Protocols for Sensor Networks, Location Discovery, Quality of a Sensor Network, Evolving Standards, Other Issues.

TEXT BOOKS:

Ad Hoc Wireless Networks: Architectures and Protocols - C. Siva Ram Murthy and B.S.Manoj, 2004, PHI.

Wireless Ad- hoc and Sensor Networks: Protocols, Performance and Control – JagannathanSarangapani, CRC Press.

REFERENCES:

Ad- Hoc Mobile Wireless Networks: Protocols & Systems, C.K. Toh , 1st Ed. Pearson Education.

Wireless Sensor Networks - C. S. Raghavendra, Krishna M. Sivalingam, 2004, Springer.

IoT and Applications

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **3-0-0-3**

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ECPE1_ **IoT Lab**

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **0-0-2-1**

Course Objective.

The course aims to introduce students to the concepts underlying the Internet of Things (IoT) through a series of lectures on the various topics that are important to understand the state-of-the-art as well as the trends for IoT. The students will be introduced to the history and evolution of IoT, as well as case studies from various industry domains. In addition, students will be required to work in teams to design, build, evaluate and test an innovative IoT system for a specific industry domain, such as sports and agriculture. Students will also be required to present their innovations to their peers in class as well as to the public (at the end of the course), and will also be required to document their findings in the form of a conference-style research paper. Students will also be exposed to real-world sports technologies, to witness these technologies in action behind-the-scenes, and to interact with experts from the industry.**

The lectures will be focused around industry domains (the verticals where IoT is applicable, or has been applied), platforms (the hardware or software platforms that are applicable for IoT), protocols (the communication protocols that are applicable to IoT) and services (the types of services that can layer over IoT).

TOPICS

Industry domains

IoT in Sports

IoT in Cities/Transportation

IoT in the Home

IoT in Retail

IoT in Healthcare

Platforms

Hardware, SoC, sensors, device drivers, IoT standards

Cloud computing for IoT

Bluetooth, Bluetooth Low Energy, beacons

Protocols

NFC, RFID, Zigbee

MIPI, M-PHY, UniPro, SPMI, SPI, M-PCIe

Wired vs. Wireless communication

GSM, CDMA, LTE, GPRS, small cell

Services/Attributes

Big-Data Analytics and Visualization

Dependability

Security

Maintainability

UNIT-I: Introduction & Concepts

Introduction & Concepts: Introduction to Internet of Things- Definitions & Characteristics of

IoT, Physical Design of IOT-Things in IoT, IoT Protocols, Logical Design of IOT-IoT Functional Blocks, IoT Communication Models, IoT Communication APIs, IOT Enabling Technologies- Wireless Sensor Networks, Cloud Computing, Big Data Analytics,Communication Protocols, Embedded Systems, IOT Levels & Deployment Templates.

UNIT-II: Domain Specific IoTs and M2M

IoT applications for Home Automation, Cities, Environment, Energy,Retail, Logistics,

Agriculture, Industry, health and Lifestyle

IoT and M2M – Introduction to M2M, Similarities and Differences between IoT and M2M.

UNIT-III: : IoT Platforms Design Methodology

Introduction, IoT Design Methodology Steps-Purpose and Requirements Specification, Process

Specification, Domain Model Specification, Information Model Specification, Service

Specifications, IoT Level Specification, Functional View Specification, Operational View

Specification, Device and Component Integration, Application Development, Case Study on IoT

System for Weather Monitoring.

UNIT-IV: Introduction to Python

Motivation for using Python for designing IoT systems, Language features of Python, Data types- Numbers, Strings, Lists, Tuples, Dictionaries, Type Conversions, Data Structures: Control of flow-if, for, while, range, break/continue, pass, functions, modules, packaging, file handling, data/time operations, classes, Exception handling, Python packages of Interest for IoT - JSON, XML, HTTPLib, URLLib, SMTPLib

UNIT-V: IoT Physical Devices and End Points

Basic building blocks of an IoT device, Rasberry Pi-About theRasberry Pi board, Rasberry Pi interfaces-Serial, SPI,I2C, Interfacing an LED and switch with RPi and controlling.

Other IoT Devices- pcDuino, BeagleBone Black, CubieboardIoT

Course Outcome:

The Student is expected to design and develop an IoT real-world application in a specific domain arming with knowledge of Python and choosing hardware for specific application.

Textbook:

Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)", 1st Edition, VPT, 2014.

Referencens:

Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications, 2013

Various research papers and articles recommended during course work.

EC4413 **EMBEDDED SYSTEMS**

Externals: 60Marks **(L-T)-P-C**

Internals: 40Marks **4-0-3**

Course Objectives:

- Understand the basics of an embedded system.
- Program an embedded system.
- To learn the design process of embedded system applications.
- To understands the RTOS and inter-process communication.
- To understand different communication interfaces.

Course Outcomes:

- At the end of this course Students will learn:
- Understand and design the embedded systems
- Learn the basics of OS and RTOS.
- Understand types of memory and interfacing to external world.
- Understand embedded firmware design approaches.
- Understand the interfacing of communication devices.

UNIT-I: INTRODUCTION TO EMBEDDED SYSTEMS

Complex systems and microprocessors-embedding computers, characteristics of embedded computing applications, challenges in embedded computing system design, performance in embedded computing; The embedded system design process-requirements, specification, architecture design, designing hardware and software, components, system integration, design example.

UNIT-II: TYPICAL EMBEDDED SYSTEM

Core of the embedded system-general purpose and domain specific processors, ASICs, PLDs, COTs; Memory-ROM, RAM, memory according to the type of interface, memory shadowing, memory selection for embedded systems; Sensors, actuators and other components-sensors, actuators, seven segment LED, relay, piezo buzzer, push button switch, reset circuit, brownout protection circuit, oscillator circuit real time clock, watch dog timer.

UNIT-III: EMBEDDED FIRMWARE DESIGN AND DEVELOPMENT

Embedded firmware design approaches-super loop based approach, operating system based approach; Embedded firmware development languages-assembly language based development, high level language based development; Programming in embedded C.

UNIT-IV: RTOS BASED EMBEDDED SYSTEM DESIGN

Operating system basics, types of operating systems, tasks, process and threads, multiprocessing and multitasking, task scheduling: non-preemptive and pre-emptive scheduling; task communication-shared memory, message passing.

