Curriculum (Scheme of Examination)

&

Syllabus

For

B.Tech

ECE, ECE - (Smart System)

ECE – (Embedded System)

SGT University, Gurugram

Credit Based Scheme w.e.f. 2017-18

SGT UNIVERSITY
FACULTY OF ENGINEERING & TECHNOLOGY
DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING
CURRICULUM- 2017-2018
B. Tech.-ECE – III Semester

Sr. No.	Subject Code	Course title	Schedule				Mark		
			L	T	P	C	Int.	Ext.	Total
1	13040301	Technical Skills I - for Electronics Engineers	0	0	2	2	50	50	100
2	13040302	Professional Communication	0	0	4	2	60	40	100
3	13040303	Discrete Mathematics	3	1	0	3	50	50	100
4		Elective III	2	0	0	2	50	50	100
5	Language elective	Elective IV	2	0	2	3	50	50	100
6	13040305	Analog Electronics Circuit	3	0	0	3	50	50	100
7	13040306	Signal & System Analysis	3	0	0	3	50	50	100
8	13040307	Network Analysis & Synthesis	3	0	0	3	50	50	100
9	13040308	Data Structure	3	0	0	3	50	50	100
10	13040309	Analog Electronics Lab	0	0	2	1	60	40	100
11	13040310	Network Analysis Lab	0	0	2	1	60	40	100
12	13040311	Data Structure Lab	0	0	2	1	60	40	100
13	13040312	Industrial Exposure- I	0	0	0	1	60	40	100
Total Contact Hours			**19**	**1**	**14**	**28**	**700**	**600**	**1300**
			34						

Elective III	
13040304	Psychology
MOOC	Technical English for Engineers
	Principles of Human Resource Management

Elective IV	
13040313	Foreign Language German 1
13040314	Foreign Language French 1
MOOC	Russian Language Communication on Skills

*****MOOC courses will start on display of list on SWAYAM portal into respective semester

SGT UNIVERSITY
FACULTY OF ENGINEERING & TECHNOLOGY
DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING
CURRICULUM- 2017-20178
B. Tech. -ECE– IV Semester

Sr. No.	Subject Code	Course title	Schedule				Mark		
			L	T	P	C	Int.	Ext.	Total
1	13040401	Technical Skills II	0	0	2	2	50	50	100
2	13040402	Aptitude Building	0	0	4	2	60	40	50
3	13040403	Numerical Methodology and Random Process	3	1	0	3	50	50	100
4		Elective V	2	0	0	2	50	50	100
5	Language Elective	Elective VI	2	0	2	3	50	50	100
6	13040405	Digital Electronics	3	0	0	3	50	50	100
7	13040406	Digital Signal Processing	3	0	0	3	50	50	100
8	13040407	Electro Magnetic Theory and Waveguides	3	0	0	3	50	50	100
9	13040408	Analog Communication	3	0	0	3	50	50	100
10	13040409	Digital Electronics Lab	0	0	2	1	60	40	100
11	13040410	Digital Signal Processing Lab	0	0	2	1	60	40	100
12	13040411	Analog Communication Lab	0	0	2	1	60	40	100
13	13040412	Industrial Training- I	0	0	0	1	60	40	100
Total Contact Hours			**19**	**1**	**14**	**28**	**700**	**600**	**1300**
			34						

Elective V	
13040404	Universal Human Values
MOOC	Language & Mind

Elective VI	
13040413	Foreign Language German II
13040414	Foreign Language French II
MOOC	Russian Language Communication on Skills

*****MOOC courses will start on display of list on SWAYAM portal into respective semester

SGT UNIVERSITY
FACULTY OF ENGINEERING & TECHNOLOGY
DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING
CURRICULUM- 2017-2018
B. Tech. – ECE-V Semester

Sr. No.	Subject Code	Course title	Schedule				Mark		
			L	T	P	C	Int.	Ext.	Total
1	13040501	Technical Skills – III	0	0	2	2	50	50	100
2	13040502	Personality and Career Building	0	0	4	2	60	40	100
3	13040503	Entrepreneurship Development	2	0	0	2	50	50	100
4	13040507	Analog Integrated Circuit	3	0	0	3	50	50	100
5	13040508	Control System	3	0	0	3	50	50	100
6	13040511	Analog Integrated Circuit & Control System lab	0	0	2	1	60	40	100
7		Elective –VII	3	0	0	3	50	50	100
8	13040512	Industry Exposure-II	0	0	0	1	60	40	100
9		Open Elective-I	3	0	0	3	50	50	100
10		**Group 1 (Electronics & Communication Engineering)**	**6**	**0**	**4**	**8**	**220**	**180**	**400**
11		**Group 2 (Smart System)**	**6**	**0**	**4**	**8**	**220**	**180**	**400**
12		**Group 3 (Embedded System)**	**6**	**0**	**4**	**8**	**220**	**180**	**400**

Group 1 (Electronics & Communication Engineering)

Sr. No.	Subject Code	Course title	Schedule				Mark		
			L	T	P	C	Int.	Ext.	Total
1		Computer Network	3	0	0	3	50	50	100
2	13040505	Antenna and Wave Propagation	3	0	0	3	50	50	100
3		Computer Network Lab	0	0	2	1	60	40	100
4		Microwave and RF Lab	0	0	2	1	60	40	100

Group 2 (Smart System)

Sr. No.	Subject Code	Course title	Schedule				Mark		
			L	T	P	C	Int.	Ext.	Total
1		Bio Medical Instrumentation	3	0	0	3	50	50	100
2		PIC Microcontroller	3	0	0	3	50	50	100
3		Sensor & Instrumentation Lab	0	0	2	1	60	40	100
4		Embedded Lab	0	0	2	1	60	40	100

Group 3 (Embedded System)

Sr. No.	Subject Code	Course title	Schedule				Mark		
			L	T	P	C	Int.	Ext.	Total
1		Microprocessor 8086 & Microcontroller 8051	3	0	0	3	50	50	100
2		VLSI design	3	0	0	3	50	50	100
3		Microprocessor & Microcontroller lab	0	0	2	1	60	40	100
4		VLSI Design lab	0	0	2	1	60	40	100

Elective-VII	
13040513	Electronic Measurements & Instrumentation
13040514	Transmission Lines and Networks
13040515	Advanced digital Signal Processing
13040516	Electromechanical Energy Conversion
MOOC	Networks & System
	Managing Services

Open Elective-I	
13010512	Traffic Engineering
13010515	Resource management and control in construction
13010513	Open channel flow
13010514	Air & Noise Pollution
13020511	E-Commerce
13020512	Soft Computing
13020513	Data Compression
13020514	Data Warehousing and Data Mining
13030507	Production Planning & Control
13030508	Advanced Machining Process
13030509	Fuels & Combustion
13030510	Refrigeration & Air Conditioning

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SGT UNIVERSITY
FACULTY OF ENGINEERING & TECHNOLOGY
DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING
CURRICULUM- 2017-2018
B. Tech. –ECE- VI Semester

Sr. No.	Subject Code	Course title	Schedule				Mark		
			L	T	P	C	Int.	Ext.	Total
1	13040601	Technical Skills – IV	0	0	2	2	50	50	100
2	13040602	Campus to Corporate	0	0	4	2	60	40	100
3	13040603	Probability and Statistics	3	0	0	3	50	50	100
4	13040604	Industrial Economics and Management	2	0	0	2	50	50	100
5		Elective VIII	3	0	0	3	50	50	100
6		Elective IX	3	0	0	3	50	50	100
7	13040609	Industrial Training- II	0	0	0	1	60	40	100
8		Open Elective-II	3	0	0	3	50	50	100
9		**Group 1 (Electronics & Communication Engineering)**	**6**	**0**	**4**	**8**	**220**	**180**	**400**
10		**Group 2 (Smart System)**	**6**	**0**	**4**	**8**	**220**	**180**	**400**
11		**Group 3 (Embedded System)**	**6**	**0**	**4**	**8**	**220**	**180**	**400**

Group 1 (Electronics & Communication Engineering)

Sr. No.	Subject Code	Course title	Schedule				Mark		
			L	T	P	C	Int.	Ext.	Total
1		Microprocessor & Microcontroller	3	0	0	3	50	50	100
2	13040606	VLSI Design	3	0	0	3	50	50	100
3		Microprocessor & Microcontroller Lab	0	0	2	1	60	40	100
4	13040608	VLSI Design Lab	0	0	2	1	60	40	100

Group 2 (Smart System)

Sr. No.	Subject Code	Course title	Schedule				Mark		
			L	T	P	C	Int.	Ext.	Total
1		VLSI Design	3	0	0	3	50	50	100
2		Arduino	3	0	0	3	50	50	100
3		VLSI Design Lab	0	0	2	1	60	40	100
4		Arduino Lab	0	0	2	1	60	40	100

Group 3 (Embedded System)

Sr. No.	Subject Code	Course title	Schedule				Mark		
			L	T	P	C	Int.	Ext.	Total
1		PIC Microcontroller & its applications	3	0	0	3	50	50	100
2		VHDL Programming	3	0	0	3	50	50	100
3		PIC applications lab	0	0	2	1	60	40	100
4		VHDL programming lab	0	0	2	1	60	40	100

Elective VIII	
13040610	Digital Image Processing
13040611	Linear Integrated Circuit
13040612	Cryptography & Network Security
13040613	Computer Architecture
MOOC	Microwave Integrated Circuits
	Marketing Management

Elective IX	
13040614	ASIC Design
13040615	Microwave & Radar
13040616	Lab view
13040617	Mobile Computing
MOOC	Principles of Modern CDMA/ MIMO/ OFDM Wireless Communications

Open Elective-II	
13010613	Renewable Energy Sources
13010612	Pre-Stressed Concrete
13010619	Architecture and Town Planning
13010618	Urban power resource management
13020610	Distributed System
13020611	Wireless & Mobile Communication
13020612	Enterprise resource planning
13020613	Mobile computing
13030606	Automobile Engineering
13030607	Rapid Manufacturing Technologies
13030610	Mechatronics
13030611	Mechanical Vibration

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SGT UNIVERSITY
FACULTY OF ENGINEERING & TECHNOLOGY
DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING
CURRICULUM- 2017-2018
B. Tech. –ECE- VII Semester

Sr. No.	Subject Code	Course title	Schedule				Mark		
			L	T	P	C	Int.	Ext.	Total
1	13040701	Professional Ethics for Electronics	2	0	0	2	50	50	100
2		Elective-X	3	0	0	3	50	50	100
3		Elective-XI	3	0	0	3	50	50	100
4	13040706	Industrial / Research Project Phase I	0	0	2	1	60	40	100
5		Open Elective-III	3	0	0	3	50	50	100
6		Open Elective-IV	3	0	0	3	50	50	100
7		**Group 1 (Electronics & Communication Engineering)**	**6**	**0**	**4**	**8**	**220**	**180**	**400**
8		**Group 2 (Smart System)**	**6**	**0**	**4**	**8**	**220**	**180**	**400**
9		**Group 3 (Embedded System)**	**6**	**0**	**4**	**8**	**220**	**180**	**400**

Group 1 (Electronics & Communication Engineering)

Sr. No.	Subject Code	Course title	Schedule				Mark		
			L	T	P	C	Int.	Ext.	Total
1	13040702	Satellite Communication and Broadcasting	3	0	0	3	50	50	100
2		Digital Communication	3	0	0	3	50	50	100
3	13040704	Broadcasting Lab	0	0	2	1	60	40	100
4		Digital Communication Lab	0	0	2	1	60	40	100

Group 2 (Smart System)

Sr. No.	Subject Code	Course title	Schedule				Mark		
			L	T	P	C	Int.	Ext.	Total
1		Robotics	3	0	0	3	50	50	100
2		Industrial Automation	3	0	0	3	50	50	100
3		Robotics Lab	0	0	2	1	60	40	100
4		Industrial Automation Lab	0	0	2	1	60	40	100

Group 3 (Embedded System)

Sr. No.	Subject Code	Course title	Schedule				Mark		
			L	T	P	C	Int.	Ext.	Total
1	13040703	Real time embedded system	3	0	0	3	50	50	100
2		VLSI device modeling	3	0	0	3	50	50	100
3		Embedded system lab	0	0	2	1	60	40	100
4		Device modeling lab	0	0	2	1	60	40	100

Elective –X	
13040708	Wireless Sensor Network
13040709	Sensors & Transducers
13040710	Wireless & Mobile Communication
13040711	Biomedical Electronics
MOOC Course	Basics tools of microwave engineering

Elective – XI	
13040712	Internet of things
13040713	Optical Communication
13040714	Neural Network & Fuzzy Logic
13040715	Robotics & Automation Engg.
MOOC Course	Estimation for Wireless Communications MIMO (or) OFDM Cellular and Sensor Networks

Open Elective-III	
13010709	Radar Remote Sensing
13010710	Construction Economics and Financial
13010711	Intelligent transport system
13010713	River engineering
13020710	Software Project Management
13020711	Image Processing & Pattern Recognition
13020709	Ethical hacking
13020706	Cloud computing
13030705	Fluid Power System
13030706	Finite Element Analysis
13030709	Nuclear Power Engineering
13030710	Robotics

Open Elective IV	
13010503	Principles & design of water treatment & disposal
13030609	Product design for manufacturing
13020511	E-commerce
13040513	Electronic measurement & instrumentation
13020804	Android App development

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SGT UNIVERSITY
FACULTY OF ENGINEERING & TECHNOLOGY
DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING
CURRICULUM- 2017-2018
B. Tech. –ECE- VIII Semester

Sr. No.	Subject Code	Course title	Schedule				Mark		
			L	T	P	C	Int.	Ext.	Total
1	13040801	Industrial / Research Project Phase II	0	0	26	13	150	50	200
	Total Contact Hours		**26**			**13**	**150**	**50**	**200**

13040301	Technical Skills -I for Electronics Engineers	Learning Schedule			
		L	T	P	C
	Pre-requisites: Basic Knowledge of Electronics Engineering	0	0	2	2

Course Objectives

1. To prepare students to build solid foundation in theory and practice of Electronics & communication engineering.
2. To make electronics &communication Engineering graduates most competent, industry ready & Competitive in public and private organization
3. To build extensive foundation among students to take up higher study.
4. To reduce the industry & academic gap & also train students as per current industry requirement.

Course Outcomes

On completion of this course, the students will be able to:

1. Understand basic concepts of Analog electronics devices.
2. Will understand the basic terminology used in digital electronics.
3. Can synthesis and analysis of electric circuits.

Course Description

This course will cover the important topics of basic courses of electronics & communication engineering. This will explain short term answers for the question related to interview for different designation in various domain of engineering.

Course Content

Unit I: Electronics Fundamental

Semi-conductor materials, Intrinsic & Extrinsic, PN diode, Junction;

Unit II: Basic Devices

Resistor, Capacitor, Inductor, Impedance, Impedance, Admittance, Active devices & passive elements, AC analysis of series & parallel circuit of RC, RL, LC, RLC.

Unit III: Signal processing

Signal classification & description of their properties, Elementary signals, Relationship in elementary signals, Classification of system.

Unit IV: Review Digital

+ve and –Ve logic system, universal logic gates, Number system & their inter-conversion, logical function minimization.

Text Books

1. Digital electronics: Morris Mano, PHI
2. Jacob. Millman, Christos C.Halkias, 'Electronic Devices and Circuits', Tata McGraw Hill Publishing Limited, New Delhi, 2008, ISBN 0070634556, 9780070634558.

Reference Books

1. P. Ramakrishna Rao, `Signal and Systems' 2008 Ed., Tata McGraw Hill, New Delhi

13040302	Professional Communication	Learning Schedule			
		L	T	P	C
	Pre-requisites: English at Semester1,2	0	0	4	2

Course Objective

1. Enhancing listening-speaking Skills
2. Enhance public speaking to further enhance the Grammar Skills
3. To understand skills pertaining to industry

Course outcome:

1. To speak confidently before the audience
2. To be able to convey their ideas in an expressive and effective way
3. Get a holistic industry perspective

Course Content

Unit-I: Writing Comprehension

Comprehension of Selected Passages from Stories and Articles, Grammatical Errors Detection, Errors in use of words, nouns, pronouns, adjectives etc i.e., all the grammatical categories, Error Detection, Errors in Sentence Formation: Tenses, Direct-Indirect Speech through Comprehension of Text from various Sources and Lab Software

Unit-II: Reading Comprehension

Developing Skills for Comprehension, Practice for Skills for Reading Comprehension, Using Text from Selected Stories/Newspapers and Handouts.

Unit-III: Narration

Finding out Topic Sentence, Order of Paragraph, Balance in Reading Comprehension, Emphasis will be Given on Correct Pronunciation and Intonation, Reading Practice and Exercise through Pictures, Video Clips and Software.

Unit-IV: Reading Skills and Narration

Reading Newspapers and Passages and Story Telling and Summarizing

Career Building

Mind Mapping, Career Planning, On camera exercises, Assessment Retake,

Books and References:

1. Sanjay Kumar and Pushp Lata 'Communication Skills', Oxford University Press 2012
2. Raymond Murphy 'Essential English Grammar', Cambridge University Press 1998
3. Meenakshi Raman and Sangeeta Sharma 'Technical Communication Principles and Practice', Oxford University Press 2012
4. Meenakshi Raman and Prakash Singh 'Business Communication' Oxford University Press 2011

13040303	Discrete Mathematics	Learning Schedule			
		L	T	P	C
	Pre-requisites: Fundamental of Mathematics	3	1	0	3

Course Objectives: The objective of this course is to:

1. Develop a foundation of set theory concepts and notation
2. Develop formal logical reasoning techniques and notation
3. Demonstrate the application of logic to analyzing and writing proofs

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

1. Construct proofs using direct proof or by contraposition or by contradiction or by cases
2. Construct mathematical arguments using logical connectives and quantifiers and verify the Correctness of an argument using propositional and predicate logic and truth tables.
3. Demonstrate the ability to solve problems using counting techniques and combinatory in the context of discrete probability.

Course Content:

Unit I: Set Theory: Introduction, Combination of sets, Multi sets, Ordered pairs. Proofs of some general identities on sets. Relations: Definition, Operations on relations, Properties of relations, Composite Relations, Equality of relations, Recursive definition of relation, Order of relations. Functions: Definition, Classification of functions, Operations on functions, Recursively defined functions, Growth of Functions, Natural Numbers: Introduction, Mathematical Induction, Variants of Induction, and Induction with Nonzero Base cases. Proof Methods, Proof by counter – example, Proof by contradiction.

Unit II: Algebraic Structures: Definition, Groups, Subgroups and order, Cyclic Groups, Co-sets, Lagrange's theorem, Normal Subgroups, Permutation and Symmetric groups, Group Homomorphism, Definition and elementary properties of Rings and Fields, Integers Modulo n.

Propositional Logic: Proposition, well-formed formula, Truth tables, Tautology, Satisfiability, Contradiction, Algebra of proposition, Theory of Inference Predicate Logic: First order predicate, well-formed formula of predicate, quantifiers, Inference theory of predicate logic.

Unit III: Partial order sets: Definition, Partial order sets, Combination of partial order sets, Hasse diagram. Lattices: Definition, Properties of lattices – Bounded, Complemented, Modular and Complete lattice. Boolean algebra: Introduction, Axioms and Theorems of Boolean algebra, Algebraic manipulation of Boolean expressions. Simplification of Boolean Functions, Karnaugh maps, Logic gates, Digital circuits and Boolean algebra.

Unit IV: Trees: Definition, Binary tree, Binary tree traversal, Binary search tree. Graphs: Definition and terminology, Representation of graphs, Multi-graphs, Bipartite graphs, planar graphs, Isomorphism and Homeomorphism of graphs, Euler and Hamiltonian paths, Graph coloring Recurrence Relation & Generating function: Recursive definition of functions, Recursive algorithms, Method of solving recurrences. Combinatory, Counting Techniques, Pigeonhole Principle

Text books:

1. Elements of Discrete Mathematics - Liu and Mohapatra, McGraw Hill Publications
2. Discrete Mathematical Structures - B. Kolman, R.C. Busby, and S.C. Ross, PHI Publications

Reference Books

1. Discrete Mathematical Structures with Application to Computer Science - Jean Paul Trembley and R Manohar, McGraw-Hill Publications.
2. Discrete and Combinatorial Mathematics - R.P. Grimaldi, Addison Wesley
3. Discrete Mathematics and Its Applications - Kenneth H. Rosen, McGraw-Hill

13040304	Psychology	Learning Schedule			
		L	T	P	C
	Pre-requisites: English	**2**	**0**	**0**	**2**

Course Objectives

1. To sensitize about Psychological and Sociological issues of human life.
2. To make them able to understand and deal with personal and organization phenomenon.
3. Develop an understanding of society as a system of social relationship and various social processes.
4. Develop capacity to analyze social stratification and social change by using relevant theoretical concepts.
5. To make learners aware of contemporary issues of society.

Course Outcomes

On completion of this course, the students will

1. Be able to understand and deal with personal and organization phenomenon.
2. Be able to deal with common psychological aspects related to an Engineer's life.
3. Be able to understand the impact of social environment on individuals, groups and communities.
4. Be able to utilize the knowledge of Sociology and to improve the quality of living of self and Social relationship at large.

Contents

Unit I: Psychology: Introduction Definition and Scope of Psychology; Psychology as a science, Personality: Definition, types of personality, Measurement of Personality. Perception, Motivation and Learning.

Unit II: Applications: Application of Psychology: Stress-management, Well-being; Self-development: Application of Psychology in building memory and creativity.

Unit III: Sociology: Introduction: Importance of Sociology for Engineers, Sociology: Definition and nature; Origin of Society, Social Processes: - Competition, Cooperation Conflict, Accommodation and Assimilation, Social groups – Types and Characteristics; Social Institutions: Marriage: and Family; Religion: Functions and dysfunctions of religion.

Unit IV: Social concerns: Social Stratification: Nature and types, Prejudices, Social Mobility. Social Changes: - Urbanization, Westernization, and Pluralism. Social Disorganization, Social Problems: - Deviance, Delinquent behavior amongst youth, Crime, Prostitution, Gender injustice, Child Abuse, Terrorism. Social Movements.

Text Books

1. Robbins Stephen, Organizational Behavior. P. Prentice Hall International, Inc. Eaglewood Cliff s, 2005, ISBN: 0-13- 191435-9, 11th Edition

2. Eastwood and Atwater, Psychology for living: Adjustment, growth and behavior today. Prentice Hall, 2005, ISBN: 0-13-118117-3, 8th Edition

Reference Books

1. Meena Hariharan and Radhanath Rath, Coping with life stress. Sage Publications, 2008, ISBN: 0761936556, 10th edition,

2. Dimatto, MR. and Martin, L.R., Health Psychology. Pearson, 2001, ISBN: 0205297773, 10th edition

13040313/13040314	Foreign Language(French/German)-I	Learning Schedule			
		L	T	P	C
	Pre-requisites: -- Communication Skills	2	0	2	3

Course Objective: Basic communication in simple French, Simple conversational phrases, formation of simple sentences, negative sentences, interrogative sentences, simple vocabulary related to house, family, common objects, simple prepositions and conjugation of about 20 verbs.

Unit – 1

Getting to know people
Starting a conversation
People and Things
Members of the family
Indefinite Article- a, an, one, some

Unit – 2

Arrival
Finding a space
If you want to ask a Question
Pronouns and Verbs
Definite Article "The"
Formation of negative sentences and questions

Unit – 3

Seeing the Sights
Finding your way on foot
How do I get to …?
How to pint out something
Verbs Again (Grammar)
Conjugation of Verbs ending in "er" –
Parler, Chanter, arriver

Unit – 4

Public Transportation
What to say to the conductor
More action Verbs
On Nouns and Articles (grammar)
Prepositions
Conjugation of Verbs ending in "IR"
Demonstrative Adjectives
This, That, These, Those
Conjugation of Verbs ending in re-Vendre, decendre etc.

Unit – 5

Numbers - Cardinal, Ordinal
Expressing- Time, Conversation regarding Time
Days of the week
Irregular verbs-Dormir, Partir, sortir, avoir, etreapprendre- comprendre
Possessive Adjectives My, Your, His, Their etc.

Text Book:

Barron's French The fast and Fun Way. Third Edition

13040305	Analog Electronics Circuit	L	T	P	C
Pre-requisites//Exposure	Semiconductor Devices and Circuits	3	0	0	3

Course Objectives

1. To learn different biasing techniques and behavior of BJT, FET at low and high frequencies.
2. To understand the principle of operation of different amplifier circuits like feedback amplifiers, power amplifiers.
3. To understand the principle of operation of different oscillators circuits.

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

1. Explain the methods of biasing transistors & design of simple amplifier circuits and to develop the ability to analyze and design analog electronic circuits using discrete components.
2. Design, construct, and take measurement of various analog circuits to compare. Experimental results in the laboratory with theoretical analysis.

Course Description

Analog Electronics is the base of Electronics & Communication stream. In this course the working of various amplifiers is explained. Students learn how BJT work at low and high frequencies, what happens in FET amplifiers, Power amplifiers and feedback amplifiers, different types of oscillators and their working, studying of various types of tuned amplifiers.

Course Content

Unit I: BJT at low and high frequencies **12 lecture hours**

Millers theorem and its dual, cascading transistor amplifier, Hybrid models of CE, CB, CC, configurations, Study of the effect of emitter by pass condenser/resistance at low frequencies, voltage gain, Current Gain, gain bandwidth product, Cascode amplifier, Coupled amplifier.

Unit II: FET amplifiers and Power Amplifiers **8 lecture hours**

Study of FET Amplifiers: Common source/gate/drain Amplifiers; NMOS/PMOS/CMOS transistor analysis; Power Amplifiers: Classification of amplifiers – class A large signal amplifiers – second harmonic distortion – higher order harmonic generations – computation of Harmonic distortion – Transformer coupled audio power amplifier – efficiency – push - pull amplifier – class B amplifier – class AB operation – Push-Pull circuit with Transistors of Complimentary Symmetry.

Unit III: Feedback Amplifiers **9 lecture hours**

The feedback concept – Transfer gain with feedback – general characteristics and advantages of negative feedback– analysis of voltage series, Voltage shunt, current series and current shunt feedback amplifiers – Study of the effect of Negative feedback on Gain, Bandwidth, Noise, Distortion, Input and Output impedances with the help of Block Schematic and Mathematical Expressions.

Unit IV: Oscillators **12 lecture hours**

Sinusoidal oscillators –phase shift oscillator – Wien bridge oscillator – Hartley oscillator – Colpits oscillator – frequency stability, Crystal oscillators.

FET Amplifiers: Common source, Common gate and Common drain Amplifiers – problems. Analysis of Single tuned, Doubled tuned and stagger tuned amplifiers.

Text Books

1. Jacob. Millman, Christos C.Halkias, 'Electronic Devices and Circuits', Tata McGraw Hill Publishing Limited, New Delhi, 2008, ISBN 0070634556, 9780070634558.

2. Jacob Millman and C. Halkias, 'Integrated Electronics – Analog and Digital Circuits and Systems', Tata Mc Graw Hill, 2001

Reference Books

1. Jacob Millman and Arvin Grabel, 'Microelectronics', McGraw Hill, 2001, 2. Electronic Devices & Circuits – David. A. Bell, 3rd Edition, Prentice – Hall, 1986

13040306	Signal And System Analysis	L	T	P	C
Pre-requisites//Exposure	Engineering Mathematics-II	3	0	0	3

Course Objectives

The students will learn and understand

1. Determination of system response for a signal.
2. Fourier and Z transform techniques as tool for signal analysis.

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

1. Demonstrate an understanding of the relation among the transfer function, convolution, and the impulse response, by explaining the relationship, and using the relationship to solve forced response problems.
2. Demonstrate an understanding of the relationship between the stability and causality of systems and the region of convergence of their Laplace transforms, by correctly explaining the relationship, and using the relationship to determine the stability and causality of systems.

Course Description

This subject is about the mathematical representation of signals and systems. The most important representations we introduce involve the frequency domain – a different way of looking at signals and systems, and a complement to the time-domain viewpoint. Indeed engineers and scientists often think of signals in terms of frequency content, and systems in terms of their effect on the frequency content of the input signal.

Course content:

Unit I: Introduction to Signals & Systems 12 lecture hours

Definition, types of signals and their representations: continuous-time/discrete-time, periodic/non-periodic, even/odd, energy/power, deterministic/ random, one dimensional/ multidimensional; commonly used signals (in continuous-time as well as in discrete-time): unit impulse, unit step, unit ramp (and their inter-relationships), exponential, rectangular pulse, sinusoidal; operations on continuous-time and discrete-time signals (including transformations of independent variables)

Unit II: Laplace-Transform (LT) and Z-transform (ZT) 6 lecture hours

One-sided LT of some common signals, important theorems and properties of LT, inverse LT, solutions of differential equations using LT, Bilateral LT, Regions of convergence (ROC), One sided and Bilateral Z-transforms, ZT of some common signals, ROC, Properties and theorems, solution of difference equations using one-sided ZT, s- to z-plane mapping

Unit III: Fourier Transforms (FT): 9 lecture hours

Definition, conditions of existence of FT, properties, magnitude and phase spectra, Some important FT theorems, Parseval's theorem, Inverse FT, relation between LT and FT, Discrete time Fourier transform (DTFT), inverse DTFT, convergence, properties and theorems, Comparison between continuous time FT and DTFT.

Unit IV: Time and frequency domain analysis of systems 9 lecture hours

Analysis of first order and second order systems, continuous-time (CT) system analysis using LT, system functions of CT systems, poles and zeros, block diagram representations; discrete-time system functions, block diagram representation, illustration of the concepts of system bandwidth and rise time through the analysis of a first order CT low pass filter.

Text Books:

1. P. Ramakrishna Rao, `Signal and Systems' 2008 Ed., Tata McGraw Hill, New Delhi

Reference Books

1. Chi-Tsong Chen, `Signals and Systems', 3rd Edition, Oxford University Press, 2004

13040307	Network Analysis And Synthesis	L	T	P	C
Pre-requisites//Exposure	Basic Electrical and Electronics Engineering	3	0	0	3

Course Objectives

1. To learn the concepts of network analysis in electrical and electronics engineering.
2. To learn linear circuit analysis, graph theory and network theorems.
3. Analyze two port networks using Z, Y, ABCD and h parameters

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

1. Analyze an electric network using graph theory and different network theorems e.g. Thevenin's theorem, superposition theorem, Nodal voltage etc. and power system transmission line using ABCD parameters.
2. Synthesize an electric network using driving point functions
3. Design active and passive filter circuits
4. Explain the electrical network theories and verify them through experiments

Course Description

Network Analysis and Synthesis is a field of engineering that deals with the study and applications of Graph theory, two port parameters and network synthesis, and also deals with the design and application of active and passive filters. Graph theory is considered to deal with the problems associated with large-scale electrical systems such as power transmission and distribution system. This course lay foundation for the students to study other subjects related to both the engineering streams.

Course Content:

Unit I: Graph Theory & Network Theorems 12 lecture hours

Graph of a Network, definitions, tree, co tree , link, basic loop and basic cut set, Incidence matrix, cut set matrix, Tie set matrix Duality, Loop and Nodal methods of analysis.

Super-position theorem, Thevenin's theorem, Norton's theorem, maximum power transfer theorem, Reciprocity theorem. Millman's theorem, compensation theorem, Tellegen's theorem.

Unit II: Network Functions and Transient analysis 8 lecture hours

Transform Impedances Network functions of one port and two port networks, concept of poles and zeros, properties of driving point and transfer functions, time response and stability from pole zero plot, transient analysis of ac & dc systems.

Unit III: Two Port Networks 9 lecture hours

Characterization of LTI two port networks ZY, ABCD and h parameters, reciprocity and symmetry. Interrelationships between the parameters, inter-connections of two port networks, T & Đ Representation.

Unit IV: Network Synthesis & Filters 10 lecture hours

Positive real function; definition and properties; properties of LC, RC and RL driving point functions, synthesis of LC, RC and RL driving point immittance functions using Foster and Cauer first and second forms. Image parameters and characteristics impedance, passive and active filter fundamentals, low pass, high pass, (constant K type) filters, and introduction to active filters.

Text Books

1. M.E. Van Valkenburg, "Network Analysis", Prentice Hall of India
2. A C.L Wadhwa, "Network Analysis and Synthesis" New Age International Publishers, 2007,
3. D. Roy Choudhary, "Networks and Systems" Wiley Eastern Ltd.

Reference Books

1. M.E. Van Valkenburg, "An Introduction to Modern Network Synthesis", Wiley Eastern Ltd.
2. A. Chakrabarti, "Circuit Theory" Dhanpat Rai & Co

13040308	Data Structure	Learning Schedule			
		L	T	P	C
	Pre-requisites: C Programming	3	0	0	3

Course Description

The purpose of this course is to provide basic concepts of data structures and algorithms. The main goal of the course is to teach the students how to select and design data structures for algorithms that are appropriate for problems that they might encounter

Course Objectives: The objective of this course is to:

1. Introduce the fundamentals and abstract concepts of Data Structures.
3. Learn how concepts of data structures are useful in problem solving.

Course Outcomes

At the end of the course student will be able to

1. Use and implement appropriate data structure for the required problems using a programming Language such as C/C++.
2. Analyze step by step and develop algorithms to solve real world problems.

Course Content:

Unit I: Introduction: Basic Terminology: Elementary Data Organization, Algorithm, Efficiency of an Algorithm, Time and Space Complexity, Asymptotic notations: Big-Oh, Time-Space trade-off. Abstract Data Types (ADT)Arrays: Definition, Single and Multidimensional Arrays, Representation of Arrays : Row Major Order, and Column Major Order, Application of arrays, Sparse Matrices and their representations. Linked lists: Array Implementation and Dynamic Implementation of Singly Linked Lists, Doubly Linked List, Circularly Linked List, Operations on a Linked List. Insertion, Deletion, Traversal, Polynomial Representation and Addition, Generalized Linked List.

Unit II: Stacks and Queues: Abstract Data Type: Primitive Stack operations: Push & Pop, Array and Linked Implementation of Stack in C, Application of stack: Prefix and Postfix Expressions, Evaluation of postfix expression, Recursion, Tower of Hanoi Problem, Simulating Recursion, Principles of recursion, Tail recursion, Removal of recursion Queues, Operations on Queue: Create, Add, Delete, Full and Empty, Circular queues, Array and linked implementation of queues in C, Dequeue and Priority Queue.

Unit III: Trees & Graphs: Basic terminology: Binary Trees, Binary Tree Representation: Array Representation and Dynamic Representation, Complete Binary Tree, Algebraic Expressions, Extended Binary Trees, Array and Linked Representation of Binary trees, Tree Traversal algorithms: In order, Preorder and Post order, Threaded Binary trees, Traversing Threaded Binary trees, Huffman algorithm.

Graphs: Terminology, Sequential and linked Representations of Graphs: Adjacency Matrices, Adjacency List, Adjacency Multi list, Graph Traversal : Depth First Search and Breadth First Search, Connected Component, Spanning Trees, Minimum Cost Spanning Trees: Primes and Kruskal algorithm. Transitive Closure and Shortest Path algorithm: Warshal Algorithm and Dijikstra Algorithm, Introduction to Activity Networks.

Unit IV: Searching: Sequential search, Binary Search, Comparison and Analysis Internal Sorting: Insertion Sort, Selection, Bubble Sort, Quick Sort, Two Way Merge Sort, Heap Sort, Radix Sort, Practical consideration for Internal Sorting. Search Trees: Binary Search Trees(BST), Insertion and Deletion in BST, Complexity of Search Algorithm, AVL trees, Introduction to m-way Search Trees, B Trees & B+ Trees Hashing: Hash Function, Collision Resolution Strategies Storage Management: Garbage Collection and Compaction.

Text Books:

1. Fundamentals of Data Structures - Horowitz and Sahani, Galgotia Publication

Reference Books:

1. Data Structures Using C and C++ - Aaron M. Tenenbaum, Yedidyah Langsam and Moshe J. Augenstein, PHI Publications
2. An Introduction to Data Structures with applications - Jean Paul Trembley and Paul G. Sorenson,

13040309	Analog Electronics Lab	L	T	P	C
Pre-requisites//Exposure	Semiconductor Devices and Circuits	0	0	2	1

Course Objectives

1. To learn different biasing techniques and behavior of BJT, FET at low and high frequencies.
2. To understand the principle of operation of different oscillators circuits.

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

1. Design, construct, and take measurement of various analog circuits to compare
2. Experimental results in the laboratory with theoretical analysis.

Course Description

Analog Electronics is the base of Electronics & Communication stream. In this course the working of various amplifiers is explained. Students learn how BJT work at low and high frequencies, what happens in FET amplifiers, Power amplifiers and feedback amplifiers, different types of oscillators and their working, studying of various types of tuned amplifiers.

List of experiments

1. To study RC coupled amplifier
2. To study darlington emitter follower
3. To study voltage series feedback amplifier
4. To study RC phase shift oscillator
5. To study Hartley and colpitt's oscillator
6. To study clipping circuits
7. To study clamping circuits
8. To study Op-amp application
9. To study voltage regulator
10. To study analog to digital converter
11. To study digital to analog converter

Text Books

1. Jacob. Millman, Christos C. Halkias, 'Electronic Devices and Circuits', Tata McGraw Hill Publishing Limited, New Delhi, 2008, ISBN 0070634556, 9780070634558.
2. Jacob Millman and C. Halkias, 'Integrated Electronics – Analog and Digital Circuits and Systems', Tata Mc Graw Hill, 2001, ISBN 0074622455, 9780074622452.

Reference Books

1. Jacob Millman and Arvin Grabel 'Microelectronics', McGraw Hill, 2001, ISBN 0074637363, 9780074637364.
2. Electronic Devices & Circuits – David. A. Bell, 3rd Edition, Prentice – Hall, 1986 ISBN 083591559X, 9780835915595.
3. Electronic Devices & Circuits – Allen Mottershead –Gale Group, 1992, ISBN 0023839902, 9780023839900.