UNIT-V: COMMUNICATION INTERFACE

Onboard communication interfaces-I2C, SPI, UART, 1 wire interface, parallel interface; External communication interfaces-RS232 and RS485,USB, infrared, Bluetooth, wi-Fi, zigbee, GPRS; Automotive networks and sensor networks.

TEXT BOOKS:

Computers as Components –Wayne Wolf, Morgan Kaufmann (second edition).

Introduction to Embedded Systems - shibu k v, Mc Graw Hill Education.

REFERENCES:

Embedded System Design -frank vahid, tony grivargis, john Wiley.

Embedded Systems- An integrated approach - Lyla b das, Pearson education 2012.

Embedded Systems – Raj kamal, TMH. 4. An embedded Software Primer, David e Simon, Pearson education

ECPE1_ **NANO ELECTRONICS**

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **3-0-0-3**

Introduction to nanotechnology, meso structures,Basics of Quantum Mechanics: Schrodinger equation, Density of States. Particle in a box Concepts, Degeneracy. Band Theory of Solids. Kronig-Penny Model. Brillouin Zones.

Shrink-down approaches: Introduction, CMOS Scaling, The nanoscale MOSFET, Finfets,

Vertical MOSFETs, limits to scaling, system integration limits (interconnect issues etc.),

Resonant Tunneling Diode, Coulomb dots, Quantum blockade, Single electron transistors,Carbon nanotube electronics, Bandstructure and transport, devices, applications, 2D semiconductors and electronic devices, Graphene, atomistic simulation

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

Understand various aspects of nano-technology and the processes involved in making nano components and material.

Leverage advantages of the nano-materials and appropriate use in solving practical problems.

Understand various aspects of nano-technology and theprocesses involved in making nano components and material.

Leverage advantages of the nano-materials and appropriate use in solving practical problems.

Text/ Reference Books:

G.W. Hanson, Fundamentals of Nanoelectronics, Pearson, 2009.

W. Ranier, Nanoelectronics and Information Technology (Advanced Electronic Materialand Novel Devices), Wiley-VCH, 2003.

K.E. Drexler, Nanosystems, Wiley, 1992.

J.H. Davies, The Physics of Low-Dimensional Semiconductors, Cambridge University Press, 1998.

C.P. Poole, F. J. Owens, Introduction to Nanotechnology, Wiley, 2003

ECPE1_ **INTRODUCTION TO MEMS**

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **3-0-0-3**

Introduction and Historical Background, Scaling Effects. Micro/Nano Sensors, Actuators and

Systems overview: Case studies. Review of Basic MEMS fabrication modules: Oxidation, Deposition Techniques, Lithography (LIGA), and Etching. Micromachining: Surface Micromachining, sacrificial layer processes, Stiction; Bulk

Micromachining, Isotropic Etching and Anisotropic Etching, Wafer Bonding. Mechanics of solids in MEMS/NEMS: Stresses, Strain, Hookes's law, Poisson effect, Linear

Thermal Expansion, Bending; Energy methods, Overview of Finite Element Method, Modeling of Coupled Electromechanical Systems.

Course Outcomes:

At the end of the course the students will be able to

Appreciate the underlying working principles of MEMS and NEMS devices.

Design and model MEM devices.

Text/Reference Book:

G. K. Ananthasuresh, K. J. Vinoy, S. Gopalkrishnan K. N. Bhat, V. K. Aatre, Micro and Smart Systems, Wiley India, 2012.

S. E.Lyshevski, Nano-and Micro-Electromechanical systems: Fundamentals of Nano-and Microengineering (Vol. 8). CRC press, (2005).

S. D. Senturia, Microsystem Design, Kluwer Academic Publishers, 2001.

M. Madou, Fundamentals of Microfabrication, CRC Press, 1997.

G. Kovacs, Micromachined Transducers Sourcebook, McGraw-Hill, Boston, 1998.

M.H. Bao, Micromechanical Transducers: Pressure sensors, accelerometers, and Gyroscopes, Elsevier, New York, 2000.

ECPE1_ **MIXED SIGNAL DESIGN**

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **3-0-0-3**

Unit I:

Analog and discrete-time signal processing, introduction to sampling theory;Analog continuoustime filters: passive and active filters; Basics of analog discrete-time filters and Z-transform.

Unit II:

Switched-capacitor filters- Nonidealities in switched-capacitor filters; Switched-capacitor filter architectures; Switched-capacitor filter applications.

Unit III:

Basics of data converters; Successive approximation ADCs, Dual slope ADCs,Flash ADCs, Pipeline ADCs, Hybrid ADC structures, High-resolution ADCs, DACs.

Unit IV:

Mixed-signal layout, Interconnects and data transmission; Voltage-mode signalingand data transmission; Current-mode signaling and data transmission.

Unit V:

Introduction to frequency synthesizers and synchronization; Basics of PLL,Analog PLLs; Digital PLs; DLLs.

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

Understand the practical situations where mixed signal analysis is required.

Analyze and handle the inter-conversions between signals.

Design systems involving mixed signals

Text/Reference Books:

R. Jacob Baker, CMOS mixed-signal circuit design, Wiley India, IEEE press, reprint 2008.

Behzad Razavi , Design of analog CMOS integrated circuits, McGraw-Hill, 2003.

R. Jacob Baker, CMOS circuit design, layout and simulation, Revised second edition, IEEE press, 2008.

Rudy V. dePlassche, CMOS Integrated ADCs and DACs, Springer, Indian edition, 2005.

Arthur B. Williams, Electronic Filter Design Handbook, McGraw-Hill, 1981.

R. Schauman, Design of analog filters by, Prentice-Hall 1990 (or newer additions).

M. Burns et al., An introduction to mixed-signal IC test and measurement by, Oxford university press, first Indian edition, 2008.

ECPE1_ **CMOS DESIGN**

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **3-0-0-3**

Review of MOS transistor models, Non-ideal behavior of the MOS Transistor.Transistor as a switch. Inverter characteristics, Integrated Circuit Layout: Design Rules, Parasitics. Delay: RC Delay model, linear delay model, logical path efforts. Power, interconnect and Robustness in CMOS circuit layout. Combinational Circuit Design: CMOS logic families including static, dynamic and dual rail logic. Sequential Circuit Design: Static circuits. Design of latches and Flip-flops.

Course Outcomes:

At the end of the course the students will be able to

Design different CMOS circuits using various logic families along with their circuit layout.

Use tools for VLSI IC design.