13040310	Network Analysis Lab	L	T	P	C
	Pre-requisites//Exposure :Basic Electrical and Electronics Engineering	0	0	2	1

Course Objectives

1. To learn linear circuit analysis, graph theory and network theorems.
2. Analyze two port networks using Z, Y, ABCD and h parameters

Course Outcomes

On completion of this course, the students will be able to

1. Design active and passive filter circuits.
2. Explain the electrical network theories and verify them through experiments.

Course Description

Network Analysis and Synthesis is a field of engineering that deals with the study and applications of Graph theory, two port parameters and network synthesis, and also deals with the design and application of active and passive filters. Graph theory is considered to deal with the problems associated with large-scale electrical systems such as power transmission and distribution system. This course lay foundation for the students to study other subjects related to both the engineering streams.

List of Experiments

1. To verify Thevenin's theorem in a.c.
2. To verify Norton's theorem in a.c.
3. To verify Superposition theorem in a.c.
4. To verify the Maximum Power Transfer Theorem.
5. Determination of Z-parameters of a two-port network.
6. To verify and determination of Y-parameters of a parallel connected two-port network.
7. Determination of H-parameters of a two-port network.
8. To verify and determination of ABCD-parameters of a cascade interconnected two-port network.
9. Determination of characteristics impedance of a symmetrical T-network using S/C and O/C test.
10. To determine equivalent parameter of parallel connections of two port network and study loading Effect.

Note: Ten experiments are to be performed, out of which at least seven experiments should be performed from above list. Remaining three experiments may either be performed from the above list or designed & setup by the concerned institution as per the scope of the syllabus.

Text Books

1. M.E. Van Valkenburg, "Network Analysis", Prentice Hall of India
2. A C.L Wadhwa, "Network Analysis and Synthesis" New Age International Publishers, 2007,
3. D.Roy Choudhary, "Networks and Systems" Wiley Eastern Ltd.

Reference Books

1. M.E. Van Valkenburg, "An Introduction to Modern Network Synthesis", Wiley Eastern Ltd.
2. A.Chakrabarti, "Circuit Theory" Dhanpat Rai & Co

13040311	Data Structure Lab	Learning Schedule			
		L	T	P	C
	Pre-requisites: C Programming	0	0	2	1

Course Objectives: The objective of this course is to

1. Understand Data Structure using C programming Language.
2. Understand DS concept like Stack, Queues, Linked list etc.
3. Understand design principles of Data Structure.

Course Outcomes

1. At the end of the course student will be able to understand Data Structure.
2. Creating different data structure like Tree, Graph etc.

List of Experiment (based on):

1. Write a program to search an element in a two-dimensional array using linear search.
2. Using iteration & recursion concepts write programs for finding the element in the array using Binary Search Method.
3. Write a program to perform following operations on tables using functions only
   a) Addition b) Subtraction c) Multiplication d) Transpose
4. Using iteration & recursion concepts write the programs for Quick Sort Technique
5. Write a program to implement the various operations on string such as length of string concatenation, reverse of a string & copy of a string to another.
6. Write a program for swapping of two numbers using 'call by value' and 'call by reference strategies.
7. Write a program to implement binary search tree.
8. Write a program to create a linked list & perform operations such as insert, delete, update, and reverse in the link list.
9. Write the program for implementation of a file and performing operations such as insert, delete, update a record in the file.
10. Create a linked list and perform the following operations on it a) add a node b) Delete a node
11. Write a program to simulate the various searching & sorting algorithms and compare their timings for a list of 1000 elements.
12. Write a program to simulate the various graph traversing algorithms.
13. Write a program which simulates the various tree traversal algorithms.

13040312	Industrial Exposure -I	Learning Schedule			
		L	T	P	C
	Pre-requisites: --Basic of Engineering	0	0	0	1

COURSE OBJECTIVES:

1. To gain first-hand experience of the various departments from utility department to packaging or service engineering in a industry
2. To get the certification in one of the modern tool/technology in respective area.

Course Outcomes

On completion of this course, the students will have a general idea about industry functioning.

Course Content

1. Industrial visit- At-least for one day in one of the reputed industry.

2. During third semester students have to undergo through one of the following program

a) Seminar on new modern technology.
b) Practical workshop on some technical tool
c) Training session in some laboratory

Note: each of program at-least of 05 days.

3. At the end of semester, students have to present through viva voce.

13040401	Technical skills-II	L	T	P	C
	Pre-requisites//Exposure : Course up to IIIrd semester	0	0	2	2

Course Objectives

1. To prepare students to build solid foundation in theory and practice of electronics engineering.
2. To make electronics engineering graduate most competent and competitive for jobs in public And private organization.
3. To build extensive foundation among students to take up higher study

Course Outcomes:

On completion of this course, the students will be able to

1. Explain the theory and operation of Advanced Electronic components and devices.
2. Explain the concepts of Communication & Networking.
3. Write the programs using languages like C, C++, and Java.

Course Description

This Course gives a description of the Advanced Electronics Components and Devices, Basics of Digital Communication, Advanced Programming using C, C++ and Test series for Competitive examinations.

Course Content

Unit I: Advanced Electronic Devices and its applications 6 Hours

Diode –Rectifiers, Clippers, Clampers. Zener Diodes, Special diodes-UJT, SCR. JFET, MOSFET, Voltage Regulators

Unit II: Communication and Networking 6 Hours

Basics of Digital Communication Transmitters, Channels and Receivers, Importance of Digital Modulation Techniques, Types of Digital Modulations (ASK,FSK,PSK,MSK), Speech Coding, TCP/IP Networks, Introduction to Wireless Routing protocols, Wi-FI,Wi-Max Networks.

Unit III: Programming Languages 6 Hours

Programming using C, C++, Basics of Java Programming Language, Simulation using MATLAB.

Unit IV: Application Development using Programming Language 6 Hours

Simulation using MATLAB Software for Electronics and Communication applications.

Text Books

1. Robert L. Boylestad, Louis Nashelsky, "Electronic Devices and Circuit Theory", 9th Edition, Pearson Education, 2007.
2. Simon Haykin, "Digital Communication Systems", 4th edition, John Wiley & Sons, 2001.

Reference Books

1. Behrouz A. Forouzan, 'Data Communication and Networking', Second Edition, Tata McGraw Hill, 2000.
2. T. S. Rappaport, Wireless digital communications; Principles and practice, Prentice Hall, NJ, 1996.

13040402	Aptitude Building	Learning Schedule			
		L	T	P	C
	Pre-requisites: English at Semester-1,2,3	0	0	4	2

Course Objectives:

1. To prepare the students write their project report
2. Get ready to write proposals implementing their ideas
3. To prepare them to speak in Public
4. To make them prepare effective Presentations
5. Enable students in Aptitude building
6. Enable students to use their Aptitude Knowledge effectively in decision making

Course Outcome:

1. Students are trained to write the proposals and assigned projects
2. Students are confident in Public Speaking
3. Students write Presentations on different Industrial topics
4. Improve arithmetic aptitude
5. Learn tricks to solve Aptitude questions faster thereby saving time during competitive exams

Course Contents

Unit-I Report, Proposal, and Project

Report Writing, Types, Structure, Style and Writing of Reports (on different topics), Characteristics of Report, Categories and Types of Report, Types of Proposal, Nature and Significance, Structure of formal Proposal, Sample Proposal, Writing Proposals on different topics, Difference between Report and Proposal, Project Writing: Essential Features, Structure, Choosing the Subject and Writing the Project on the related Subject.

Unit-II: Speaking Skills

Group Discussions, Public Speaking, Assertive and Negotiation Strategies.

Unit-III: Communication Skills

Activities related to Skills required for Engineers (Managerial Skills, Leadership Skills, and Organizational Skills).

Unit-IV: Strategies for Recruitment

Recruitments and Interviews, Stages in Job Interview, Desirable Qualities, Reviewing the common Question Types of Interviews.

Unit-V: Numbers and Arithmetic Basic

Classification of Numbers, Divisibility rules –LCM/HCF, Remainders – Base System, Surds, Indices, Logarithms, Percentage, Profit and Loss, Ratio and Proportion, Approximations, Vedic Maths, Intro to DI, Comprehensive Practice Test on Number system, Percentage and Calculation,

Simple Arithmetic:

Code-decoding, Analogies, Direction Test, Blood relations ,Comprehension Practice test-1 (Cumulative) ,Comprehension Practice test-2 (Cumulative)

Books and References

1. Sanjay Kumar and Pushp Lata ‘Communication Skills’, Oxford University Press 2012
2. Meenakshi Raman and Sangeeta Sharma ‘Technical Communication Principles and Practice’, Oxford University Press 2012
3. R. K. Narayan, Malgudi Days: A Collection of Short Stories, Penguin 2006
4. Meenakshi Raman and Prakash ‘Business Communication’ Oxford University Press 2011

13040403	Numerical Methodology and Random process	Learning Schedule			
		L	T	P	C
	Pre-requisites: Mathematics	3	1	0	3

Course Objectives:

To enhance problem solving skills of engineering students using a powerful problem solving tool namely numerical methods. The tool is capable of handling large systems of equations, nonlinearities and complicated geometries that are common in engineering practice but often impossible to solve analytically.

Course Outcomes:

On completion of this course, the students will be able to

1. Apply various numerical methods and appreciate a trade off in using them.
2. Understand the source of various types of errors and their effect in using these methods.
3. To distinguish between Numerical and Analytical methods along with their Merits and demerits.
4. Understand the use of digital computers in implementation of these methods.
5. Develop a code in C/C++ for the solution of problems that may not be solved by analytical methods.

Course Content:

Unit-I: Non- Linear Equations and system of Linear Equations

Introduction, error and error propagation, Bisection method, False position Method, Method of Iteration, Newton-Raphson Method, Secant Method, Gauss Elimination method Gauss – Jordan method, Gauss – Seidel method, convergence of iterative methods.

Unit-II: Interpolation:

Newton's Forward and Backward Interpolation, Lagrange's Interpolation, Newton's Divided Difference Interpolation, Inverse Interpolation.

Unit-III: Numerical Differentiation and Integration

Derivations from difference tables, Higher order derivations. Newton – Cotes integration formula, Trapezoidal rule, Simpson's rule, Boole's rule and Weddle's rule, Romberg's Integration.

Unit-IV: Numerical Solution of Ordinary

Taylor series method, Euler and modified Euler method, Runge Kutta methods, Milne's method, Finite Difference method.

Unit-V: Partial Differential Equations

Finite difference approximations of partial derivatives, Solution of Laplace's equation (Elliptic) by Liebmann's iteration method, Solution of one dimensional heat equation (Parabolic) by Bender-Schmidt method and Crank – Nicolson method, Von-Neumann stability condition, Solution of one dimensional wave equation (Hyperbolic), CFL stability condition.

Text Books:

1. Introductory Methods of Numerical Analysis: S.S. Sastry, PHI learning Pvt Ltd.

Refrence Books:

1. Numerical Methods for Scientific and Engineering computation: M.K Jain, S.R.K Iyengar and R.K Jain, New age Inter-national Publishers.
2. Numerical Method: E. Balagurusamy, Tata McGraw Hill Publication.

13040404	Universal Human Values	Learning Schedule			
		L	T	P	C
	Pre-requisites: Adaptive	**2**	**0**	**0**	**2**

Course Description:

The methodology of this course is universally adaptable, involving a systematic and rational study of the human being vis-à-vis the rest of existence. It is free from any dogma or value prescriptions. This process of self-exploration takes the form of a dialogue between the teacher and the students to begin with and within the student himself/herself finally.

Course Objective:

1. To create an awareness on Engineering Ethics and Human Values.
2. To understand social responsibility of an engineer.
3. To appreciate ethical dilemma while discharging duties in professional life.

Course Outcomes:

On completion of this course, the students will be able to

1. Understand the significance of value inputs in a classroom and start applying them in their life and profession
2. Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.

Course Content:

Unit I: Introduction to Value Education

Value Education, Definition, Concept and Need for Value Education; the Content and Process of Value Education; Basic Guidelines for Value Education; Self exploration as a means of Value Education; Happiness and Prosperity as parts of Value Education.

Unit II: Harmony in the Human Being

Human Being is more than just the Body; Harmony of the Self ('I') with the Body; Understanding Myself as Co-existence of the Self and the Body; Understanding Needs of the Self and the needs of the Body; Understanding the activities in the Self and the activities in the Body.

Unit III: Harmony in the Family and Society and Harmony in the Nature

Family as a basic unit of Human Interaction and Values in Relationships; The Basics for Respect and today's Crisis: Affection, e, Guidance, Reverence, Glory, Gratitude and Love; Comprehensive Human Goal: The Five Dimensions of Human Endeavour; Harmony in Nature: The Four Orders in Nature; The Holistic Perception of Harmony in Existence.

Unit IV: Social Ethics

The Basics for Ethical Human Conduct; Defects in Ethical Human Conduct; Holistic Alternative and Universal Order; Universal Human Order and Ethical Conduct; Human Rights violation and Social Disparities.

Unit V: Professional Ethics

Value based Life and Profession; Professional Ethics and Right Understanding. ; Competence in Professional Ethics; Issues in Professional Ethics – The Current Scenario; Vision for Holistic Technologies, Production System and Management Models.

Text Books

1. A.N Tripathy, New Age International Publishers, 2003.
2. Bajpai. B. L, New Royal Book Co, Lucknow, Reprinted, 2004
3. Bertrand Russell Human Society in Ethics & Politics

Reference Books

2. Gaur. R.R., Sangal. R, Bagaria. G.P, A Foundation Course in Value Education, Excel Books, 2009.
3. Gaur. R.R., Sangal. R, Bagaria. G.P, Teachers Manual Excel Books, 2009.
4. I.C. Sharma. Ethical Philosophy of India Nagin & co Julundhar
5. Mortimer. J. Adler, - Whatman has made of man

13040413	Foreign Language(French/German)-II	Learning Schedule			
		L	T	P	C
	Pre-requisites: Foreign Language(French/German)-I	2	0	2	3

Course Objective: Conversational Practice, formation of sentences, negative sentences, interrogative sentences, and simple vocabulary related to house, family, common objects, simple prepositions and conjugation of Irregular verbs. Writing paragraphs in French.

Unit – 1
Ordinal Numbers
Our Travel plans
Grammar conjugation of verbs ending in – re, oir
Countries and Languages

Unit – 2
Weather, Seasons, Months, Day
Conjugation of Verbs Irregular verbs
Possessive Adjectives
Travel by Train

Unit – 3
Vouloir and Pouvoir /irregular verbs Meals/ Foods
Ordering food
Wines, Cheese,

Unit – 4
Breakfast, Lunch, Dinner
Visit to a Restaurant

Unit – 5
Clothing store,
Food store
Stationary Store

Text Book:
Barron's French The fast and Fun Way. Third Edition
Mauger: Civilasationet. Langue Francaise

13040405	Digital Electronics	L	T	P	C
	Pre-requisites//Exposure : Knowledge of Basic Algebra, Basic Electronics	3	0	0	3

Course Objectives

1. Understanding the different number systems used in computerized system and codes used to represent the digits and fundamental of arithmetic operation using each number system and codes.
2. Understanding the minimization of logic expression and designing combinational and sequential digital circuits
3. Enabling students to take up application specific sequential circuit to specify the finite state machine and designing the logic circuit.

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

1. Verify and analyze the input/output data of each logic gate and circuits such as adders, counters, coders, etc.
2. Apply the digital circuit design concept in developing basic component of computer organization, projects or experiments.

Course Description

The course introduces Boolean algebra, Reduction techniques and demonstrates the design of logic gates. Knowledge of digital systems design based on combinational and sequential logic is also imparted. This course further teaches about PLD, Memories and Logic Families.

Course Content

Unit I: Number System and Boolean algebra **7 lecture hours**

Review of number system; types and conversion, codes. Boolean algebra: De-Morgan's theorem, switching functions, Prime Implicants and Essential Prime Implicants definition and simplification using K-maps up to 5 variables & Quine McCluskey method.

Unit II: Combinational Circuits **8 lecture hours**

Introduction to Logic Gates: AND, OR, NOT, NAND, NOR, EX-OR, EX-NOR and their combinations. Design of adder, subtractors, comparators, code converters, encoders, decoders, multiplexers and de-multiplexers, Function realization using gates & multiplexers.

Unit III: Synchronous Sequential Circuits **8 lecture hours**

Introduction to Latches and Flip flops - SR, D, JK and T. Design of synchronous sequential circuits – Counters, shift registers. Finite State Machine Design, Mealy, Moore Machines, Analysis of synchronous sequential circuits;, state diagram; state reduction; state assignment with examples.

Unit IV: Asynchronous Sequential Circuits **8 lecture hours**

Analysis of asynchronous sequential machines, state assignment, asynchronous design problem.

Unit V: PLD, Memories and Logic Families **8 lecture hours**

Memories: ROM, RAM, PROM, EPROM, Cache Memories, And PLA, PLD, And FPGA, digital logic families: TTL, ECL, CMOS.

Text Books

1. Mano, Morris. "Digital logic." Computer Design. Englewood Cliffs Prentice-Hall (1979).
2. Kumar, A. Anand. Fundamentals of Digital Circuits 2Nd Ed. PHI Learning Pvt. Ltd., 2009.

Reference Books

1. Floyd, Thomas L. Digital Fundamentals, 10/e. Pearson Education India, 1986.
2. Malvino, Albert Paul, and Donald P. Leach. Digital principles and applications. McGraw-Hill, Inc., 1986.
3. Jain, Rajendra Prasad. Modern Digital Electronics 3e. Tata McGraw-Hill Education, 2003.

13040406	Digital Signal Processing	L	T	P	C
	Pre-requisites//Exposure : Signals and Systems	3	0	0	3

Course Objectives

1. To impart the knowledge of key DSP concepts and how do they relate to real applications.
2. To introduce to the methods of time domain and frequency domain implementation.
3. To present a comprehensive introduction to important DSP technologies with a focus on filter design techniques and Fourier analysis of signals using DFT.

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

1. Apply digital signal processing fundamentals.
2. Acquire the knowledge of representation of discrete-time signals in the frequency domain, using z-transform and discrete Fourier transform.

Course Description

Digital signal processing (DSP) is concerned with the representation of signals in digital form, and with the processing of these signals and the information that they carry. Although DSP, as we know it today, began to flourish in the 1960's, some of the important and powerful processing techniques that are in use today may be traced back to numerical algorithms that were proposed and studied centuries ago.

Course Content

Unit I: Discrete Time Signals and Systems 10 lecture hours

Sequences, discrete time systems, LTI systems, frequency domain representation of discrete time signals and systems, discrete time signals and frequency domain representation, Fourier Transform Discrete Fourier Transform: Discrete Fourier transforms, properties, linear convolution using DFT, DCT.

Unit II: Sampling of Continuous Time Signals 10 lecture hours

Sampling and reconstruction of signals, frequency domain representation of sampling, discrete time processing of continuous time signals, continuous time processing of discrete time signals, changing the sampling rate using discrete time processing, multi rate signal processing, digital processing of analog signals, over sampling and noise shaping in A/D and D/A conversion.

Unit III: Transform Analysis of LTI Systems 10 lecture hours

Frequency response of LTI systems, system functions, frequency response for rational system functions, magnitude-phase relationship, all pass systems, minimum phase systems, and linear systems with generalized linear phase Overview of finite precision numerical effects, effects of coefficient quantization, Effects of round-off noise in digital filters, zero-input limit cycles in fixed point realizations of IIR digital filters.