Text/Reference Books:

N.H.E. Weste and D.M. Harris, CMOS VLSI design: A Circuits and Systems

Perspective, 4thEdition, Pearson Education India, 2011.

C.Mead and L. Conway, Introduction to VLSI Systems, Addison Wesley, 1979.

J. Rabaey, Digital Integrated Circuits: A Design Perspective, Prentice Hall India, 1997.

P. Douglas, VHDL: programming by example, McGraw Hill, 2013.

L. Glaser and D. Dobberpuhl, The Design and Analysis of VLSI Circuits, Addison Wesley, 1985.

ECPE1_ **POWER ELECTRONICS**

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **3-0-0-3**

Unit I:

Characteristics of Semiconductor Power Devices: Thyristor, power MOSFET and IGBT- Treatment should consist of structure, Characteristics, operation, ratings, protections and thermal considerations. Brief introduction to power devices viz. TRIAC, MOS controlled thyristor (MCT), Power Integrated Circuit (PIC) (Smart Power), Triggering/Driver, commutation and snubber circuits for thyristor, power MOSFETs and IGBTs (discrete and IC based).Concept of fast recovery and schottky diodes as freewheeling and feedback diode.

Unit II:

Controlled Rectifiers: Single phase: Study of semi and full bridge converters for R, RL, RLE and level loads. Analysis of load voltage and input current- Derivations of load form factor and ripple factor, Effect of source impedance, Input current Fourier series analysis of input current to derive input supply power factor, displacement factor and harmonic factor.

Unit III:

Choppers: Quadrant operations of Type A, Type B, Type C, Type D and type E choppers, Control techniques for choppers – TRC and CLC, Detailed analysis of Type A chopper. Step up chopper. Multiphase Chopper

Unit IV:

Single-phase inverters: Principle of operation of full bridge square wave, quasi-square wave, PWM inverters and comparison of their performance. Driver circuits for above inverters and mathematical analysis of output (Fourier series) voltage and harmonic control at output of inverter (Fourier analysis of output voltage). Filters at the output of inverters, Single phase current source inverter

Unit V:

Switching Power Supplies: Analysis of fly back, forward converters for SMPS, Resonant converters - need, concept of soft switching, switching trajectory and SOAR, Load resonant converter - series loaded half bridge DC-DC converter.

Applications: Power line disturbances, EMI/EMC, power conditioners. Block diagram and configuration of UPS, salient features of UPS, selection of battery and charger ratings, sizing of UPS. Separately excited DC motor drive. P M Stepper motor Drive.

Course Outcomes:

At the end of this course students will demonstrate the ability to

Build and test circuits using power devices such as SCR

Analyze and design controlled rectifier, DC to DC converters, DC to AC inverters,

Learn how to analyze these inverters and some basic applications.

Design SMPS.

Text /Reference Books:

Muhammad H. Rashid, “Power electronics” Prentice Hall of India.

Ned Mohan, Robbins, “Power electronics”, edition III, John Wiley and sons.

P.C. Sen., “Modern Power Electronics”, edition II, Chand& Co.

V.R.Moorthi, “Power Electronics”, Oxford University Press.

Cyril W., Lander,” Power Electronics”, edition III, McGraw Hill.

G K Dubey, S R Doradla,: Thyristorised Power Controllers”, New Age International Publishers.
SCR manual from GE, USA.

ECPE1_ **HIGH SPEED ELECTRONICS**

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **3-0-0-3**

Unit I:

Transmission line theory (basics) crosstalk and nonideal effects; signal integrity: impact of packages, vias, traces, connectors; non-ideal return current paths, high frequency powerdelivery, methodologies for design of high speed buses; radiated emissions and minimizing system noise;

Noise Analysis: Sources, Noise Figure, Gain compression, Harmonic distortion,

Intermodulation,Cross-modulation, Dynamic range

Unit II:

Devices: Passive and active, Lumped passive devices (models), Active (models,low vs highfrequency)

Unit III:

RF Amplifier Design, Stability, Low Noise Amplifiers, Broadband Amplifiers (and Distributed) Power Amplifiers, Class A, B, AB and C, D E Integrated circuit realizations, Cross-over distortion Efficiency RF power output stages

Unit IV:

Mixers –Upconversion Downconversion, Conversion gain and spurious response.Oscillators Principles.PLL Transceiver architectures

Unit V:

Printed Circuit BoardAnatomy, CAD tools for PCB design, Standard fabrication, Microvia Boards. Board Assembly: Surface Mount Technology, Through Hole Technology, Process Control and Design challenges.

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

Understand significance and the areas of application of high-speed electronics circuits.

Understand the properties of various components used in high speed electronics

Design High-speed electronic system using appropriate components.

Text/Reference Books:

Stephen H. Hall, Garrett W. Hall, James A. McCall "High-Speed Digital System Design: A Handbook of Interconnect Theory and Design Practices", August 2000, Wiley-IEEE Press

Thomas H. Lee, "The Design of CMOS Radio-Frequency Integrated Circuits", CambridgeUniversity Press, 2004, ISBN 0521835399.

Behzad Razavi, "RF Microelectronics", Prentice-Hall 1998, ISBN 0-13-887571-5.

Guillermo Gonzalez, "Microwave Transistor Amplifiers", 2nd Edition, Prentice Hall.

Kai Chang, "RF and Microwave Wireless systems", Wiley.

R.G. Kaduskar and V.B.Baru, Electronic Product design, Wiley India, 2011

ECPE1_ **EMBEDDED SYSTEMS DESIGN**

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **3-0-0-3**

Prerequisite: Microprocessor and Microcontrollers Course

Objectives:

1. To provide an overview of Design Principles of Embedded System.

2. To provide clear understanding about the role of firmware , operating systems in correlation with hardware systems.

Course Outcomes:

1. Expected to understand the selection procedure of Processors in the Embedded domain.

2. Design Procedure for Embedded Firmware.

3. Expected to visualize the role of Real time Operating Systems in Embedded Systems

4. Expected to evaluate the Correlation between task synchronization and latency issues

UNIT -I:

Introduction to Embedded Systems Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems.

UNIT -II:

Typical Embedded System: Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS), Memory: ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces.

UNIT -III:

Embedded Firmware: Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, Real Time Clock, Watchdog Timer, Embedded Firmware Design Approaches and Development Languages.

UNIT -IV:

RTOS Based Embedded System Design: Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling.

UNIT -V:

Task Communication: Shared Memory, Message Passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication/Synchronization Issues, Task Synchronization Techniques, Device Drivers, How to Choose an RTOS.

TEXT BOOKS:

Introduction to Embedded Systems - Shibu K.V, Mc Graw Hill.

REFERENCE BOOKS:

Embedded Systems - Raj Kamal, TMH.

Embedded System Design - Frank Vahid, Tony Givargis, John Wiley.

Embedded Systems – Lyla, Pearson, 2013

An Embedded Software Primer - David E. Simon, Pearson Education.

EC4421 ANALOG VLSI AND MIXED SIGNAL DESIGN

Externals: 60Marks **(L-T)-P-C**

Internals: 40Marks **4-0-3**

Course Objective:

- To understand the types of active filters and its operation.
- To understand the types of continuous time filters and digital filters and its operation.
- To understand various ADC and DAC converters and its importance in the Electronic systems.
- Gives Knowledge on VHDL Programming language for Mixed Signal Circuit Design.
- Extension the Verilog concepts for analog VLSI circuits.

Course Outcomes:

- Able to design filters with active devices only.
- Able to design the first and second order digital filters.
- The ability to use and design DAC and ADC techniques for data conversions.
- The ability to program, Mixed Signal VLSI Circuits.
- Verilog program for analog VLSI circuits.

UNIT I: Introduction to Active Filters (PLL) & Switched capacitor filters

Active RC Filters for monolithic filer design: First & Second order filter realizations - universal active filter (KHN)- self tuned filter - programmable filters - Switched capacitor filters: Switchedcapacitor resistors - amplifiers –comparators - sample & hold circuits – Integrator-Biquad.

UNIT II: Continuous Time filters & Digital Filters

Introduction to Gm - C filters - bipolar transconductors - CMOS Transconductors using Triode transistors, active transistors - BiCMOStransconductors – MOSFET C Filters - Tuning Circuitry - Dynamic range performance -Digital Filters: Sampling – decimation – interpolation - implementation of FIR and IIR filters.

UNIT III: Digital to Analog & Analog to Digital Converters

Non-idealities in the DAC - Types of DAC's: Current switched, Resistive, Charge redistribution (capacitive), Hybrid, segmented DAC's - Techniques for improving linearity - Analog to Digital Converters: quantization errors -non-idealities - types of ADC's: Flash, two step, pipelined, successive approximation, folding ADC's.Sigma Delta Converters: Over sampled converters - over sampling without noise & with noise – implementation imperfections - first order modulator - decimation filters- second order modulator - sigma delta DAC & ADC's

UNIT IV: Analog and Mixed Signal Extensions to VHDL

Introduction - Language design objectives - Theory of differential algebraic equations - the 1076 .1 Language - Tolerance groups - Conservative systems - Time and the simulation cycle -A/D and D/A Interaction - Quiescent Point - Frequency domain modeling and examples.

UNIT V: Analog Extensions to Verilog

Introduction –data types –Expressions-Signals-Analog Behavior-Hierarchical structures-Mixed Signal Interaction. Introduction - Equation construction - solution - waveform Filter functions - simulator - Control Analysis - Multi -disciplinary model.

TEXT BOOKS:

David A. Johns, Ken Martin, “Analog Integrated Circuit Design” John Wiley & Sons, 2002.

Rudy van de Plassche “Integrated Analog-to-Digital and Digital-to-Analog Converters “,Kluwer 1999.

Antoniou, “Digital Filters Analysis and Design” Tata McGraw Hill, 1998.

REFERENCES:

Phillip Allen and Douglas Holmberg "CMOS Analog Circuit Design" Oxford University. Press, 2000.

BenhardRazavi, “Data Converters”, Kluwer Publishers, 1999.

Jacob Baker, Harry W LI, and David E Boyce “CMOS, Circuit Design Layout and Simulation”, Wiley- IEEE Press, 1 st Edition, 1997.

Tsividis Y P, “Mixed Analog and Digital VLSI Devices and Technology”, Mc-Graw Hill,1996.

ECPE1_ **CMOS ANALOG VLSI DESIGN**

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **3-0-0-3**

COURSE OBJECTIVES

1. To understand CMOS analog circuits design
2. To simulate Analog circuits using H SPICE.
3. To learn noise modeling of CMOS analog circuits

UNIT I - ANALOG CMOS SUB-CIRCUITS

Introduction to analog design, Passive and active current mirrors, band-gap references, Switched Capacitor circuits - basic principles, sampling switches, switched capacitor integrator, switched capacitor amplifier, simulation of CMOS sub circuits using SPICE.

UNIT II - CMOS SINGLE STAGE AMPLIFIERS

Common-Source stage (with resistive load, diode connected load, current-source load, triode load, source degeneration), source follower, common-gate stage, cascode stage, folded cascode stage. Frequency responses of CS stage, CD stage, CG stage, cascode stage, simulation of CMOS amplifiers using SPICE.

UNIT III - DIFFERENTIAL AMPLIFIER & OPERATIONAL AMPLIFIERS

Single-ended and differential operation, basic differential pair – qualitative and quantitative analyses, common-mode response, differential pair with MOS loads, Performance parameters of op-amp, one stage op-amp, two-stage CMOS op-amp, Gain boosting, slew rate, power supply rejection, Simulation of differential amplifiers using SPICE.

UNIT IV - OSCILLATORS

General considerations, Ring oscillators, LC oscillators – cross-coupled oscillators, Colpitts oscillator, One-port oscillator, and voltage controlled oscillators. Simulation of oscillators using SPICE.

UNIT V - NOISE CHARACTERISTICS

Statistical characteristics of noise, Types of noise - thermal noise, flicker noise, Representation of noise in circuits, noise in single-stage amplifiers (CS, CD and CG stages), noise bandwidth.

TEXT BOOK

Razavi*, "Design of analog CMOS integrated circuits",* McGraw Hill, Edition 2002.

REFERENCES

1. Gray, Meyer, Lewis, Hurst, *"Analysis and design of Analog Integrated Circuits",* Willey International, 4th Edition, 2002.
2. Allen, Holberg, *"CMOS analog circuit design",* Oxford University Press, 2nd Edition, 2012.

COURSE OUTCOMES

1. Analog circuits are essential in interfacing and building amplifiers and low pass filters.
2. Able to do the design of analog sublevel blocks.
3. Learn some design methods for CMOS analog circuit.