Unit IV: Filter Design Techniques 12 lecture hours

Design of D-T IIR filters from continuous – time filters, design of FIR filters by windowing, Kaiser Window method, optimum approximations of FIR filters, FIR equiripple approximation. DFT analysis of sinusoidal signals, time-dependent Fourier transforms: Block convolution, Fourier analysis of non – stationary and stationary random signals.

Text Books

1. Oppenheim A.V., Schafer, Ronald W. & Buck, John R.,"Discrete Time Signal processing", Pearson Education ,2nd Edition.

Reference Books

1. De Fatta, D.J.Lucas, J.G. & Hodgkiss, W. S.," Digital Signal Processing", John Wiley& Sons.
2. Proakis, J.G. & Manolakis, D.G.," Digital Signal Processing: Principles Algorithms and Applications", Prentice Hall of India.

13040407	Electromagnetic Field Theory and Waveguides	L	T	P	C
	Pre-requisites//Exposure : Engineering Physics– I	3	0	0	3

Course Objectives: The students will learn and understand

1. Behaviour of electrostatic and electromagnetic fields and their application in electrical and electronics engineering fields.
2. Maxwell's equation in integral and differential form, their interpretation and applications.
3. Propagation of EM wave in free space, conductors & dielectrics.

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

1. Calculate electric and magnetic fields from stationary and dynamic charge and current distributions
2. Understand the phenomenon of wave propagation with the aid of Maxwell's equations.

Course Description

Electromagnetic Field Theory acquire understanding and ability to analyze static electric and magnetic fields, time-varying electric and magnetic fields, wave propagation in different types of media. This course may also be useful for the practicing engineers who want to refresh their understanding in Electromagnetic.

Course Content

Unit I: Coordinate Systems and Transformation **08 Lectures**

Coordinate systems and transformation: Cartesian coordinates, circular cylindrical coordinates, spherical coordinates Vector calculus: Differential length, area and volume, line surface and volume integrals, del operator, gradient of a scalar, divergence of a vector and divergence theorem, curl of a vector and Stoke's theorem, Laplacian of a scalar.

Unit II: Electrostatics **08 Lectures**

Electrostatic fields, Coulombs law and field intensity, Electric field due to charge distribution, Electric flux density, Gausses's Law – Maxwell's equation, Electric dipole and flux lines, energy density in electrostatic fields. Electric field in material space: Properties of materials, convection and conduction currents, conductors, polarization in dielectrics, dielectric constants, continuity equation and relaxation time, boundary condition. Electrostatic boundary value problems: Poission's and Laplace's equations, general procedures for soling Poission's or Laplace's equations, resistance and capacitance, method of images.

Unit III: Magnetostatics **08 Lectures**

Magnetostatics: Magneto-static fields, Biot-Savart's Law, Ampere's circuit law, Maxwell's equation, application of ampere's law, magnetic flux density- Maxwell's equation, Maxwell's equation for static fields, magnetic scalar and vector potential. Magnetic forces, materials and devices: Forces due to magnetic field, magnetic torque and moment, a magnetic dipole, magnetization in materials, magnetic boundary conditions, inductors and inductances, magnetic energy.

Unit IV: Waves and Applications **14 Lectures**

Waves and applications: Maxwell's equation, Faraday's Law, transformer and motional electromotive forces, displacement current, Maxwell's equation in final form. Electromagnetic wave propagation: Wave propagation in lossy dielectrics, plane waves in lossless dielectrics, plane wave in free space, plane waves in good conductors, power and the pointing vector, reflection of a plain wave in a normal incidence. **Transmission Lines:** Transmission lines: Transmission line parameters, Transmission line equations, Smith chart, Introduction to waveguides.

Text Books

1. M. N. O. Sadiku, "Elements of Electromagnetic", 5th Edition, Oxford University Press 2010,

Reference Books

1. W. H. Hayt and J. A. Buck, "Electromagnetic field theory", 7th Edition, TATA Mc Graw Hill, ISBN9780070612235

13040408	Analog Communication	L	T	P	C
	Pre-requisites//Exposure : Signal and systems	3	0	0	3

Course Objectives

1. Concepts of communication engineering.
2. Different analog modulation techniques used.
3. Systematic comparison of various modulation techniques.

Course Outcomes

On completion of this course, the students will be able to

1. Understand different modulation and demodulation techniques.
2. Apply signal and system analysis tools in the time and frequency domains, including impulse response, convolution, frequency response, Fourier series, Fourier transform, and Hilbert transform.
3. Develop the ability to compare and contrast the strengths and weaknesses of various communication systems.

Course Description

Communication is the basic process of exchanging information. **Analog Communication**, as the name suggests is the subject which deals with the techniques employed in communication and basically analog in nature. It is a common knowledge that understanding digital communication is impossible if one does not have a knowledge in analog communication methods.

Course Content

Unit I: Basics of Communication Theory **10 lecture hours**

Need and Importance of Communication, Elements of Communication System, Generalized block diagram of communication system, Types of communication systems- Simplex and Duplex systems, Analog and digital systems, Applications of Electronic Communications, Electromagnetic Spectrum used in communication and various frequency bands, Concept of bandwidth. Noise in communication and types of noise (External and Internal), Noise voltage, Signal-to-noise ratio, Noise Figure, Noise temperature.

Unit II: Amplitude Modulation **8 lecture hours**

Concept of modulation and demodulation, baseband and pass band signals. Amplitude Modulation (AM)- generation & demodulation, Modified forms of AM- Double sideband suppressed carrier (DSBSC), single sideband suppressed carrier (SSBSC) and Vestigial sideband (VSB) modulation, Mixers, Frequency Division Multiplexing.

Unit III: Angle Modulation **12 lecture hours**

Phase modulation (PM) and Frequency modulation (FM), narrow and wideband FM, Generation & demodulation, phase locked loop (PLL), homodyne and heterodyne receivers, elements of TV broadcast and reception; **Noise in CW modulation:** Receiver model, SNR, noise figure, noise temperature, noise in DSB-SC, SSB, AM & FM receivers, pre-emphasis and de-emphasis.

Unit V: Pulse Modulation **8 lecture hours**

Sampling Process, Basics of Pulse modulation, Types of Pulse Modulation – PAM, PWM and PPM.

Text Books

1. Simon Haykin, "Communication Systems", 4th edition, John Wiley & Sons, 2006, ISBN 812650904X, 9788126509041.
2. J. Proakis & M. Salehi, "Communication system engineering", 2nd edition, Prentice Hall, 2002, ISBN 0130617938, 9780130617934

Reference Books

1. R. E. Ziemer, W. H. Tranter: "Principles of Communications: Systems, Modulation, and Noise", 5th Edition, Pearson Education India, 1998, ISBN 8131703266, 9788131703267
2. Herbert Taub and Donal L. Schilling, "Principles of communication Systems", Tata McGraw-Hill Education, 2008, ISBN 0070648115, 9780070648111

13040409	Digital Electronics Lab	L	T	P	C
	Pre-requisites//Exposure : Knowledge of Basic Algebra, Basic Electronics	0	0	2	1

Course Objectives

1. Verifying and analyzing the practical digital circuits.
2. Enabling students to take up application specific sequential circuit to specify the finite state machine and designing the logic circuit.

Course Outcomes

On completion of this course, the students will be able to

1. Verify and analyze the input/output data of each logic gate and circuits such as adders, counters, coders, etc.
2. Analyze the basic operation of memory cell and its limitations in circuit designing.

Course Description

The course introduces Boolean algebra, Reduction techniques and demonstrates the design of logic gates. Knowledge of digital systems design based on combinational and sequential logic is also imparted. This course further teaches about PLD, Memories and Logic Families.

List of Experiments

1. Introduction to digital electronics lab- nomenclature of digital ICs, specifications, study of the data sheet, gates using TTL ICs concept of Vcc and ground, verification of the truth tables of logic gates using TTL
2. Implementation of the given Boolean function using logic gates in both SOP and POS forms
3. Verification of state tables of RS, JK, T and D flip-flops using NAND & NOR gates.
4. Implementation and verification of Decoder/De-multiplexer and Encoder using logic gates
5. Implementation of 4x1 multiplexer using logic gates.
6. Implementation of 4-bit parallel adder using 7483 IC
7. Design, and verify the 4-bit synchronous counter
8. Design, and verify the 4-bit asynchronous counter
9. Static and Dynamic Characteristic of NAND and Schmitt-NAND gate(both TTL and MOS)
10. Study of Arithmetic Logic Unit

Text Books

1. Mano, Morris. "Digital logic." Computer Design. Englewood Cliffs Prentice-Hall (1979).
2. Kumar, A. Anand. Fundamentals of Digital Circuits 2Nd Ed. PHI Learning Pvt. Ltd., 2009.
3. Taub, Herbert, and Donald L. Schilling. Digital integrated electronics. New York: McGraw-Hill, 1977.

Reference Books

1. Floyd, Thomas L. Digital Fundamentals, 10/e. Pearson Education India, 1986.
2. Malvino, Albert Paul, and Donald P. Leach. Digital principles and applications. McGraw-Hill, Inc., 1986.
3. Jain, Rajendra Prasad. Modern Digital Electronics 3e. Tata McGraw-Hill Education, 2003.

13040410	Digital Signal Processing Lab	L	T	P	C
	Pre-requisites//Exposure : Signals and Systems	0	0	2	1

Course Objectives

1. Understand the DSP concepts and to relate to real applications.
2. Time domain and frequency domain implementation.

Course Outcomes

On completion of this course, the students will be able to

1. Apply digital signal processing fundamentals.
2. To construct new experiment independently or as a team member.

Course Description

Digital signal processing (DSP) is concerned with the representation of signals in digital form, and with the processing of these signals and the information that they carry.

List of Experiments:

Perform the experiments using DSP Hardware Processor using Programes in C Language:

1. To understand sampling theorem & generation of waveforms like sine, square & Triangle.
2. To study Quantization technique.
3. To study PCM encoding & Hamming code generation.
4. To Study Digital modulation techniques ASK/FSK& PSK.
5. To study FIR Filter Implementation.
6. To study Auto correlation & linear convolution

Experiments to be performed on MATLAB

1. Represent basic signals (Unit step, unit impulse, ramp, exponential, sine and cosine).
2. To develop program for discrete convolution.
3. To develop program for discrete correlation.
4. To design analog filter (low-pass, high pass, band-pass, band-stop).
5. To design digital IIR filters (low-pass, high pass, band-pass, band-stop).
6. To design FIR filters using windows technique.

Text Books

1. Oppenheim A.V., Schafer, Ronald W. & Buck, John R.,"Discrete Time Signal processing", Pearson Education , 2nd Edition.

Reference Books

1. De Fatta, D. J. Lucas, J. G. & Hodgkiss, W. S.," Digital Signal Processing", John Wiley & Sons.
2. Proakis, J.G. & Manolakis, D.G.," Digital Signal Processing: Principles Algorithms and Applications", Prentice Hall of India.
3. Rabiner, L.R. and Gold B., "Theory and applications of DSP", Prentice Hall of India.

13040411	Analog Communication Lab		L	T	P	C
	Pre-requisites//Exposure :	Signal and systems	0	0	2	1

Course Objectives

1. Concepts of communication engineering.
2. Different analog modulation techniques used.

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

1. Understand different modulation and demodulation techniques.
2. Develop the ability to compare and contrast the strengths and weaknesses of various modulation techniques.

Course Description

The Lab subject basically deals with the different aspects of a signal and spectra. It also deals with the modulation of signals and different mathematical aspects related to signals. It gives a more analytical look into the basic entities such as those of signals, modulation, noise etc. which form the base for higher studies in telecommunication.

List of Experiments:

1. To design Modulation and Demodulation of Amplitude Modulated signal.
2. To design Modulation and Demodulation of Frequency modulated Signal.
3. To design Pulse Amplitude Modulation.
4. To design Pulse Width Modulation.
5. To design Pulse Position Modulation.
6. To design Band-pass Filter.
7. To design Mixer Circuit.

Text Books

1. Simon Haykin, “Communication Systems”, 4th edition, John Wiley & Sons, 2006, ISBN 812650904X, 9788126509041.
2. Bernard Sklar, "Digital Communication”, Pearson Education India 2009, ISBN 8131720926, 9788131720929.

Reference Books

1. R. E. Ziemer, W. H. Tranter: “Principles of Communications: Systems, Modulation, and Noise”, 5th Edition, Pearson Education India, 1998, ISBN 8131703266, 9788131703267
2. Herbert Taub and Donal L. Schilling, “Principles of communication Systems”, Tata McGraw-Hill Education, 2008, ISBN 0070648115, 9780070648111
3. K. Sam Shanmugam,”Digital and Analog Communication Systems”, John Wiley and Sons, 2006, ISBN 8126509147, 9788126509140.

13040412	Industrial Training -I	Learning Schedule			
		L	T	P	C
	Pre-requisites: --Courses up to 3rd sem	0	0	0	1

COURSE OBJECTIVES:

1. To gain first-hand experience of working as an engineering professional, including the technical application of engineering knowledge.
2. To experience the discipline of working in a professional organization and multidisciplinary team.
3. To develop technical, interpersonal and communication skills.

Course Outcomes

On completion of this course, the students will be able to get the structure of industry. He will know the various departments of industry & how industry works.

Course Content

1. After 4th semester & before 5th semester.
2. Duration for training should be fifteen days to twenty days.
3. It can be either in Industry for study the working process or institution for preparation of a project.
4. Students have to submit three spiral binding report & PPT presentation.

13040501	Technical Skills –III	Learning Schedule			
		L	T	P	C
	Pre-requisites: Courses up to 4th sem	0	0	2	2

Course Objectives

1. To prepare students to build solid foundation in theory and practice of electronics engineering.
2. To make electronics engineering graduate most competent and competitive for jobs in public and private organization
3. To build extensive foundation among students to take up higher study

Course Outcomes

On completion of this course, the students will be able to

1. Explain the theory and operation of Advanced Electronic components and devices.
2. Explain the concepts of Communication & Networking.
3. Write the programs using languages like C, C++, and Java.
4. Familiarize with application development using programming language.
5. Solve the questions designed for recruitment tests

Course Description

This Course gives a description of the Advanced Electronics Components and Devices, Basics of Digital Communication, Advanced Programming using C, C++ and Test series for Competitive examinations.

Course Content

Unit I: Digital Electronics fundamentals **12 Hours**

Logical expression minimization, combinational devices, sequential device.

Unit II: Communication Engineering **8 Hours**

Basics of Digital Communication Transmitters, Channels and Receivers, Importance of Digital Modulation Techniques, Types of Modulations.

Unit III: Electromagnetic Theory **10 Hours**

Maxwell Equations, Transmission line, Waveguides

Unit IV: Computer Networking **12 Hours**

TCP/IP architecture, Networking devices, LAN, MAN, WAN, Networking topologies, IP addressing. Sub-netting

Text Books

1. Simon Haykin, "Digital Communication Systems", 4th edition, John Wiley & Sons, 2001.
2. Digital Electronics, Morris mano

Reference Books

1. Behrouz A.Forouzan, 'Data Communication and Networking', Second Edition, Tata McGraw Hill, 2000.

13040502	Personality & Career Building	Learning Schedule			
		L	T	P	C
	Pre-requisites: Adaptive and punctual	0	0	4	2

Course objectives:

1. Holistic approach focusing on
2. Negotiation skills
3. Team work
4. Balancing the emotional Quotient of the individuals
5. Ready to apply for a job
6. Skill development related to classification of numbers
7. Implementing logical Aptitude in decision making

Course outcomes:

1. Get an idea of industry perspective
2. Give the Effective Presentation
3. Able to develop a logical thought process related to every aspect of life
4. Able to widen the horizon of one's thought process and data analysis skills
5. Able to interpret Data and convert into information

Course Content

Unit-I: Strategies and Skills Required for Career building/ Recruitment/ Team building

Learning of Different Strategies to be used: Negotiation, Assertions, Politeness through Conversation, Assertive Strategies, Leadership Skills, Team Work, Management Skills through Group Activities.

Unit-II: Group Discussions and Role Play

Listening and Speaking Comprehensions through Group Discussion and audio-visual aids, do's and Don'ts of Group Discussions related to various topics (Day-Today life/ Social Issues/ Political and Others.

Unit-III: Business/job Correspondence

Resume Writing, Letter Writing, Job Application Letter

Unit-IV: Time and Work, Data Interpretation

Time and Work ,Time speed and Distance, Table, Line Graph, Bar Graph, Cube, Dice, Calendars, Test on Bar and Pie Charts, Comprehensive Practice test- 1 on Area Covered, Comprehensive Practice test- 2 on Area Covered.

Unit-V: Algebra and Simple Reasoning

Linear and Quadratic Equation, Function Basics, Inequalities, Progression, Set Theory/ Venn diagram, Pie Chart, Permutation and Combination, Probability, Visual Reasoning, Alphabet based Reasoning, Comprehensive Practice test- 1 on Area Covered, Comprehensive Practice test- 2 on Area Covered.

Text books:

1. Sanjay Kumar and Pushp Lata 'Communication Skills', Oxford University Press 2012
2. Raymond Murphy 'Essential English Grammar', Cambridge University Press 1998
3. Meenakshi Raman and Sangeeta Sharma 'Technical Communication Principles and Practice', Oxford University Press 2012.

Reference Books

1. R. K. Narayan, Malgudi Days: A Collection of Short Stories, Penguin 2006
2. Meenakshi Raman and Prakash 'Business Communication' Oxford University Press 2011
3. Hory Sankar Mukerjee 'Business Communication Connecting at Work' Oxford University Press 2013

13040503	Entrepreneurship Developer	Learning Schedule			
		L	T	P	C
		2	0	0	2

Course Description

Entrepreneurship Development is a challenging, applicable degree program that integrates management concepts in a technical and innovative setting as required by today's dynamic business environment. It develops graduates with relevant skills preparing students for entry into management careers in business, government, public, or social service organizations. Industry-trained faculty translates theory to practice; advising students through the diversity of the curriculum, project-based learning, and internships.

Course Objectives: The objective of the course is to

1. To make the students aware of the importance of entrepreneurship opportunities available in the society for the entrepreneur.

2. Acquaint them with the challenges faced by the entrepreneur.

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

1. Explain the major concepts in the functional areas of accounting, marketing, finance, and management.

2. Apply decision-support tools to business decision making.

Course Content

Unit-1 Introduction: Entrepreneur: Evolution, Characteristics, Types, Functions of Entrepreneur - Distinction between an Entrepreneur and a Manager, Concept, Growth of Entrepreneurship in India, Role of Entrepreneurship in Economic Development. Rural Entrepreneurship: Concept, Need, Problems, Rural Industrialization in Retrospect, How to Develop Rural Entrepreneurship, NGOs and Rural Entrepreneurship

Unit-2 Women Entrepreneurship: Concept, functions, Growth of Women Entrepreneurs, Problems, Development of Women Entrepreneurs - Recent Trends, Entrepreneurial Motivation Concept, Theories, factors, Entrepreneurial Competencies Concept, Major Entrepreneurial Competencies Small Enterprises: Definition, Characteristics, Relationship between Small and Large Units, Rationale, Objectives, Scope, Opportunities for an Entrepreneurial Career, Role of small Enterprise in Economic development

Unit-3 Project Identification And Selection (PIS): Meaning of Project, Project Identification, Project Selection, Project Formulation: Meaning, Significance, Contents, Formulation, Planning Commission's Guidelines for Formulating a Project Report, Specimen of a Project Report, Network Analysis, Common Errors in Project Formulation, Project Appraisal Concept, Methods of project appraisal, Growth of Business Ideas, Intellectual Property.