ECPE1 **CMOS DIGITAL VLSI DESIGN**

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **3-0-0-3**

Course Objectives:

1. This is an introductory course which covers basic theories and techniques of digital VLSI Circuit design in CMOS technology.

2. In this course, we will study the fundamental concepts and structures of MOS Transistor and designing digital VLSI Circuits, static and dynamic Power Dissipation, interconnect analysis, Propagation delays, MOS Inverters and their Characteristics.

3. The course is designed to give the student an understanding of the different Combinational circuit design, Sequential MOS Logic Gates and CMOS Dynamic Logic Circuits including their Transient Analysis, design steps and behavior.

Unit I MOS Transistor-First Glance at the MOS device, MOS Transistor under static conditions, threshold voltage, Resistive operation, saturation region, channel length modulation, velocity saturation, Hot carrier effect-drain current Vs voltage charts, sub threshold conduction, equivalent resistance, MOS structure capacitance & CMOS logics.

Unit II MOS Inverter, Switching characteristics & Interconnect Effects- Delay Time, Interconnect Parasitic Capacitances, Resistance, RC Delays, Inductances, Gate Delays, Stage Ratio, Power Dissipation, CMOS Logic Gate Design, Transmission Gate & BiCMOS.

Unit III Combinational Circuit Design: NAND Gate, NOR Gate, Transient Analysis of NAND & NOR Gate. Sequential MOS Logic Gates: Behavior of Bitable element, CMOS latches & Clocked Flip-Flops, Clock Skew & Clocking Strategies.

Unit IV CMOS Dynamic Logic Circuits: Pass Transistor Logic-0 and 1 transfer, Charge Storage & Leakage. Voltage Bootstrapping. High Performance Dynamic CMOS Circuits: Domino CMOS Logic. NORA CMOS Logic, Zipper CMOS Circuits, TSPC Dynamic CMOS.

Unit V Semiconductor Memories: ROM, DRAM, SRAM, PLA, Cell, Leakage Circuit and Input/output Circuit.

Text books:

1.Jan.M.Rabaey., Anitha Chandrakasan Borivoje Nikolic, "Digital Integrated Circuits", SecondEdition.

2.Sung-Mo Kang, Yusuf Leblebici, "CMOS Digital IC- Analysis and Design", 3rd Edition, Tata McGraw Hill.

Reference books:

1.Neil H.E Weste and Kamran Eshraghian, "Principles of CMOS VLSI Design", 2nd Edition, Addition Wesley, 1998.

COURSE OUTCOMES

1. Able to design digital circuits in circuit-level.

2. Able to have a digital circuit design with optimizing speed and area.

3. Semiconductor memories cell can be enhanced with the existed memory cells.

EC4411 **REAL TIME OPERATING SYSTEMS**

Externals: 60Marks **(L-T)-P-C**

Internals: 40Marks **4-0-3**

Course Objectives:

- To understand the need of real time operating system.
- To learn the basic concepts of inter process communication (IPC).
- To analyze various scheduling algorithms related to RTOS.
- To introduce the elementary concepts of Vx works.
- To study the basic concepts of UNIX operating system.

Course Outcomes:

- At the end of this course Students will learn:
- 1.Understand Real-time operating system requirements and applications.
- Categorize different scheduling approaches for real time scheduler.
- Compare different real time systems.
- Analyze a module and understand design issues.
- Develop a real time embedded system module.

UNIT-I:

Introduction to Real Time Systems Structures of Operating System (Monolithic, Microkernel, Layered, Exo-kernel and Hybrid kernel structures), Operating system objectives and functions, Virtual Computers, Interaction of OS and Hardware architecture, Evolution of operating systems, Batch, multi programming. Multitasking, Multiuser, parallel, distributed and real-time OS.

UNIT-II:

Process Management of OS/RTOS Hard versus Soft Real-Time System: Jobs and Processors, release time, deadlines, and timing constraints, hard and soft timing constraints, hard real-time systems. Uniprocessor Scheduling: Types of scheduling, scheduling algorithms: FCFS, SJF, Priority, Round Robin, UNIX Multi-level feedback queue scheduling, Thread scheduling, Multiprocessor scheduling concept, Real Time scheduling concept.

UNIT-III:

Real Time Operating System Concepts Foreground and Background Systems, Shared Resource, Critical section of a Code, Multi-Tasking, Task, Context switch, Kernel, Scheduler, Preemptive and non-preemptive kernel, Inter Task Communication: Message Mailboxes, Message queues or pipes and Event flags, Semaphores, Interrupts

UNIT-IV:

Introduction to Vx works/UNIX OS Elementary Concepts of Vx Works: Multitasking, Task State Transition, Task Control- Task Creation and Activation, Task Stack, Task Names and IDs, Task Options, Task Information, Task Deletion and Deletion Safety. Fundamental Concepts of UNIX Operating Systems UNIX Kernel – File system, Concepts of – Process, Concurrent Execution & Interrupts. Process Management – forks & execution. Basic level Programming with system calls, Shell programming and filters.

UNIT-V:

Linux development process Types of Host /Target Development and debug setup, Generic Architecture of an Embedded Linux System, System start up, Types of Boot configurations, System Memory Layout, Development Tools: Project Workspace, IDE, GNCC cross platform, selecting and configuring kernel, setting up boot loader.

TEXT BOOKS:

Tanenbaum,"Modern Operating Systems," 4/e, Pearson Edition, 2014.

Jane W.S.Liu, Real Time Systems, Pearson Education, Asia, 2001. REFERENCES: 1. Jean J Labrosse,"Embedded Systems Building Blocks Complete and Ready-to-use Modules in C" ,2/e, CRC Press ,1999. 2. Karim Yaghmour, Jon Masters, Gilad Ben-Yesset, Philippe Gerum, "Building Embedded Linux Systems", O'Reilly Media, 2008.

Wind River Systems, "VxWorks Programmers Guide 5.5", Wind River Systems Inc.2002.

EC4423 **CAD FOR VLSI CIRCUITS**

Externals: 60Marks **(L-T)-P-C**

Internals: 40Marks **4-0-3**

Course Objectives:

- To make understand the VLSI CAD tools flow with Algorithmic Graphs.
- Gives knowledge on layout design rules and various algorithms for placement and partitioning of circuits.
- Understands the Floor planning and routing process in the VLSI CAD tools.
- Knows the various concepts of simulation and synthesis process in VLSI CAD tools.
- Gives Knowledge on modelling concepts of synthesis process.

Course Outcomes:

- Understands the complete VLSI CAD tool flow.
- Able to follow the design rules and debug it while creating layouts for circuits in VLSI CAD tool and also understands the placement and partitioning of the digital systems.
- Able to debug the floor planning and routing problems in the VLSI CAD tools for the digital systems.
- Understands the simulation and synthesis process and make advantage to debug the errors when developing and using the VLSI CAD tools.
- Able to develop a synthesis process in the VLSI CAD tools

UNIT I: VLSI DESIGN METHODOLOGIES

Introduction to VLSI Design methodologies - Review of Data structures and algorithms - Review of VLSI Design automation tools - Algorithmic Graph Theory and Computational Complexity - Tractable and Intractable problems - general purpose methods for combinatorial optimization.

UNIT II:DESIGN RULES

Layout Compaction - Design rules - problem formulation - algorithms for constraint graph compaction - placement and partitioning - Circuit representation - Placement algorithms - partitioning

UNIT III:FLOOR PLANNING

Floor planning concepts - shape functions and floorplan sizing - Types of local routing problems - Area routing - channel routing - global routing - algorithms for global routing.

UNIT IV:SIMULATION

Simulation - Gate-level modeling and simulation - Switch-level modeling and simulation - Combinational Logic Synthesis - Binary Decision Diagrams - Two Level Logic Synthesis.

UNIT V:MODELLING AND SYNTHESIS

High level Synthesis - Hardware models - Internal representation - Allocation assignment and scheduling - Simple scheduling algorithm - Assignment problem - High level transformations.

TEXTBOOKS:

S.H. Gerez, "Algorithms for VLSI Design Automation", John Wiley & Sons,2002.

N.A. Sherwani, "Algorithms for VLSI Physical Design Automation", Kluwer Academic Publishers, 2002.

EC4424 **RF INTEGRATED CIRCUITS**

Externals: 60Marks **(L-T)-P-C**

Internals: 40Marks **4-0-3**

Course Objectives:

- To educate students fundamental RF circuit and system design skills.
- To introduce students, the basic transmission line theory, single and multiport networks, RF component modelling.
- To offer students experience on designing matching and biasing networks & RF transistor amplifier design.

Course Outcomes:

- At the end of this course Students will learn:
- Understand the design bottlenecks specific to RF IC design, linearity related issues, ISI.
- Identify noise sources, develop noise models for the devices and systems.
- Specify noise and interference performance metrics like noise figure, IIP3 and different matching criteria.
- Comprehend different multiple access techniques, wireless standards and various transceiver architectures
- Design various constituents' blocks of RF receiver front end.

Unit I: INTRODUCTION TO RF AND WIRELESS TECHNOLOGY:

Complexity comparison, Design bottle necks, Applications, Analog and digital systems, Choice of Technology. BASIC CONCEPTS IN RF DESIGN: Nonlinearity and time variance, ISI, Random process and noise, sensitivity and dynamic range, passive impedance transformation.

Unit II: MULTIPLE ACCESS:

Techniques and wireless standards, mobile RF communication, FDMA, TDMA, CDMA, Wireless standards.

Unit III: TRANSCEIVER ARCHITECTURES:

General considerations, receiver architecture, Transmitter Architecture, transceiver performance tests, case studies.

Unit IV: AMPLIFIERS, MIXERS AND OSCILLATORS:

LNAs, down conversion mixers, Cascaded Stages, oscillators, Frequency synthesizers.

Unit V: POWER AMPLIFIERS:

General considerations, linear and nonlinear Pas, classification, High Frequency power amplifier, large signal impedance matching, linearization techniques.

Text Books:

BehzadRazavi, RF Microelectronics Prentice Hall of India, 2001

Thomas H. Lee, the Design of CMOS Radio Integrated Circuits, Cambridge University Press.

ECPE1_ **FIBER OPTIC COMMUNICATION**

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **3-0-0-3**

Unit I:

Introduction to vector nature of light, propagation of light, propagation of light ina cylindrical dielectric rod, Ray model, wave model.

Unit II:

Different types of optical fibers, Modal analysis of a step index fiber.

Signaldegradation on optical fiber due to dispersion and attenuation. Fabrication of fibers and measurement techniques like OTDR.

Unit III:

Optical sources - LEDs and Lasers, Photo-detectors - pin-diodes, APDs, detectorresponsivity, noise, optical receivers. Optical link design - BER calculation, quantum limit, power penalties.

Unit IV:

Optical switches - coupled mode analysis of directional couplers, electro-opticswitches.

Optical amplifiers - EDFA, Raman amplifier.

Unit V:

WDM and DWDM systems. Principles of WDM networks.

Nonlinear effects in fiber optic links. Concept of self-phase modulation, groupvelocity dispersion and solition based communication.

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

Understand the principles fiber-optic communication, the components and the bandwidth advantages.

Understand the properties of the optical fibers and optical components.

Understand operation of lasers, LEDs, and detectors

Analyze system performance of optical communication systems

Design optical networks and understand non-linear effects in optical fibers

EC4434 ANTENNAS AND WAVE PROPAGATION

Externals: 60Marks **(L-T)-P-C**

Internals: 40Marks **4-0-3**

Course Objectives:

- Understand basic terminology and concepts of Antennas.
- To attain knowledge on the basic parameters those are considered in the antenna design process and the analysis while designing that.
- Analyze the electric and magnetic field emission from various basic antennas and
- mathematical Formulation of the analysis.
- To have knowledge on antenna operation and types as well as their usage in real time filed.
- Aware of the wave spectrum and respective band based antenna usage and also to know thepropagation of the waves at different frequencies through different layers in the existing layered free space environment structure.