Unit-4 Financing Of Enterprises

Need for Financial Planning, Sources of finance, Capital Structure, Term-loan, Sources of Short-Term Finance, Capitalization, Venture capital, Export Finance, Institutional Finance To Entrepreneurs, Preparation of Business Plans, Commercial Banks, Other financial institutions

Unit-5 Bank Institution Support to Entrepreneurs

Need for Institutional support - Small Entrepreneurs: NSIC, SIDO, SSIB, SSICS, SISI, DICs, Industrial Estates Specialized Institutions, TCOs Brief introduction about Marketing of products and services, Human resource issues, Total quality management issues for small enterprises, Growth strategies in small businesses, sickness in small businesses, small enterprises in international business

Text Books

1. Roy Rajeev, Entrepreneurship Oxford Latest Edition

2. E. Gordon & K. Natarajan Entrepreneurship Development Himalaya 2008

Reference Books

1. P. C. Jain Handbook For New Entrepreneur Oxford Latest Edition

2. S. S. Khanka Entrepreneurial Development S. Chand Latest Edition

13040507	Analog Integrated Circuits	L	T	P	C
Pre-requisites//Exposure	Semiconductor Devices and Circuits	3	0	0	3

Course Objectives

The student will be able to learn and understand

1. Architecture, electrical characteristics and applications of OP-AMP.
2. Architecture, Characteristics and Applications of PLL, ADC, DAC and regulators.
3. Apply the methods learned in the class to design and implement practical problems

Course Outcomes

On completion of this course, the students will be able to

1. Demonstrate the ability to apply the practice of Analog Integrated Circuits in real-world problems.
2. Design, layout, and testing of Op Amps and other analog circuits.
3. Identify, formulate, and solve engineering problems in Analog Integrated Circuit Design

Course Description

To enable the students to understand the fundamentals of integrated circuits and designing electronic circuits using it. Analysis of four quadrant and variable trans-conductance multipliers, Voltage controlled Oscillator D/A converter- Current driven DAC, Switches for DAC, A/D converter Wave shaping circuits, Multivibrator- Monostable & Bistable, Schmitt Trigger circuits, IC 555 Timer, Application of IC 555, Frequency to Voltage converters.

Course Content

Unit I: Operational Amplifiers **10 lecture hours**

Analysis of difference amplifiers, Monolithic IC operational amplifiers, specifications, frequency compensation, slew rate and methods of improving slew rate, Linear and Nonlinear Circuits using operational amplifiers and their analysis, Inverting and Non inverting Amplifiers.

Unit II: Applications of Operational Amplifiers **10 lecture hours**

Differentiator, Integrator Voltage to Current convertor, Instrumentation amplifier, Sine wave Oscillators, Low pass and band pass filters, comparator, Multivibrator and Schmitt trigger, Triangle wave generator, Precision rectifier, Log and Antilog amplifiers, Non-linear function generator.

Unit III: Analog Multiplier and PLL **10 lecture hours**

Analysis of four quadrant and variable trans-conductance multipliers, Voltage controlled Oscillator, Closed loop analysis of PLL, AM, PM and FSK modulators and demodulators. Frequency synthesizers, Commander ICs.

Unit IV: D/A and D/A Converters **14 lecture hours**

Analog switches, High speed sample and hold circuits and sample and hold IC's, Types of D/A converter- Current driven DAC, Switches for DAC, A/D converter, Flash, Single slope, Dual slope, Successive approximation, DM and ADM, Voltage to Time and Voltage to frequency converters.

Text Books

1. Sergio Franco, “Design with operational amplifiers and analog integrated circuits ", McGraw Hill, 2002, ISBN 0070530440, 9780070530447

2. Ramakant A. Gayakwad, “OP - AMP and Linear IC's ", 4th Edition, Prentice Hall, 2000, ISBN 0132808684, 9780132808682

Reference Books

1. Botkar K.R., “Integrated Circuits ", Khanna Publishers, 1996.

2. Taub and Schilling, “Digital Integrated Electronics ", Tata McGraw-Hill Education, 2004, ISBN 0070265089, 9780070265080

3. Millman J. and Halkias C.C., “Integrated Electronics ", McGraw Hill, 2001, ISBN 0074622455, 9780074622452

13040508	Control Systems	L	T	P	C
	Pre-requisites//Exposure : Measurement & Instrumentation, Signals & System	3	0	0	3

Course Objectives

The students will learn and understand

1. Methodology for modeling mechanical, electrical, and other types of dynamic systems using both frequency domain and state-space techniques.
2. Principles of feedback control to a variety of scientific disciplines

Course Outcomes

On completion of this course, the students will be able to

1. Know the methodology for modeling dynamic systems
2. Work with state-space models and their application to frequency domain models.
3. Design feedback controllers and compensators to achieve desired performance specifications.

Course Description

Study of analog and computer controlled systems, classical and modern control system design methods, state space, dynamics of linear systems, and frequency domain analysis and design techniques. Analysis of linear feedback systems, their characteristics, performance, and stability. The Routh-Hurwitz, root-locus, Bode, and Nyquist techniques

Course Content

Unit I: Introduction to Control System **8 lecture hours**

Open loop & closed control; servomechanism, Physical examples. Transfer functions, Block diagram algebra, and Signal flow graph, Mason's gain formula Reduction of parameter variation and effects of disturbance by using negative feedback.

Unit II: Time Response analysis **8 lecture hours**

Standard test signals, time response of first and second order systems, time response specifications, steady state errors and error constants, Steady state Accuracy, Transient Accuracy, Disturbance, Rejection, Design specifications of second order systems: Derivative error, derivative output, integral error and PID compensations, design considerations for higher order systems.

Unit III: Concept of Stability & Algebraic Criteria **8 lecture hours**

Concept of Stability, Necessary condition for Stability, Routh Hurwitz Stability Criterion, Relative Stability Analysis, and Stability of Systems modeled in State variable form. Root locus concepts, its construction, Root contours, Sensitivity of roots of Characteristic equations.

Unit IV: Frequency response Analysis **12 lecture hours**

Polar and inverse polar plots, Bode plots, Stability in Frequency Domain: Nyquist stability criterion; assessment of relative stability: gain margin and phase margin; Nichols Charts; **Introduction to Design of control systems :** lead, lag and lead-lag networks, design of closed loop systems using compensation techniques in time domain and frequency domain. Review of state variable technique: State Models for Linear continuous Time systems, State Variables for linear discrete time, Conversion of state variable model to transfer function model and vice-versa, Controllability and observability and their testing.

Text Books

1. Nagrath & Gopal, "Control System Engineering", 4th Edition, New age International, ISBN: 0130980412. 8.
2. K. Ogata, "Modern Control Engineering", Prentice Hall of India, 3rd edition ISBN: 0132273071

Reference Books

1. Norman S. Mise, Control System Engineering 4th edition, Wiley Publishing Co, ISBN: 0132273071.

13040511	Analog integrated circuit & control system Lab	L	T	P	C
	Pre-requisites//Exposure : AIC & control system	0	0	2	1

Course Objectives

1. To familiarize the students with the analog computer
2. To help the students understand and practice the modeling, simulation, and implementation of a physical dynamical system by a linear time invariant ordinary differential equation
3. To highlight the electrical modeling of a second order system and analyze the under-damped, over-damped and critically damped cases
4. To familiarize students with Servo-Motor.
5. To implement the basic principles of Servo-Motor calibration.

Course Outcomes

1. Students will demonstrate the ability to apply what they have learned theoretically in the field of control engineering using both analog and digital techniques.
2. Students will demonstrate the ability to apply what they have learned theoretically in the field of control engineering using both analog and digital techniques.

Course Content

1. Log and antilog amplifiers.
2. Voltage comparator and zero crossing detectors.
3. Second order filters using operational amplifier for–

- Low pass filter of cutoff frequency 1 KHz.
- High pass filter of frequency 12 KHz
- Band pass filter with unit gain of pass band from 1 KHz to 12 KHz.

4. Wien bridge oscillator using operational amplifier.
5. Determine capture range; lock in range and free running frequency of PLL.
6. Voltage regulator using operational amplifier to produce output of 12V with maximum load current of 50 mA.
7. Voltage to current and current to voltage convertors.
8. Function generator using operational amplifier (sine, triangular & square wave)
9. Astable and monostable multiviberator using IC 555
10. To study speed Torque characteristics of a) A.C. servo motor b) DC servo motor
11. (a) To demonstrate simple motor driven closed loop DC position control system.
    (b) To study and demonstrate simple closed loop speed control system.
12. To study the lead, lag, lead-lag compensators and to draw their magnitude and phase plots.
13. To study a stepper motor & to execute microprocessor or computer-based control of the same by changing number of steps, direction of rotation & speed.
14. To implement a PID controller for temperature control of a pilot plant.
15. To study behavior of 1 order, 2 order type 0, type 1 system.
16. To study control action of light control device.
17. To study water level control using an industrial PLC.
18. To study motion control of a conveyor belt using a industrial PLC

13040513	Electronics Measurements and Instrumentation	L	T	P	C
	Pre-requisites//Exposure : Basic Electrical and Electronics Engineering	3	0	0	3

Course Objectives

1. To know the necessity of different measuring instruments and their design principle
2. To understand the working principle of different measuring instruments and technical solutions to handle different errors.
3. To learn the architecture and working principle of advanced measuring instrument and their applications.

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

1. Learn units, dimensions, standards and errors and basics of different types of measuring instruments to measure different electrical quantities
2. Apply their knowledge to measure electrical quantities using standard analog and digital measuring instruments.

Course Description

This course deals with the basics of Electrical and Electronic measuring instruments used in laboratory and industry. In the process they learn different type of instruments like PMMC, Moving Iron, Electrodynamometer which includes voltmeter, ammeter, wattmeter, energy meter, power factor meter, frequency meter, Q meter, etc. Students will also learn about different AC and DC bridges to obtain various electrical parameters. Display devices which include DVM, CRO, and DSO etc are also learnt to analyze electrical signals in the course.

Course Content

Unit I: Philosophy of Measurement & Analog Measurement of Electrical Quantities 13 lecture

Unit & dimensions, standards, Errors, Characteristics of Instruments and measurement system, basics of statistical analysis. PMMC instrument, DC ammeter, DC voltmeter, Ohm meter, Moving Iron instrument, Electrodynamics Wattmeter, errors and remedies, Three Phase Wattmeter, Power in three phase system, Energy meter

Unit II: Measurement: Instrument Transformer 5 lecture hours

Instrument Transformer and their applications in the extension of instrument range, Introduction to measurement of speed, frequency and power factor.

Unit III: Measurement of Parameters 8 lecture hours

Different methods of measuring low, medium and high resistances**,** measurement of inductance & capacitance with the help of AC Bridges- Wheatstone, Kelvin, Maxwell, Hay's, Anderson, Owen, Heaviside, Campbell, Schering, Wien bridges, Wagner Earthling device, Q Meter.

Unit IV: AC Potentiometer & Magnetic Measurement 12 Lecture hours

Polar type & Co-ordinate type AC potentiometers, application of AC Potentiometers in electrical measurement. Ballistic Galvanometer, Flux meter. **Digital Measurement:** Concept of digital measurement, Digital voltmeter, Frequency meter, Power Analyzer and Harmonics Analyzer, Electronic, Multimeter. DSO and its applications.

Text Books

1. E.W. Golding & F.C. Widdis, “Electrical Measurement &Measuring Instrument”, A.W. Wheeler & Co. Pvt. Ltd. India.

A.K. Sawhney, “Electrical & Electronic Measurement & Instrument”, Dhanpat Rai & Sons

Reference Books

1. Forest K. Harries, “Electrical Measurement”, Willey Eastern Pvt. Ltd. India
2. W. D. Cooper,” Electronic Instrument & Measurement Technique “ Prentice Hall International

13040514	Transmission Lines And Networks	L	T	P	C
	Pre-requisites//Exposure : Electromagnetic Theory	3	0	0	3

Course Objectives

1. To learn the concepts of network analysis in electrical and electronics engineering.
2. To learn transmission lines and networks.
3. To learn active and passive filter circuits

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

1. Analyze the power distribution through transmission line.
2. Explain the electrical transmission lines and verify them through experiments

Course Description:

Transmission line theory is considered to deal with the problems associated with large-scale electrical systems such as power transmission and distribution system. This course lay foundation for the students to study other subjects related to both the engineering streams.

Course Content

Unit I-Transmission Line Theory **10 Hours**

General theory of Transmission lines, the transmission line general solution The infinite line Wavelength, velocity of propagation – Waveform distortion – the distortion less line - Loading and different methods of loading – Line not terminated in Z0 – Reflection coefficient – calculation of current , voltage, power delivered and efficiency of transmission – Input and transfer impedance - Open and short circuited lines – reflection factor and reflection loss.

Unit II-High Frequency Transmission Lines **08 Hours**

Transmission line equations at radio frequencies – Line of Zero dissipation – Voltage and current on the dissipation less line, Standing Waves, Nodes , Standing Wave Ratio – Input impedance of the dissipation less line - Open and short circuited lines – Power and impedance measurement on lines – Reflection losses – Measurement of VSWR and wavelength.

Unit III-Impedance Matching In High Frequency Lines **10 Hours**

Impedance matching: Quarter wave transformer – Impedance matching by stubs – Single stub and double stub matching – Smith chart – Solutions of problems using Smith chart – Single and double stub matching using Smith chart.

Unit IV-Passive Filters **12Hours**

Characteristic impedance of symmetrical networks – filter fundamentals. Design of filters: Constant K, Low Pass, High Pass, Band Pass, Band Elimination, m-derived sections and composite. **Attenuators and Equalizers:** Attenuators: T, π, Lattice Attenuators, Bridged – T attenuator, L-Type Attenuator. Equalizers: inverse network, series, full series, shunt, full shunt, constant resistance T, constant resistance π, constant resistance lattice and bridged T network

Text books & References Books

1. John D. Ryder, "Networks, Lines and Fields", PHI, 2009.
2. Sudhakar. A, Shyammohan S Palli, "Circuits and Networks – Analysis and Synthesis", Tata McGraw Hill, 4th Edition, 2010

13040515	Advanced Digital Signal Processing	L	T	P	C
	Pre-requisites//Exposure : Signal & System	3	0	0	3

Course Objectives

1. Students learn the essential advanced topics in digital signal processing that are necessary for successful graduate-level research.
2. The course includes a review of the linear constant-coefficient system properties covered in an undergraduate DSP course, and then examines a variety of multirate filter structures, time-varying and adaptive systems, fast algorithms, and other topics.

Course Outcomes: On completion of this course, you should be able to:

1. Master modern signal processing tools including vector spaces, bases and frames, operators, signal expansions and approximation, as well as classical signal processing tools including Fourier and z transforms, filtering, and sampling.
2. Apply the above tools to real-world problems including spectral analysis, filter design, noise cancellation, signal compression, rate conversion, feature extraction, inverse problems, machine learning and justify why these are appropriate tools.

Course Description

Basic concept review of digital signals and systems; computer-aided digital filter design, quantization effects, decimation and interpolation, and fast algorithms for convolution and the DFT; introduction to adaptive signal processing.

Course Content

Unit I: Fourier Transform & inverse Fourier transform 12 lecture hours

Fourier Transform & inverse Fourier transform: Frequency domain design of digital filters, Fourier transform, use of Fourier transform in Signal processing. The inverse Fourier transform, sampling continuous function to generate a sequence, Reconstruction of continuous -time signals from Discrete-time sequences.

Unit II: DFT & FFT & Z transform with Applications 12 lecture hours

Discrete Fourier transforms properties of DFT, Circular Convolution, Fast Fourier Transform, and Realizations of DFT. The Z-transform, the system function of a digital filter, Digital Filter implementation from the system function, the inverse Z- transform, properties & applications, Special computation of finite sequences, sequence of infinite length & continuous time signals, computation of Fourier series & time sequences from spectra.

Unit III: Digital Filter Structure & Implementation 12 lecture hours

Discrete convolution, stability tests, steady state response, Amplitude & Phase characteristics, stabilization procedure, Ideal LP Filter, Physical reliability & specifications. FIR Filters, Truncation windowing & Delays, design example, IIR Filters: Review of design of analog filters & analog frequency transformation. Design of LP filters using impulse invariance method, bilinear transformation, Phase equalizer, digital all pass filters.

Unit IV: Implementation of Filters 8 lecture hours

Realization block diagrams, Cascade & parallel realization, effect of infinite-word length, transfer function of degree 1 & 2, Sensitivity comparisons, effects of finite precision arithmetic on Digital filters.

Text Books

1. "Digital Signal Processing, 4th Edition" by Proakis and Manolakis, Prentice Hall,
2. M. Vetterli, J. Kovacevic, and V. K. Goyal, “Foundation of Signal Processing”, Cambridge University Press, 2014

Reference Books

1. Rabiner & Gold, “Theory & application of digital Signal Processing”, PHI 1992.

13040516	Electromechanical Energy Conversion	L	T	P	C
	Pre-requisites//Exposure : Electrical Technology	3	0	0	3

Course Objectives

To study the working of different electrical machines.

Course Outcomes:

1. Students learn to analyze three phase networks
2. Students learn to analyze magnetic fields and circuits
3. Students learn to analyze principles of electromechanical energy conversion
4. Students learn to analyze performance of transformers
5. Students learn to analyze performance of synchronous generators
6. Students learn to analyze performance of induction motors

Course Content

Unit I: Magnetic Circuits and Induction **10 lecture hours**

Magnetic Circuits, Magnetic Materials and their properties, static and dynamic EMFs, force on current carrying conductor, AC operation of Magnetic Circuits, Hysteresis and Eddy current losses.

Unit II: DC Machines **10 lecture hours**

Basic theory of DC generator, brief idea of construction and working, EMF equation, load characteristics, basic theory of DC motor, concept of back EMF, torque and power equations, load characteristics, starting methods and speed control of DC motors, applications.

Unit III: Synchronous Machine and Synchronous Motor **12 lecture hours**

Constructional features, Armature winding, EMF Equation, Winding coefficients, equivalent circuit and phasor diagram, Armature reaction, O. C. & S. C. tests, Voltage Regulation; Starting methods, Effect of varying field current at different loads, V- Curves.

Unit IV: Three Phase Transformer & Induction Machine **14 lecture hours**

Review of Single phase transformer. Three Phase transformer: Basics & operation. **Induction Machine**: Constructional features, Rotating magnetic field, Principle of operation Phasor diagram, equivalent circuit, torque and power equations, Torque- slip characteristics, no load & blocked rotor tests, efficiency, Induction generator & its applications. Introduction of S**ingle phase Induction Motor, R**epulsion motor. **AC Commutator Motors:** Universal motor, single phase a.c. series compensated motor, stepper motors, servo motor.