Course Outcomes:

- Student will be able to:
- Aware of antenna parameter considerations
- Capable to analyze the designed antenna and field evaluation under various conditions andformulate the electric as well as magnetic fields equation set for far field and near field conditions
- Understand the array system of different antennas and field analysis under application of different currents to the individual antenna elements
- Understand the design issues, operation of fundamental antennas and their operation
- methodology in practice.
- Design a lens structure and also the bench set up for antenna parameter measurement of testingfor their effectiveness
- Knowledge about the means of propagation of electromagnetic waves

UNIT-I: Antenna Basics:

Introduction, Basic Antenna Parameters – Patterns, Beam Area, Radiation Intensity, Beam Efficiency, Directivity-Gain-Resolution, Antenna Apertures, Illustrative Problems. Fields fromOscillating Dipole, Field Zones, Front - to-back Ratio, Antenna Theorems, Radiation, Retarded Potentials – Helmholtz Theorem.Thin Linear Wire Antennas – Radiation from Small Electric Dipole, Quarter Wave Monopole and Half Wave Dipole – Current Distributions, Field Components, Radiated Power, Radiation Resistance, Beam Width, Directivity, Effective Area, Effective Height, Natural Current Distributions, Far Fields and Patterns of Thin Linear Centre-fed Antennas of Different Lengths, Illustrative Problems. Loop Antennas - Introduction, Small Loop, Comparison of Far Fields of Small Loop and Short Dipole, Radiation Resistances.

UNIT-II: Antenna Arrays:

Point Sources – Definition, Patterns, arrays of 2 Isotropic Sources - Different Cases, Principle of Pattern Multiplication, Uniform Linear Arrays – Broadside Arrays, Endfire Arrays, EFA with Increased Directivity, Derivation of their Characteristics and Comparison, BSAs with Non-uniform Amplitude Distributions –General Considerations and Binomial Arrays, Illustrative Problems.

Antenna Measurements:Introduction, Concepts - Reciprocity, Near and Far Fields, Coordinate System Patterns to be Measured, Pattern Measurement Arrangement, Directivity Measurement, Gain Measurements (by Comparison, Absolute and 3- Antenna Methods)

UNIT-III: VHF, UHF and Microwave Antennas-I:

Arrays with Parasitic Elements, Yagi-Uda Array, Folded Dipoles and their Characteristics,Helical Antennas – Helical Geometry, Helix Modes, Practical Design Considerations for Monofilar Helical Antenna in Axial and Normal Modes, Horn Antennas – Types, Optimum Horns, Design Considerations of Pyramidal Horns, Illustrative Problems.

VHF, UHF and Microwave Antennas - II:

Microstrip Antennas – Introduction, Features, Advantages and Limitations, Rectangular Patch Antennas– Geometry and Parameters, Characteristics of Microstrip Antennas. Impact of Different Parameters on Characteristics, 103 Reflector Antennas – Introduction, Flar Sheet and Corner Reflectors, Paraboloidal Reflectors – Geometry, Pattern Characteristics, Feed Methods, Reflector Types – Related Features, Illustrative Problems. Lens Antennas – Introduction, Geometry of Non-metallic Dielectric Lenses, Fermat‘s Principle, Zoning, Applications.

UNIT-IV: Wave Propagation – I:

Introduction, Definitions, Categorizations and General Classifications, Different Modes of WavePropagation, Ray/Mode Concepts, Ground Wave Propagation (Qualitative Treatment) Introduction, Plane Earth Reflections, Space and Surface Waves, Wave Tilt, Curved Earth Reflections. Space Wave Propagation – Introduction, Field Strength Variation with Distance andHeight, Effect of Earth‘s Curvature, Absorption, Super Refraction, M-Curves and Duct Propagation, Scattering Phenomena, Tropospheric Propagation.

UNIT-V: Wave Propagation – II:

Sky Wave Propagation – Introduction, Structure of Ionosphere, Refraction and Reflectionof Sky Waves by Ionosphere, Ray Path, Critical Frequency, MUF, LUF, OF, Virtual Height and Skip Distance, Relation between MUF and Skip Distance, Multihop Propagation.

TEXT BOOKS:

Antennas and Wave Propagation – J.D. Kraus, R.J. Marhefka and Ahmad S. Khan, TMH, New Delhi, 4thed., (Special Indian Edition), 2010.

Electromagnetic Waves and Radiating Systems – E.C. Jordan and K.G. Balmain, PHI, 2nd ed.2000.

A.Harish, M.Sachidanada," Antennas and Wave Propagation", Oxford University Press,2007

REFERENCES:

Antenna Theory - C.A. Balanis, John Wiley & Sons, 3rd Ed., 2005.

Antennas and Wave Propagation – K.D. Prasad, Satya Prakashan, Tech India Publications,New Delhi,2001.

Transmission and Propagation – E.V.D. Glazier and H.R.L. Lamont, The Services Text Book of Radio,vol. 5, Standard Publishers Distributors, Delhi.

Antennas – John D. Kraus, McGraw-Hill (International Edition), 2nd Ed. 1988.

Electronic and Radio Engineering – F.E. Terman, McGraw-Hill, 4th edition, 1955.

ECPE1_ MICROWAVE THEORY AND TECHNIQUES

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **3-0-0-3**

Unit I:

Introduction to Microwaves-History of Microwaves, Microwave Frequency bands; Applications of Microwaves: Civil and Military, Medical, EMI/ EMC. Mathematical Model of Microwave Transmission-Concept of Mode, Features of TEM, TE and TM Modes, Losses associated with microwave transmission, Concept of Impedance in Microwave transmission.

Unit II:

Analysis of RF and Microwave Transmission Lines- Coaxial line, Rectangular waveguide, Circular waveguide, Strip line, Micro strip line. Microwave Network Analysis- Equivalent voltages and currents for non-TEM lines, Network parameters for microwave circuits, Scattering Parameters.

Unit III:

Passive and Active Microwave Devices- Microwave passive components: Directional Coupler, Power Divider, Magic Tee, Attenuator, Resonator. Microwave active components: Diodes, Transistors, Oscillators, Mixers. Microwave Semiconductor Devices: Gunn Diodes, IMPATT diodes, Schottky Barrier diodes, PIN diodes. Microwave Tubes: Klystron, TWT, Magnetron.

Unit IV:

Microwave Design Principles- Impedance transformation, Impedance Matching, Microwave Filter Design, RF and Microwave Amplifier Design, Microwave Power Amplifier Design, Low Noise Amplifier Design, Microwave Mixer Design, Microwave Oscillator Design. Microwave Antennas- Antenna parameters, Antenna for ground based systems, Antennas for airborne and satellite borne systems, Planar Antennas. Microwave Measurements- Power, Frequency and impedance measurement at microwave frequency, Network Analyzer and measurement of scattering parameters, Spectrum Analyzer and measurement of spectrum of a microwave signal, Noise at microwave frequency and measurement of noise figure. Measurement of Microwave antenna parameters.