Text Books:

1. D. P. Kothari & I. J. Nagrath, “Electric Machines”, Tata Mc Graw Hill
2. Ashfaq Hussain“Electric Machines” Dhanpat Rai & Company

Reference Books:

1. P. S. Bimbhra, “Electrical Machines”, Khanna Publisher
2. Fitzerald, A. E., Kingsley and S. D. Umans “Electric Machinery”, MC Graw Hill.

13040512	Industrial Exposure -II	Learning Schedule			
		L	T	P	C
	Pre-requisites: -- Industrial Training –I	**0**	**0**	**0**	**1**

COURSE OBJECTIVES:

1. To gain first-hand experience of the various departments from utility department to packaging or service engineering in a industry

2. To get the certification in one of the modern tool/technology in respective area.

Course Outcomes

On completion of this course, the students will have a general idea about industry functioning.

Course Content

1. Industrial visit- At-least for one day in one of the reputed industry.

2. During fifth semester students have to earn at least one certification through following program

d) Seminar on new modern technology.

e) Practical workshop on some technical tool

Note: each of programs should be of one to two week duration.

At the end of semester, students have to present through viva voce

13040408	Computer Networks	L	T	P	C
	Pre-requisites//Exposure : Digital Communication	3	0	0	3

Course Objectives

1. To educate with the architecture, protocols and network organization of the Internet
2. To update the trends in innovation approach towards development of high speed networks
3. To learn the challenges involved in developing TCP/IP suite wired cum wireless real networks

Course Outcomes

On completion of this course, the students will be able to

1. Explain the layered architecture of computer networks and its important
2. Reason out the motivating factors to design efficient MAC protocol improving spectrum utilization efficiency
3. Make out the operation of TCP, its application scenarios and constraints in wireless domain

Course Description

This course deals with computer network topologies and OSI reference model. The discussion on MAC protocol and TCP/IP architecture is carried out. This course also deals with routing protocol of mobile networks. At learning this course students will understand the protocols of real networks and technological issues in developing more efficient and high speed real networks

Course Content

Unit I: Network and Services **7 lecture hours**

Approaches to Network design, Network topologies and design constraints, Transmission media - copper and optical fiber, OSI Reference Model; Overview of TCP/ IP, Application Layer Protocols and TCP/IP, Application Layer Protocols and TCP/IP Utilities. Peer-to-peer protocols: Service Models, ARQ Protocols and reliable data transfer service, sliding Window Flow Control.

Unit II: Medium Access Control Protocol **10 lecture hours**

Multiple access communication, Random access scheduling approaches to medium access control, Delay performance of MAC and channelization schemes, LAN Access methods, Introduction to LAN Standards, IEEE 802.5, FDDI, WLAN, Hubs, Bridges and Switches Ethernet networking.

Unit III: Packet Switching Networks **7 lecture hours**

Network Services and Internal Network Operation, Packet Network Topology, Routing in packet Networks, shortest path Algorithms, and Introduction to traffic management & QoS.

Unit IV: TCP/IP Architecture **8 lecture hours**

The Internet Protocol, IP addressing and subnetting, Limitations of IPv4 and Introduction to IPv6, User Datagram protocol, Transmission Control Protocol, Introduction to Internet Routing Protocols.

Unit V: Wireless Routing Protocols **8 lecture hours**

Routing in cellular radio mobile communication networks, Packet radio Routing Internet based mobile ad-hoc networking, communication strategies, routing algorithms Destination sequenced Distance Vector(DSDV),Dynamic source Routing (DSR),Ad-hoc On demand Distance Vector(AODV) &Temporarily Ordered Routing algorithm (TORA),Quality of service

Text Books

1. A. Leon –Garcia, Indra Widjaja, "Communication Networks", Tata McGraw Hill.
2. W. Stallings, "Data and Computer Communication", 7th edition, PHI, New Delhi

Reference Book

3. M.Steen Strub, "Routing in Communication networks", PH, New York.
4. William Stallings, High speed Networks TCP/IP & ATM Design Principles, PH, NY

13040505	Antenna and Wave Propagation	L	T	P	C
	Pre-requisites//Exposure : Electromagnetic Field Theory	3	0	0	3

Course Objectives

The student will learn and understand

1. Fundamental antenna parameters and numerical methods to analyze and differentiate the antennas.
2. Mechanism and models for radio-wave propagation.

Course Outcomes

On completion of this course, the students will be able to

1. Identify basic antenna parameters.
2. Design and analyze antenna arrays.
3. Design and analyze wire and aperture antennas.
4. Identify the characteristics of radio-wave propagation.

Course Description

Antenna and Wave Propagation is to introduce to the students the basics of radiating elements and effect of propagation of radio waves in actual environment. This course provides students with comprehensive coverage of a wide variety of antennas and propagation topics related to numerous communication systems with a particular emphasis on military applications. The course presents fundamental theory together with techniques for the practical design, measurement and application of antennas over the RF (radio-frequency) to milli-metre wave frequency range.

Course Content

Unit – I: Antenna Fundamentals 8 Lectures

Retarded potential - Radiation mechanism, directivity and gain, bandwidth, polarization, co polarization and cross polarization level, beam width, input impedance, bandwidth, efficiency, input impedance, antenna effective length and area, antenna temperature- radiation pattern- Gain- Directivity and Impedance measurements.

Unit – II: Design of Arrays 6 Lectures

Linear Array - Two element array, N-element linear array- broadside array, End fire array-Directivity, radiation pattern. Planar array – array factor, beam width, directivity. Circular array -array factor.

Unit – III: Design of Antennas 10 Lectures

Long wire, V-Antenna, Rhombic antenna, Monopole Antenna - dipole antenna, helical antenna, Spiral antenna, Log periodic antenna, Yagi-Uda antenna. Aperture antenna - Horn antenna, parabolic reflector antenna. Micro-strip antenna.

Unit – IV: Antennas for modern wireless communications 12 Lectures

Antennas for Terrestrial mobile communication - mobile handsets and base stations. Antennas for Satellite Communication- MSAT briefcase terminal and vehicle mounted Antennas. **Wave Propagation: R**eflection, refraction and Transmission, Scattering and diffraction. Propagation Model- Path Loss, Free space loss, Plane earth Loss. Modes of propagation- Ground wave Propagation, Sky wave Propagation, and Space wave, Tropospheric Refraction, Obstruction Loss, Diffraction, and Influence of Clutter. - Tropospheric effects, Ionospheric Effects.

Text Book

1. J. D. Krauss, “Antenna for all Applications”, TMH, 3rd Edition, 2010, ISBN 0-89006-513-6.
2. C. A. Balanis, “Antenna Theory - Analysis and Design”, Third Edition, John Wiley & Sons, 2010. ISBN 0-471-66782-X

Reference Books

1. R. S. Elliot, “Antenna Theory and Design”, IEEE Press, John Wiley, 2005, ISBN-13 978-0-470-01741-8, 3rd edition.
2. K. D. Prasad, “Antennas and Radiating Systems”, Satyaprakasan

	Computer Networking Lab	Learning Schedule			
		L	T	P	C
	Pre-requisites: -- Computer fundamentals & Computer networking	0	0	2	1

Course Objectives

The objective of teaching Applied Numerical Methods lab is to develop the computational skills of the students to solve various mathematical problems by numerical techniques using C programming.

Course Outcomes

Students will be able to solve problems of mathematics using computers and apply their knowledge gain solving real life problems appearing in various engineering applications that are often impossible to solve using analytical techniques.

List of Experiment

1. Program to find a root of a nonlinear equation using the Method of Bisection.
2. Program to find a root of a nonlinear equation using the Method of False Position.
3. Program to find the root of a nonlinear equation using the Newton-Raphson method.
4. Program to obtain the solution of a system of linear equations using Gauss elimination method.
5. Program to obtain the solution of a system of linear equations using Gauss -Seidel method.
6. Program to construct Newton's forward difference interpolation polynomial.
7. Program to construct Lagrange's interpolation polynomial formula.
8. Program to evaluate a definite integral by Trapezoidal rule.
9. Program to evaluate a definite integral by Simpson's rule.
10. Program to find the solution of initial value problem using Euler's method.
11. Program to find the solution of initial value problem using Modified Euler's method.
12. Program to find solution of initial value problem using fourth order Runge Kutta method.
13. Program for solving ordinary differential equation by Milne method.
14. Program for solving elliptic partial differential equation by Liebmann's iteration method.
15. Program for solving parabolic partial differential equation by Crank-Nicolson method.

	Microwave and RF lab	L	T	P	C
	Pre-requisites//Exposure : EMT Basics	0	0	2	1

Course Objectives: The student will learn and understand
1. Analysis and the design of active and passive microwave devices.

Course Outcome: The students will be able to
1. Have knowledge of transmission and waveguide structures.
2. Know how to model and determine the performance characteristics of a microwave circuit or systems.

Course Description: Basic Microwave Engineering laboratory concerns with the implementation of basic principles and applications of Microwave Transmission Lines, Waveguide Components, Microwave Tubes, Microwave Solid State Devices and Microwave Measurements.

List of Experiments:
1. Study of Microwave Components
2. Mode Characteristics of Refl ex Klystron
3. V-I characteristics of GUNN Diode
4. VSWR Measurement of unknown load
5. Study of E-plane & H-plane Tee
6. Study of Magic Tee
7. Study of Directional Coupler
8. Study of Circulator & Isolator
9. Study of transmission line circuits and Micro strip lines.
10. Design microwave small signal and power amplifiers.
11. Design microwave detectors and mixers.
12. Design microwave control circuits.
13. Understand microwave integrated circuits (MICs).
14. Understand MIC processing techniques.

Text Book

1. D. M.Pozar, “Microwave engineering”, John Wiley, 3/e, 2005
2. Samuel Y. Liao, “Microwave Devices and Circuits”, 3/e, PHI, New Delhi, 1987.

Reference Books

1. Rober. E. Collin, “Foundations of Microwave Engineering”, John Wiley, 3/e, 2001
2. Annapurna Dasand S, K. Das, “Microwave Engineering”, Tata Mc Graw-Hill, New Delhi, 2000
3. R. Chatterjee, “Microwave Engineering”, Affiliated East west Press PVT Ltd, 2001
4. O. P. Gandhi, “Microwave Engineering”, Pergamon Press, NY, 1983.

	Bio medical instrumentation	L	T	P	C
	Pre-requisites Exposure : Electrical and electronic measuring devices	3	0	0	3

Course Objectives

1. The course is designed to make the student acquire an adequate knowledge of the physiological systems of the human body and relate them to the parameters that have clinical importance.
2. The fundamental principles of equipment that are actually in use at the present day are introduced.

Course Outcomes

1. To provide an acquaintance of the physiology of the heart, lung, blood circulation and circulation respiration. Biomedical applications of different transducers used.
2. To introduce the student to the various sensing and measurement devices of electrical origin. .

Course Description

To develop an understanding of the measurement principles of medical instrumentation, including biochemical sensors, bio-potential amplifiers, bioelectrical signals (ECG, EEG), measurement of respiratory function, cardiac variables, blood pressure, blood flow as well as medical devices.

Unit I Physiology AND Transducers 9 hours

Cell and its structure , Resting and Action Potential , Nervous system: Functional organization of the nervous system , Structure of nervous system, neurons , synapse ,transmitters and neural communication , Cardiovascular system , respiratory system , Basic components of a biomedical system , Transducers , selection criteria – Piezo electric, ultrasonic transducers – Temperature measurements - Fibre optic temperature sensors.

Unit II Electro – Physiological Measurements 9 hours

Electrodes –Limb electrodes –floating electrodes – Peregelled disposable electrodes - Micro, needle and surface electrodes – Amplifiers: Preamplifiers, differential amplifiers, chopper amplifiers – Isolation amplifier. ECG – EEG – EMG – ERG – Lead systems and recording methods

Unit III Non-Electrical Parameter Measurements 9 hours

Measurement of blood pressure – Cardiac output – Heart rate – Heart sound –Pulmonary function measurements – spirometer – Photo Plethysmography, Body Plethysmography – Blood Gas analysers: pH of blood –measurement of blood pCO2, pO2, finger-tip oxymeter - ESR, GSR measurements .

Unit IV Medical imaging 9 hours

Radio graphic and fluoroscopic techniques – Computer tomography – MRI – Ultrasonography – Endoscopy – Thermography – Different types of biotelemetry systems and patient monitoring – Introduction to Biometric systems

Text books

1. R.S.Khandpur, ‘Hand Book of Bio-Medical instrumentation’, Tata McGraw Hill Publishing Co Ltd., 2003.
2. Leslie Cromwell, Fred J.Weibell, Erich A.Pfeiffer, ‘Bio-Medical Instrumentation and Measurements’, II edition, Pearson Education, 2002 / PHI.

References

1. M.Arumugam, ‘Bio-Medical Instrumentation’, Anuradha Agencies, 2003.

	PIC Microcontroller	Learning Schedule			
		L	T	P	C
	Pre-requisites: Basic C	2	0	0	2

Course Objectives:

1. The aim of this course to provide the student with a detailed understanding of to microcontrollers.
2. The course covers fundamentals, the 8051 architecture, assembly language programming, instruction set, serial communication and interfacing techniques of 8051 microcontroller

Course Outcome:

1. Students will be well equipped to write programs and they have complete knowledge of 8051 architecture

Course Description

The PIC Microcontroller is an electronic device that is easy-to-use in both hardware and software. Sensing the environment by receiving inputs from many sensors, PIC Microcontroller affects its surroundings by controlling lights, motors, and a number of other accessories.

Course Contents

12 HOURS

Unit I: **T**he 8051 architecture- hardware- oscillator and clock-program counter –data pointer-registers-stack and stack pointer-special function registers- -memory organization-program memory-data memory -input / output ports –external memory counter and timer-serial data input / output-interrupts

12 HOURS

Unit-II: 8051 assembly language programming-structure of assembly language assembling and running an 8051 program- addressing modes-accessing memory using various addressing modes-instruction set- arithmetic operations and programs-logical operations and programs -jump and call instructions and programs -i /o pot programs -single bit instructions and programs –timer and counter - and programs 8051 serial communication -connection to rs-232- serial communication programming-interrupts programming

12 HOURS

Unit-III: Introduction to pic micro controller's architecture of pic, pin description, CPU registers, addressingmodes, instruction set

12 HOURS

Unit-IV: Interfacing of different pattern of leds, lcds of different size, seven segment display. Programming for adc application-temperature sensor interfacing with controller, programming for interrupt based applications, programming for serial communication-implementation with real time application, i2c protocol – programming for i2c protocol-real time application

Text book

1. The 8051 microcontrollers and embedded systems : muhammed ali mazidi
2. The 8051 microcontrollers architecture, programming & applications

	Sensors and instrumentation lab	L	T	P	C
	Pre-requisites//Exposure :Knowledge of Basic Electronics	0	0	2	1

Course Objectives

1 .To learn how to visualize and work on laboratory and multidisciplinary tasks.
2 .To demonstrate various Bridges &sensors using simulation and hardware set ups.
To Measure Voltage, Current, Power factor, Power, Energy

Course Outcomes

1 .Have knowledge, to demonstrate the designing and conducting experiments, to analyze and interpret data.
2. Provides the ability to visualize and work on laboratory and multidisciplinary tasks.

Course Description

The Biosensors and Instrumentation module examines the methods used to interface sensors for biological and biomedical applications with electronics. One focus will be on transducers, meaning devices which convert information from one form of energy to another. Students will undertake a "horizon scanning" research exercise to investigate the industrial and research potential of a specific type of biosensor

List of Experiments

1) Calibration of pressure gauges
2) Calibration of resistance temperature detector for temperature measurement
3) Calibration of thermister and RTD
4) Calibration of thermocouple for temperature measurement
5) Calibration of vibration setup
6) Study and calibration of photo and magnetic
Speed pickups for the measurement of speed
7) Measurement of angular displacement using capacitive transducer
8) Measurement of strain gauge
9) Study and calibration of LVDT transducer for displacement measurement

Text Books

Figliola, R. S. , Beasley, Donald E; Theory and design for mechanical measurements; 4th ed; John Wiley, 2006.

	Embedded lab	L	T	P	C
	Pre-requisites//Exposure :Knowledge of Basic c, analog electronics	0	0	2	1

Course Objective

Students have knowledge about the basic functions of embedded systems

Course outcomes

An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

Course Description

In this class, the fundamentals of embedded system hardware and firmware design will be explored. Issues such as embedded processor selection, hardware/firmware partitioning, glue logic, circuit design, circuit layout, circuit debugging, development tools, firmware architecture, firmware design, and firmware debugging will be discussed. The Intel 8051, a very popular microcontroller, will be studied. The architecture and instruction set of the microcontroller will be discussed, and a wirewrapped microcontroller board will be built and debugged by each student. The course will culminate with a significant final project which will extend the base microcontroller board completed earlier in the course

List of Experiments

1. Write an alp to generate 10 khz square wave
2. Write an alp to generate 10 kHz freq. using interrupts.
3. Write an alp to interface one microcontroller with other serial/parallel communication.
4. Write an alp for temperature measurement to display on intelligent LCD display.
5. Write an alp for temperature measurement to display on intelligent LCD display.
6. Develop an embedded system for traffic light controller using microcontroller.
7. Develop an embedded system for automatic motion of a car & subsequent display on LCD using microcontroller.
8. Write an alp to add two numbers & display the result on led
9. Write an alp to add two numbers & display the result on LCD
10. Write an alp to multiply two numbers & display the result on led
11. Write an alp to multiply two numbers & display the result on LCD

Text Books

1. wolf, w. computers as components- principles of embedded computing system design. academic press (indian edition available from harcourt india pvt. ltd., 27m block market, greater kailash ii, new delhi-110 048.)
2. vahid and t. givargis. embedded system design: a unified hardware/software introduction , wiley, 2002.
3. furber, arm system-on-chip architecture, pearson.

	Microprocessors and Microcontrollers	L	T	P	C
	Pre-requisites//Exposure : Digital Design/Computer Organization and Architecture	3	0	0	3

Course Objectives

1. To gain an in-depth understanding of the operation of microprocessors and microcontrollers, machine language programming & interfacing techniques with peripheral devices
2. To learn the concept of designing computer organization and architecture
3. To gain an understanding of applications of microprocessors in designing processor-based automated electronics system.

Course Outcomes

On completion of this course, the students will be able to

1. Explain the internal organization and operation of microprocessors/microcontrollers.
2. Program 8086 Microprocessor, 8051 and PIC Microcontrollers for application specific solution
3. Design microprocessors/microcontrollers-based systems
4. Implement and develop new experiments on microprocessor/microcontroller based systems.

Course Description

Microprocessor and microcontrollers are the most useful electronic chips which are used to design and develop processor and computer based automatic smart electronics systems for home and industry application.

Text Books

1. Barry B Brey, The intel microprocessor: architecture, programming and interfacing, Prentice hall of India, NewDelhi, 2003.ISBN-0138027455, 4th Edition.

2. Mohammad Ali Mazidi and Janice Gillispie Maszidi "The 8051 Microcontroller and Embedded Systems" Pearson education, 2003, ISBN- 9788131710265, 2ndEdition.