Unit V:

Microwave Systems- Radar, Terrestrial and Satellite Communication, Radio Aidsto Navigation, RFID, GPS. Modern Trends in Microwaves Engineering- Effect of Microwaves on human body, Medical and Civil applications of microwaves, Electromagnetic interference and Electromagnetic Compatibility (EMI & EMC), Monolithic Microwave ICs, RFMEMS for microwave components, Microwave Imaging.

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

Understand various microwave system components their properties.

Appreciate that during analysis/ synthesis of microwave systems, the different mathematical treatment is required compared to general circuit analysis.

Design microwave systems for different practical application.

Text/Reference Books:

R.E. Collins, Microwave Circuits, McGraw Hill

K.C. Gupta and I.J. Bahl, Microwave Circuits, Artech house

EC4426 ELECTRONIC MEASUREMENTS AND INSTRUMENTATION

Externals: 60Marks **(L-T)-P-C**

Internals: 40Marks **4-0-3**

Course Objectives:

This course provides

- An introduction to measurement techniques and instrumentation design and operation
- The basic concepts of units measurement error and accuracy, the construction and design of measuring devices and circuits measuring instruments and their proper applications
- To use different measuring techniques and measurement of different physical parameters using different transducers

Course Outcomes:

- Upon a successful completion of this course, the student will be able to:
- Describe the fundamental concepts and principles of instrumentation.
- Explain the operations of the various instruments required in measurements.
- Apply the measurement techniques for different types of tests.
- To select specific instrument for specific measurement function.
- Understand principle of operation, working of different electronic instruments like digital multi meter, vector voltmeter.
- Learners will apply knowledge of different oscilloscopes like CRO, DSO.
- Students will understand functioning, specification, and applications of signal analyzing instruments.

UNIT - I:

Block Schemantics of Measuring Systems: Performance characteristics, Static characteristics, Accuracy, Precision, Resolution, Types of Errors, Gaussian Error, Root Sum Squares formula, Dynamic Characteristics, Repeatability, Reproducibility, Fidelity, Lag; Measuring Instruments: DC Voltmeters, D' Arsonval Movement, DC Current Meters, AC Voltmeters and Current Meters, Ohmmeters, Multimeters, Meter Protection, Extension of Range, True RMS Responding Voltmeters, Specifications of Instruments.

UNIT - II:

Signal Analyzers: AF, HF Wave Analyzers, Harmonic Distortion, Heterodyne wave Analyzers, Spectrum Analyzers, Power Analyzers, Capacitance-Voltage Meters, Oscillators. Signal Generators: AF, RF Signal Generators, Sweep Frequency Generators, Pulse and Square wave Generators, Function Generators, Arbitrary waveform Generator, Video Signal Generators, and Specifications.

UNIT - III:

Oscilloscopes: CRT, Block Schemantic of CRO, Time Base Circuits, Lissajous Figures, CRO Probes, High Frequency CRO Considerations, Delay lines, Applications: Measurement of Time, Period and Frequency Specifications.

Special Purpose Oscilloscopes: Dual Trace, Dual Beam CROs, Sampling Oscilloscopes, Strorage Oscilloscopes, Digital Storage CROs.

UNIT - IV:

Transuducers: Classification, Strain Gauges, Bounded, unbounded; Force and Displacement Transducers, Resistance Thermometers, Hotwire Anemometers, LVDT, Thermocouples, Synchros, Special Resistance Thermometers, Digital Temperatue sensing system, Piezoelectric Transducers, Variable Capacitance Transducers, Magneto Strictive Transducers.

UNIT - V:

Bridges: Wheat Stone Bridge, Kelvin Bridge, and Maxwell Bridge.

Measurement of Physical Parameters: Flow Measurement, Displacement Meters, Liquid level Measurement, Measurement of Humidity and Moisture, Velocity, Force, Pressure - High Pressure, Vacuum level, Temperature - Measurements, Data Acqisition Systems.

TEXTBOOKS:

Electronic instrumentation: H.S.Kalsi - TMH, 2nd Edition 2004.

Modern Electronic Instrumentation and Measurement Techniques: A.D. Helbincs, W.D. Cooper: PHI, 5th Edition, 2003.

REFERENCES:

Electronic Instrumentation and Measurements - David A. Bell, Oxford Uiv. Press, 1997.

Electronic Measurements and Instrumentation: B. M. Oliver, J. M. Cage TMH Reprint.

Measurement Systems - Emest O. Doebelin and Dhanesh N Manik, 6th Ed., TMH.

Electronic Measurements and Instrumentations by K. Lal Kishore, Pearson Education - 2010.

Industrial Instrumentation: T. R. Padmanabham Spiriger 2009.

SCHEME OF EVALUATION

Special Evaluation Pattern for the following courses:

S.NO.	Type of Course	Internals	Externals
1	HS1101: Communication Skills-I, HS1201: Communication Skills-II (Theory course)	Activities and Assignments = 40Marks	Written exam: 60Marks
2	HS1601: English Language Lab	Orals (50Marks)	Written exam: 50Marks
3	CE1001 (Engineering Graphics): (Course Type: Lab)	40	60

SCHEME OF EVALUATION		
Assessment Method	**Description**	**Weightage**
Assignment & Continuous monitoring	Assignments & Evaluation of drawings	25%
Mid Term	2 mid examinations will be conducted and best of 2 will be considered.	25%
End Term	Students will be evaluated based on the understanding of the principles, skills and practices of the course	50%

Evaluation Pattern for General Courses:

S.NO.	Type of Course	Internals	Externals
1	Theory	Best two out of Three MTs (2x15) + Assignments (10)= 40Marks	60Marks
2	Lab	(Report+Record) (20)+ Attendance(10) + Internal Viva (10)= 40 Marks	Lab Experiment (40) + External Viva (20) = 60 Marks
3	19EC2901,19EC2902, 19EC3901 (1 credit Mini project, 1 credit Technical seminar)	NA	100Marks
4	19ECP01 (2 credits Mini project)	Mid-Sem review (40 Marks)	End-Sem review (60 Marks)
5	19ECP02 (1 credit Summer Internship)	Industry Expert (30 Marks) + RGUKT panel (70 Marks)	
6	19ECP03(3 credits Project),19ECP04(8 credits project)	Three Internal Reviews (3X20) = 60Marks	External Review=40Marks
7	19ECCV-I,19ECCV-II (0 credit Comprehensive Viva)	NA	100 Marks