Reference Books

1. Kenneth J. Ayla, "The 8051 Micro controller", Thomson learning, 3rd edition, 2004, ISBN-140186158X

2. Alan Clements, "Principles of Computer Hardware", OxfordUniversity Press, 3rd Edition, 2003, ISBN-9780198564539

Course Content

Unit I: Introduction **6 lecture hours**

Introduction to Microprocessors, Microcontrollers and system design – Assembly and High-Level language programming – System Development Environment: assembler, compiler and integrated development environment.

Unit II: 8086 Microprocessor **6 lecture hours**

Architecture and Programming of 8086 microprocessor: pipelining, Instruction sets, addressing modes – Memory addressing, decoding and Memory interfacing – Interrupts and interrupts handling.

Unit III: I/O and Bus Interfacing **9 lecture hours**

Interfacing methods – 8255 PPI interface, 8254 timer interface, 8259 PIC and DMA controller interface – Bus Interface: electrical characteristics, interfacing ISA bus, EISA, PCI bus, LPT, USB and RS232 interface.

Unit IV: 8051 Microcontroller **9 lecture hours**

Introduction to single chip Microcontrollers, Intel MCS-51 family features –8051/8031-architecture – 8051 assembly language programming, addressing modes – Programming interrupts, timers and serial communication – system design with 8051.

	VLSI Design	L	T	P	C
	Pre-requisites//Exposure :Digital Design	3	0	0	3

Course Objectives

The student will learn and understand

1. Transistor-Level CMOS Logic Design.
2. Estimation and Optimization of combinational circuits using RC delay models and logical efforts.

Course Outcomes

The students will be able to

1. Create models of moderately sized CMOS circuits that realize specified digital functions.
2. Have an understanding of the characteristics of CMOs circuit construction.

Course Description

A course in VLSI semiconductor devices, modern CMOS technology, crystal growth, fabrication, and basic properties of silicon wafers. It will focus on lithography, thermal oxidation, (Si/Si) 2, interface, dopant diffusion, ion implantation, thin film deposition, etching, and back-end technology.

Text Books

1. Sung-Mo Kang & Yusuf Leblebici, "CMOS Digital Integrated Circuits – Analysis and Design", 3rd Edition, Tata McGraw-Hill, New Delhi, 2003.
2. Jan M. Rabaey, Anantha Chandrakasan and Borivoje Nikolic, "Digital Integrated Circuits: a design perspective", 2nd Edition, Pearson Education, 2003.

Reference Books

1. David A. Hodges, Horace G. Jackson, Resve A. Saleh, "Analysis and Design of Digital Integrated Circuits: In Deep Submicron Technology", McGraw, 2003.

Course Content

Unit – I: MOS Transistor 12 lecture hours

Introduction to MOS Transistor Theory: nMOS, pMOS Enhancement Transistor, MOSFET as a Switch, Threshold voltage, Body effect. MOS Device Design Equations, Basic DC equations, Short Channel Effects and Device Models - Scaling Theory, Threshold Voltage Variation, Mobility Degradation with Vertical Field, Velocity Saturation, Hot Carrier Effects, Output Impedance Variation with Drain- Source Voltage, MOS Device Models, Small Signal AC Characteristics and Modelling of MOS Transistors using SPICE.

Unit – II: MOS Inverters: Static Characteristics 12 lecture hours

Introduction, Voltage Transfer Characteristic (VTC), Noise Immunity and Noise margins, Resistive-Load Inverter, Inverters with n-Type MOSFET Load and CMOS Inverter, DC Characteristics of CMOS Inverter, Calculation of VIL, VIH, VOL, VOH and VTH, Design of CMOS Inverters, Supply Voltage Scaling in CMOS Inverters, Power and Area considerations.

Unit – III: MOS Inverters: Switching Characteristics 9 lecture hours

Switching Characteristics of CMOS Inverter- Delay-Time Definitions, CMOS Propagation Delay, Calculation of Delay times, Estimation of Interconnect parasitic- Interconnect Capacitance Estimation, Interconnect Resistance Estimation, Layout of an Inverter, Calculation of Interconnect Delay- RC Delay Models.

Unit – IV: CMOS Logic Structures and Subsystem Design 9 lecture hours

Combinational MOS logic circuits- CMOS Logic Circuits (NAND, NOR and Complex Logic Gates, Multiplexers etc.), CMOS Transmission Gates (Pass Gates), Pseudo nMOS logic, Dynamic CMOS logic, Clocked CMOS logic and CMOS Domino logic; **Sequential MOS logic circuits**-Behaviour of Bistable Elements, The SR Latch Circuit, Clocked Latch and Flip-Flop Circuits, CMOS D-Latch and Edge-Triggered Flip-Flop.

Subsystem design process- design of 4-bit shifter, arithmetic building blocks like adders, multipliers and ALU.

	Microprocessors and Microcontrollers Lab	L	T	P	C
	Pre-requisites//Exposure : Digital Design/Computer Organization and Architecture	0	0	2	1

Course Objectives

1. Understanding and implementation of the operation of microprocessors and microcontrollers, machine language programming & interfacing techniques with peripheral devices.

Course Outcomes

On completion of this course, the students will be able to:

1. Program 8086 Microprocessor, 8051 and PIC Microcontrollers for application specific solution
2. Design microprocessors/microcontrollers-based systems.
3. Implement and develop new experiments on microprocessor/microcontroller based systems.

Course Description

Students will be able to design, construct, program, verify, analyze, and troubleshoot fundamental microprocessor interface and control circuits using related equipments.

Text Books

1. Barry B Brey, The intel microprocessor: architecture, programming and interfacing, Prentice hall of India, NewDelhi, 2003.ISBN-0138027455, 4th Edition.
2. Mohammad Ali Mazidi and Janice Gillispie Maszidi "The 8051 Microcontroller and Embedded Systems" Pearson education, 2003, ISBN- 9788131710265, 2ndEdition.

Reference Books

1. Kenneth J. Ayla, "The 8051 Micro controller", Thomson learning, 3rd edition, 2004, ISBN-140186158X
2. Alan Clements, "Principles of Computer Hardware", Oxford University Press, 3rd Edition, 2003, ISBN-9780198564539

List of Experiments:

1. To Add Two Binary Number Each 2 Bytes Long.
2. To Find The Maximum Number. In A Given String (16 Bytes Long) and Store It in Location 0510.
3. To Sort A String of A No. of Bytes In Descending Order.
4. To Multiply An ASCII String Of Eight Numbers By A Single ASCII Digit. The Result Is A String Of Unpacked BCD Digits.
5. To Divide A String Of Unpacked ASCII Digit.
6. A Data String of No. Of bytes (to be specified in CX reg.) Is located From the Starting Address 0500. The Data String Is To Be Converted To Its Equivalent 2's Complement From And The Result Is Be Stored From 0600 Onwards.

Microcontroller Lab (Additional Programs)

1. Addition of 2 numbers and stored result at 3012
2. Subtraction of 2 numbers and stored result at 3012
3. Division of 2 numbers and stored result at 3012
4. Multiplication of 2 numbers and stored result at 3012

	VLSI Design Lab	L	T	P	C
	Pre-requisites//Exposure : Digital Design	0	0	2	1

Course Objectives

The student will learn and understand

1. Transistor-Level CMOS Logic Design.
2. Estimation and Optimization of combinational circuits.

Course Outcomes

The students will be able to

1. Create models of moderately sized CMOS circuits that realize specified digital functions.

Course Description

A course in VLSI design laboratory will provide a practical knowledge for the implementation of analog and digital VLSI circuits.

Text Books

1. Sung-Mo Kang & Yusuf Leblebici, "CMOS Digital Integrated Circuits – Analysis and Design", 3rd Edition, Tata McGraw-Hill, New Delhi, 2003.
2. Jan M. Rabaey, Anantha Chandrakasan and Borivoje Nikolic, "Digital Integrated Circuits: a design perspective", 2nd Edition, Pearson Education, 2003.

Reference Books

1. David A. Hodges, Horace G. Jackson, Resve A. Saleh, "Analysis and Design of Digital Integrated Circuits: In Deep Submicron Technology", McGraw, 2003.
2. David A. Johns and Ken Martin, "Analog Integrated Circuit Design" John Wiley and Sons Inc., 1997.
3. Neil Weste and David Harris, "CMOS VLSI Design: A Circuits and Systems Perspective", 4th Edition, Addison-Wesley, 2010
4. John P.Uyemura, "CMOS Logic Circuit Design", Springer International Edition.2005.Logic Circuit Design", Springer International Edition.2005.

List of Experiments:

(A) Combinational circuits:

1. Write a program of AND, NAND, XOR, NOR, OR, NOT, gates using dataflow and behavioral modeling.
2. Write a program of half adder and full adder using structural modeling.
3. Write a program of 1x4 DEMUX and 4x1 MUX using structural modeling.
4. Write a program of 3x8 DECODER and 8x3 ENCODER.
5. Write a program of 4 bit binary to gray and gray to binary code converter.

(B) Sequential circuits:

1. Write a program of JK, SR, D, T flip flop with reset and preset and study its characteristics.
2. Write a program of shift registers.
3. Write a program to count no. of one's by using variable.
4. Write a program of finite state machine.
5. Write a program of clock divider circuit.

13040601	Technical Skills-IV	L	T	P	C
	Pre-requisites//Exposure	0	0	2	2

Course Objectives

1. To learn the basic concepts of analog communication and analog integrated circuits.
2. To learn the basic concepts of antenna wave propagations.
3. To learn the basic concepts of transmission lines and networks.
4. To learn the basic concepts of microprocessor & microcontroller.
5. To learn the basic concepts of control system.

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

1. Understand the basic concepts of antenna wave propagations.
2. Understand the basic concepts of transmission lines and networks.
3. Understand the basic concepts of microprocessor & microcontroller.
4. Understand the basic concepts of control system.

Course Content

Unit I- Antenna and Wave Propagation 08 Hours

Antenna Fundamentals- gain, directivity, impedance, radiation pattern, design of arrays, design of antennas, Antennas for modern wireless communications, Wave Propagation theory basics**.**

Unit II- Transmission Lines and Networks 08 Hours

General theory of Transmission lines, Transmission line equations at radio frequencies, Reflection coefficient, Reflection losses – Measurement of VSWR and wavelength, Impedance matching, Characteristic impedance of symmetrical networks, filters, Attenuators

Unit III- Microprocessor and Microcontroller 08 Hours

Introduction to Microprocessors, 8086 Microprocessor, I/O and Bus Interfacing- PPI interface, 8254 timer interface, 8259 PIC and DMA controller interface.

Introduction to Microcontrollers, Intel MCS-51 family features, ARM microcontrollers, Advanced Microprocessor Architectures- 286, 486, Pentium; Microcontrollers 8051 systems

Unit IV- Control System 08 Hours

Introduction to Control System- Open loop & closed control, time response of first and second order systems, Routh Hurwitz Stability Criterion, Root locus, polar plots, Bode plots, Nyquist stability criterion, lag and lead-lag networks, state variable technique.

Text Books:

1. Millman J. and Halkias C.C., “Integrated Electronics ", McGraw Hill, 2001, ISBN 0074622455, 9780074622452
2. J. Proakis & M. Salehi, “Communication system engineering”, 2nd edition, Prentice Hall, 2002, ISBN 0130617938, 9780130617934
3. K. D. Prasad, “Antennas and Radiating Systems”, Satyaprakasan
4. Barry B Brey, The Intel microprocessor: architecture, programming and interfacing, Prentice hall of India, New Delhi, 2003.ISBN-0138027455, 4th Edition
5. Nagrath & Gopal, “Control System Engineering”, 4th Edition, New age International, ISBN: 0130980412.
6. Umesh Sinha, “Transmission Lines and Network”, Satya Prakashan Publishing Company, New Delhi, 2012

13040602	Campus to corporate	L	T	P	C
		0	0	4	2
	Pre-requisites//Exposure: Personality Development & Career Building				

Course Description:

Practice makes a man perfect – so says the wise man. The course in this semester hence, focuses on the practice of company sample papers along with mock interviews – general, technical and HR. It aims to give a holistic approach to a student's final preparation.

Course Objectives:

1. To assess the current level of students.
2. To give a real time GD, Interview practice to the students.
3. To prepare students for technical interviews.
4. To prepare the students for the placement process and future career prospects.

Course Outcomes:

At the end of this course, the learner will be:

1. Able to analyze self and make necessary corrections
2. Able to recognize and make use of the strengths
3. Able to structure and express their thoughts during interviews , GD and presentations
4. Able to develop skills for career enhancement

Course Content:

Unit I: Workplace Skills **10 Hours**

1. Workplace Skills
2. Future work skills
3. Career and Motivation
4. Elocution Skills – Brainstorming sessions on Employability skills
5. Technical Skills (Branch Specific) with special reference to previous placement papers of various companies.

Unit II: Resume Writing and Group Discussion **10 Hours**

1. Recap of CV / Resume (Print version).
2. Group Discussion - Types of Group Discussion.
3. Mock Group Discussion – (Assessment by Corporate experts and SLLL Trainers.
4. Technical Skills - (Branch Specific) for e.g. for IT and ITES Basics of C, C++ etc.

Unit III: Interview Skills **10 Hours**

1. Comprehensive Online Tests contd.
2. Interview Skills
3. Mock Interview (Assessment by Corporate experts and SLLL Trainers)
4. Individual Video clip of students' introduction
5. Technical Interview
6. HR round Interview

Text Books:

1. SLLL own text book

Reference Books:

1. Delivering Employability Skills in the Lifelong Learning Sector by Ann Gravells, ISBN-10: 1844452956
2. Sample Papers of Various companies
3. Real world HR interviews from companies across various sectors like IT, ITES, Manufacturing, etc.

13040603	Probability & Statistics	L	T	P	C
	Pre-requisites//Exposure:	3	0	0	3

Course Description:

The course begins with the theoretical study of probability distributions which is widely used in all engineering applications. The student is then introduced to the logic as well as the technical side of the main forms of inference: point estimation, interval estimation and hypothesis testing. Special tests of significance and ANOVA are also dealt with. Lastly, the course emphasizes on the concepts of Correlation and Regression and different types of curve fitting by the method of least squares are discussed.

Course Objectives:

1. To give an exposure to the students the basic concepts of Probability and Statistical methods and their application.
2. To serve as a foundation to analyze problems in Science and Engineering applications through Statistical testing Method.

Course Outcomes:On completion of this course, the students are expected to learn

1. Basics of Probability distributions
2. Various tests of Hypothesis and Significance

Course Content:

Unit I: Probability Distributions 12 Hours

Review of basic probability, Random variables, Probability Distribution, Mathematical Expectation and Variance of Probability distribution, Standard discrete distributions: Binomial, Poisson and Geometric distributions, Probability density function, Cumulative distribution function, Expectation and Variance, Standard continuous distributions - Uniform, Normal, Exponential, Joint distribution and Joint density functions.

Unit II: Sampling and Estimation Theory 10 Hours

Population and Sample, Statistical inference, Sampling with and without replacement, Random samples, Population parameters, Sample statics, Sampling distributions, Sample mean, Sampling distribution of means, Sample variances, Sampling distribution of variances, Case where population variances is unknown, Unbiased estimates and efficient estimates, point estimate and Interval Estimates, Confidence Interval estimates of population parameters, Confidence intervals for variance of a Normal distribution, Maximum likelihood estimates.

Unit III: Tests of Hypothesis and Significance 10 Hours

Statistical hypothesis, Null and Alternate hypothesis, test of hypothesis and significance, Type I and Type II errors, Level of Significance, Tests involving the Normal distribution, One-Tailed and Two-Tailed tests, P value. Special tests of significance for Largesamples and Small samples (F, chi- square, z, t- test), ANOVA.

Unit IV: Correlation and Regression 10 Hours

Correlation, Rank correlation, Regression Analysis, Linear and Non linear Regression, Multiple regression, Curve fitting by method of least squares, fitting of straight lines, polynomials, exponential curves.

Text books:

1. R. E. Walpole, R. H. Mayers, S. L. Mayers and K. Ye, (2007), Probability and Statistics for Engineers and Scientists,8th Edition, Pearson Education.

2. Sheldon M. Ross, (2011), Introduction to Probability and Statistics for Engineers and Scientists, 4th Edition, Academic Foundation.

Reference books:

1. Douglas C. Montgomery, (2012), Applied Statistics and Probability for Engineers, 5th Edition, , Wiley India

2. Spiegel, M. R., Schiller, J. and Srinivasan, R. A., (2010), Probability & Statistics, 3rdEdition, TataMcGraw Hill,

13040604	Industrial Economics & Management	L	T	P	C
	Pre-requisites//Exposure- Economics	2	0	0	2

Course description:

The course describes the basics of demand and demand forecasting. It explains cost functions, cost control, cost reduction and pricing techniques.

Course objectives:

1. To describe the role of the company in the society, the different business cultures, and how companies are organized and managed from a business concept to ongoing operations with the support of strategic planning, formulation ofObjectives and management control.
2. To describe central theories within the field of industrial management, such as costing, and to master terminology within the field. Furthermore, to have the ability to use tools in fields such as costing and investment analysis.

Course outcomes:

1. Get an idea of Pricing Practices.
2. Get an idea of Market Equilibrium and Price determination.
3. Develop Strategies to incorporate knowledge of good practices of foreign market in indigenous market.

Course content:

Unit I: Introduction **10 Hours**

Introduction: The Scope and Method of Managerial economics – Fundamental Economics concepts Managerial Economics with other subjects -Objectives of the Firm.

Unit II: Demand and Supply Analysis **10 Hours**

Meaning, Types and Determinants – Demand estimation- Demand elasticity for decision making Business and Economic forecasting: Qualitativeand Quantitative methods – Supply analysis: Meaning, elasticity and determinants – Market equilibrium and price determination.

Unit III: Production Economics **10 Hours**

Production and Production function – Types – Estimation – Returns to Scale – Economies and Diseconomies of Scale and Economies of Scope.Factor Inputs - Input-Output Analysis.

Unit IV: Market Structure **10 Hours**

Perfect Competition – Imperfect Competition: Monopoly – Monopolistic – Oligopolistic Strategy, Cartels, Cournot, Kinked Demand and Price Leadership. Oligopolistic Rivalry & Theory of Games – Measurement of economic concentration – Policy against monopoly and restrictive trade practices - Competition Law – Pricing Practices: Objectives – Determinants – Pricing Methods – Government Policies and Pricing.

Unit V: Introduction to Macroeconomics **10 Hours**

Circular Flow of Income and Expenditures – Components of National Income and its significance - Measuring Gross Domestic Product (GDP) –Inflation and Business Cycles – Government Fiscal and Monetary Policy - Balance of payments – Foreign exchange markets

Text Books

1. P.L. Mehta – Managerial Economics Analysis, Problems and cases, Sultan Chand & Co. Ltd., 2001

Reference Books

1. Peterson and Lewis: Managerial Economics, 4th Ed., Prentice Hall , 2004
2. Dholakia and Oza: Microeconomics for Management Students, 2nd Edition, Oxford University Press
3. Gregory Mankiw: Principles of Microeconomics, Havcourt Asia Publishers, 2001
4. Mote and paul – Managerial Economics, Tata McGraw Hill, 2001
5. Varshney R land Maheswari K L – Managerial Economics, Sultan Chand, 2000.

13040610	Digital Image Processing	L	T	P	C
	Pre-requisites//Exposure : Signal Processing	3	0	0	3

Course Objectives

1. To impart the basic concepts of image segmentation and shaping
2. To apply different types signal processing techniques in image processing

Course Outcomes

On completion of this course, the students will be able to

1. Know Basics of Image formation and transformation using sampling and quantization
2. Define different types of signal processing techniques used for image sharpening and smoothing
3. Perform and demonstrate the compression and coding techniques used for image data

Course Description

Digital image processing is a fascinating subject in several aspects. Human beings perceive most of the information about their environment through their visual sense. While for a long time images could only be captured by photography, we are now at the edge of another technological revolution which allows image data to be captured, manipulated, and evaluated electronically with computers. With breathtaking pace, computers are becoming more powerful and at the same time less expensive, so that widespread applications for digital image processing emerge.

Course Content

Unit I: Introduction to Image Processing 8 lecture hours

Image formation, image geometry perspective and other transformation, sterio imaging elements of visual perception. Digital Image-sampling and quantization serial & parallel Image processing.

Unit II: Signal Processing 8 lecture hours

Signal Processing - Fourier, Walsh-Hadmard discrete cosine and Hotelling transforms and their properties, filters, correlators and convolvers. Image enhancement-Contrast modification. Histogram specification, smoothing, sharpening, frequency domain enhancement, pseudo-colour Enhancement.

Unit III: Image Restoration 8 lecture hours

Image Restoration-Constrained and unconstrained restoration Wiener filter , motion blur remover, geometric and radiometric correction Image data compression-Huffman and other codes transform compression, predictive compression two tone Image compression, block coding, run length coding, and contour coding.

Unit IV: Segmentation Techniques 12 lecture hours

Segmentation Techniques-thresholding approaches, region growing, relaxation, line and edge detection approaches, edge linking, supervised and unsupervised classification techniques, remotely sensed image analysis and applications; **Shape Analysis:** – Gestalt principles, shape number, moment Fourier and other shape descriptors, skelton detection, Hough transform, topological and texture analysis, shape matching.

Text Books

1. Ganzalez and Wood, “Digital Image Processing”, Addison Wesley, 1993
2. Anil K. Jain, “Fundamental of Image Processing”, Prentice Hall of India

Reference Books

1. Rosenfeld and Kak, “Digital Picture Processing” vol. I & vol. II, Academic, 1982
2. Ballard and Brown, “Computer Vision”, Prentice Hall, 1982.
3. Wayne Niblack, “An Introduction to Digital Image Processing”, Prentice Hall, 1986
4. Milan Sonka, Vaclav Hlavac, Roger Boyle, “Image Processing, Analysis and Machine Vision”, Vikas Publications

13040611	Linear Integrated circuits	Learning Schedule			
		L	T	P	C
	Pre-requisites: Analog devices	3	0	0	3

Course Objectives:

1. To teach the basic concepts in the design of electronic circuits using linear integrated circuits and their applications in the processing of analog signals.

Course Outcome:

1. To introduce the basic building blocks of linear integrated circuits.
2. To teach the linear and non-linear applications of operational amplifiers.

Course Description

This is a course on the design and applications of operational amplifiers and analog integrated circuits. This course introduces basic op-amp principles and show how the op-amp can be used to solve a variety of application problems.

Unit I: IC Fabrication and Circuit Configuration for Linear IC 9 hours

Advantages of IC's over discrete components – Manufacturing process of monolithic IC's – Construction of monolithic bipolar transistor – Monolithic diodes – Integrated Resistors – Monolithic Capacitors – Inductors. Current mirror and current sources, Current sources as active loads, Voltage sources, Voltage References, BJT Differential amplifier with active loads, General operational amplifier stages -and internal circuit diagrams of IC 741, DC and AC performance characteristics, slew rate, Open and closed loop configurations.

Unit-II: Applications of Operational Amplifiers 9 hours

Sign Changer, Scale Changer, Phase Shift Circuits, Voltage Follower, V-to-I and I-to-V converters, adder, subtractor, Instrumentation amplifier, Logarithmic amplifier, Antilogarithmic amplifier, Comparators, Schmitt trigger, Precision rectifier, peak detector, clipper and clamper, Low-pass.

UNIT III Analog Multiplier And Pll 9 hours

Analog Multiplier using Emitter Coupled Transistor Pair – Gilbert Multiplier cell – Variable transconductance technique, analog multiplier ICs and their applications, Operation of the basic PLL, Closed loop analysis, Voltage controlled oscillator, Monolithic PLL IC 565, application of PLL for AM detection, FM detection, FSK modulation and demodulation and Frequency synthesizing.

UNIT IV Analog To Digital and Digital To Analog Converters 8

Analog and Digital Data Conversions, D/A converter – specifications – weighted resistor type, R-2R Ladder type, Voltage Mode and Current-Mode *R – 2R* Ladder types – , A/D Converters – specifications – Successive Approximation type – Single Slope type – Dual Slope type – A/D Converter using Voltage-to-Time Conversion – Over-sampling A/D Converters.

TEXT BOOKS:

1. david a.bell, 'op-amp & linear ics', oxford, 2013.
2. d.roy choudhary, sheil b.jani, 'linear integrated circuits', ii edition, new age, 2003.
3. ramakant a.gayakward, 'op-amps and linear integrated circuits', iv edition, pearson education,

13040612	Cryptography and Network Security	L	T	P	C
	Pre-requisites//Exposure : Communication & Networking	3	0	0	3

Course Objectives

1. Understand security concepts, Ethics in Network Security.
2. Understand security threats, and the security services and mechanisms to counter them
3. Comprehend and apply relevant cryptographic techniques
4. Comprehend security services and mechanisms in the network protocol stack
5. Comprehend and apply authentication services and mechanisms

Course Outcomes

On completion of this course, the students will be able to
Should be able to identify network security threats and determine efforts to counter them
1) Should be able to write code for relevant cryptographic algorithms.
2) Should be able to write a secure access client for access to a server
3) Should be able to send and receive secure mails

Course Description

Cryptography and network security, to study various aspects of Network Security Attacks, Services and Mechanisms.

Course Content

Unit 1 **12 Lecture hours**

Introduction: The need for security-security approaches-principles of security-Plain Text and Cipher Text-substitution and Transposition Techniques-Encryption and Decryption-Symmetric and Asymmetric Cryptography-Stenography-key range and key size-types of attacks

Unit 2 **8 Lecture hours**

Symmetric Key Cryptographic Algorithms: Algorithm types and modes-overview of symmetric key cryptography-DES-IDEA-RC5-BLOWFISH-AES-Differential and Linear Cryptanalysis.

Unit 3 **8 lecture hours**

Asymmetric Key Cryptographic Algorithms: Overview of asymmetric key cryptography- RSA algorithm-symmetric and asymmetric key cryptography together-digital signatures-knapsack algorithm-some other algorithms.

Public Key Infrastructure: Introduction-Digital certificates- Private Key management-The PKIX model-Public Key Cryptography Standards- XML, PKI and Security

Unit 4 **10 lecture Hours**

Network Security: Brief Introduction to TCP/IP- firewalls-IP security-Virtual Private Networks case studies on cryptography and security.

Text Book:

1. Cryptography and Network security, Atul Kahate, Tata McGraw-Hill Pub company Ltd., New Delhi

Reference Books:

1) Network Security Private Communication in a public world, Charlie Kaufman, Radia Perlman & Mike Speciner, Prentice Hall of India Private Ltd., New Delhi
2) Network Security Essentials Applications and Standards, William Stallings, Pearson Education, New Delhi
3) Network Security: The Complete Reference by Roberta Bragg, Mark Phodes-Ousley, Keith Strassberg Tata Mcgraw-Hill

13040613	Computer Arcitecture	L	T	P	C
	Pre-requisites//Exposure : Basic of Computer & Digital Electronics	3	1	0	3

Course Objectives

To have a thorough understanding of the basic structure and operation of a digital computer.

1. To discuss in detail the operation of the arithmetic unit including the algorithms & implementation of fixed-point and floating-point addition, subtraction, multiplication & division.
2. To study in detail the different types of control and the concept of pipelining. To study the hierarchical memory system including cache memories and virtual memory.
3. To study the different ways of communicating with I/O devices and standard I/O interfaces.

Course Outcomes

At the end of course, the students should be able to:

1. Design arithmetic & logic units.
2. Design & analyses pipelined control units.
3. Evaluate performance of memory systems.
4. Understand parallel processing units.

Course Description

To discuss the basic structure of a digital computer and to study in detail the organization of the Control unit, the Arithmetic and Logical unit, the Memory unit and the I/O unit.

Course Content

Unit I: Basic Structure Of Computers **10 lecture hours**

Functional units - Basic operational concepts - Bus structures -
Software performance – Memory locations and addresses – Memory operations – Instruction and instruction sequencing – Addressing modes – Assembly language – Basic I/O operations – Stacks and queues.

Unit II: Arithmetic Unit **12 lecture hours**

Addition and subtraction of signed numbers – Design of fast adders – Multiplication of positive numbers - Signed operand multiplication and fast multiplication – Integer division – Floating point numbers and operations; **Basic Processing Unit:** Execution of a complete instruction – Multiple bus organization – Hardwired control – Micro programmed control - Pipelining – Basic concepts – Data hazards – Instruction hazards – Influence on Instruction sets – Data path and control consideration – Superscalar operation.

Unit III: Memory System **10 lecture hours**

Basic concepts – Semiconductor RAMs - ROMs – Speed - size and cost – Cache memories - Performance consideration – Virtual memory- Memory Management requirements – Secondary storage.

Unit IV: I/O Organization **8 lecture hours**

Accessing I/O devices – Interrupts – Direct Memory Access – Buses – Interface circuits – Standard I/O Interfaces (PCI, SCSI and USB).

Text Books

1. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, 5th Edition “Computer Organization”, McGraw-Hill, 2002.

Reference Books

1. William Stallings, “Computer Organization and Architecture – Designing for Performance”, 6th Edition, Pearson Education, 2003.
2. David A. Patterson and John L. Hennessy, “Computer Organization and Design: The hardware / software interface”, 2nd Edition, Morgan Kaufmann, 2002.
3. John P. Hayes, “Computer Architecture and Organization”, 3rd Edition, McGraw-Hill, 1998.

13040614	ASIC Design	L	T	P	C
	Pre-requisites//Exposure : VLSI design	3	0	0	3

Course Objectives

1. To study the design flow of different types of ASIC.
2. To familiarize the different types of programming technologies and logic devices.
3. To analyze the synthesis, Simulation and testing of systems.
4. To know about different high performance algorithms and its applications in ASIC

Course Outcomes

1. After completing this course, the student would have gained knowledge in the circuit design aspects at the next transistor and block level abstractions of FPGA and ASIC design.
2. In combination with the course on CAD for VLSI, the student would have gained sufficient theoretical knowledge for carrying out FPGA and ASIC designs.

Course Description

An application-specific integrated circuit (ASIC) is an integrated circuit (IC) customized for a particular use, rather than intended for general-purpose use. Application-specific standard products (ASSPs) are intermediate between ASICs and industry standard integrated circuits like the7400 or the 4000 series.

Course Content

Unit I: Introduction to ASICS, CMOS Logic and ASIC Library Design 8 Lecture hours

Types of ASICs - Design flow - CMOS transistors - Combinational Logic Cell – Sequential logic cell - Data path logic cell - Transistors as Resistors - Transistor Parasitic Capacitance- Logical effort.

Unit II: ASIC Physical Design 8 lecture hours

System partition -partitioning - partitioning methods – interconnect delay models and measurement of delay - floor planning - placement – Routing: global routing - detailed routing - special routing - circuit extraction – DRC

Unit III: Logic Synthesis, Simulation and Testing 8 lecture hours

Design systems - Logic Synthesis - Half gate ASIC -Schematic entry - Low level design language - PLA tools -EDIF- CFI design representation. Verilog and logic synthesis -VHDL and logic synthesis - types of simulation -boundary scan test - fault simulation - automatic test pattern generation.

Unit IV: Programmable ASICS, ASIC Logic Cells and I/O Cells 14 lecture hours

Anti fuse - static RAM - EPROM and EEPROM technology - Actel ACT - Xilinx LCA –Altera FLEX - Altera MAX DC & AC inputs and outputs - Clock & Power inputs - Xilinx I/O blocks; **FPGA:** Logic blocks, routing architecture, Design flow technology - mapping for FPGAs, Xilinx XC4000 - ALTERA's FLEX 8000/10000, ACTEL's ACT-1,2,3 and their speed performance

Text Books

1. M. J. S. Smith, " Application - Specific Integrated Circuits", Pearson,2003
2. Douglas J. Smith, HDL Chip Design, Madison, AL, USA: Doone Publications, 1996

Reference Books

1. P. K. Chan & S. Mourad, Digital Design Using Field Programmable Gate Array, Prentice Hall, 1994.
2. F. Nekoosa, Timing Verification of Application-Specific Integrated Circuits (ASICs).Prentice Hall PTR, 1999.
3. Wayne Wolf, FPGA-Based System Design, Prentice Hall PTR, 2004.
4. Steve Kilts, "Advanced FPGA Design," Wiley Inter-Science

13040615	Microwave & Radar	L	T	P	C
	Pre-requisites//Exposure : Electromagnetic Theory basics	3	1	0	3

Course Objectives

1. To understand the theoretical principles underlying microwave devices and networks.
2. To design microwave components such as power dividers, hybrid junctions, microwave filters, ferrite devices, and single-stage microwave transistor amplifiers.
3. To understand and quantify the effects of noise in microwave systems.
4. To quantify the signal and noise characteristics of microwave systems such as communication networks, radars, and radiometers, and relate this to the design. process

Course Outcomes

1. Knowledge about Microwave Solid State Devices.
2. Ability to identify and study the performance of Wave Guides and Resonators
3. Study the performance of Microwave Components.
4. Study the comparative performance analysis of Microwave Tubes and Circuits.
5. Knowledge about Microwave Measurements.
6. Study the measurement of impedance using smith chart.

Course Description

Microwave & Radar system pertains to the study and design of microwave circuits, components, and systems. Fundamental principles are applied to analysis, design and measurement techniques in this field. The short wavelengths involved distinguish this discipline from Electronic engineering. This is because there are different interactions with circuits, transmissions and propagation characteristics at microwave frequencies.

Course Content

Unit I: Waveguides **10 lecture hours**

Introduction, comparison with transmission lines, propagation in TE & TM mode, rectangular wave guide, TEM mode in rectangular wave guide, characteristic impedance, introduction to circular waveguides and planar transmission lines.

Unit II: Microwave Components & Tubes **12 lecture hours**

Directional couplers, tees, hybrid ring, S-parameters, attenuators, cavity resonators ,mixers & detectors, matched Load, phase shifter ,wave meter, Ferrite devices: Isolators, circulators; **Microwave Tubes:** Limitation of conventional tubes; Construction, operation and properties of Klystron amplifier, reflex Klystron, magnetron, TWT , BWO , crossed field amplifiers.

Unit IV: Microwave Solid State Device **8 lecture hours**

Varactor diode, Tunnel diode, Schottky diode, GUNN diode, IMPATT, TRAPATT and PIN diodes. MASER, parametric amplifiers.

Unit V: Microwave Measurements **6 lecture hours**

Power measurement using calorimeter & barometers, measurement of SWR, frequency, wavelength and impedance. Microwave bridges.

Unit VI: Introduction to Radar **12 lecture hours**

Block Diagram and operation, Radar Frequencies, Simple form of Radar Equation, Prediction of Range Performance, Pulse Repetition frequency and Range Ambiguities, Applications of Radar.

Text Books

1. Microwave devices and circuits :Samuel Liao; PHI
2. Microwave devices & Radar Engg: M. Kulkarni; Umesh

Reference Books

1. Microwaves and Radar : A.K. Maini; Khanna
2. Microwave Engineering by A Dass and S K Dass

13040616	Lab view	L	T	P	C
	Pre-requisites//Exposure -- Matlab	3	0	0	3

Chapter 1: Introduction to Automation **10hrs**

Basic Components of Automation, Hardware Classification of Automation, Lab VIEW Environment Basics: Front Panel, Block Diagram, Controls Palette, Numeric Sub Palette, Boolean Sub Palette, String & Path Sub Palette , Function Palette, Tools Palette, Wiring, Toolbar, Execution

Chapter 2: Common Tools in Lab VIEW **10 hrs**

Selecting a Tool, Shortcut Menus, Property Dialog Boxes, Front Panel Window Toolbar, Block Diagram Window Toolbar, Debugging Tools in Lab VIEW

Chapter 3: Programming in LabVIEW **15 hrs**

Data Structures, , Arrays, Auto-Indexing, Array Functions, Clusters, Cluster Order, Cluster Elements, Enumerated data, Working with Strings, Execution Structures, While loops, for loops, Case structures, Passing Data between Loop Iterations – shift registers, Handling Errors – error handling and error clusters.

Chapter 4: Working with Projects **10 hrs**

Project Explorer, Deployment, Exercises; Design Techniques: Force Program Flow, Shift Register, State Programming Architecture, Multiple Loops/Parallel programming, Template

*Study material is readily available on internet. Students are required to use the digital resources related to LabVIEW.

13040617	Mobile Computing	L	T	P	C
Pre-requisites//Exposure	Semiconductor Devices and Circuits	3	1	0	3

Course Objectives

1. Introduction of an advanced element of learning in the field of wireless communication.
2. The students to the concepts of wireless devices and mobile computing.
3. To understand the use of transaction and e-commerce principles over such devices to support mobile business concepts.
4. To appreciate the social and ethical issues of mobile computing, including privacy.

Course Outcomes

On completion of this course, the students will be able to

1. A working understanding of the characteristics and limitations of mobile hardware devices including their user-interface modalities.
2. A comprehension and appreciation of the design and development of context-aware solutions for mobile devices.
3. An awareness of professional and ethical issues, in particular those relating to security and privacy of user data and user behavior.

Course Description

Mobile computing is human–computer interaction by which a computer is expected to be transported during normal usage, which allows for transmission of data, voice and video. Mobile computing involves mobile communication, mobile hardware, and mobile software. Communication issues include ad hoc networks and infrastructure networks as well as communication properties, protocols, data formats and concrete technologies. Hardware includes mobile devices or device components. Mobile software deals with the characteristics and requirements of mobile applications.

Course Content

Unit I: Introduction to Mobile Communications and Computing 12 lecture hours

Introduction to MC, limitations, and architecture; **GSM:** Mobile services, System architecture, Radio interface, Protocols, Localization & calling, Handover, Security & New data services.

Unit II: Wireless) Medium Access Control 8 lecture hours

(Motivation for a specialized MAC (Hidden and exposed terminals, near and far terminals), SDMA, FDMA, TDMA, CDMA.

Unit III: Mobile Network Layer and Transport Layer 12 lecture hours

Mobile IP (Goals, assumptions, entities and terminology, IP packet delivery, agent advertisement and discovery, registration, tunneling and encapsulation, optimizations), Dynamic Host Configuration Protocol (DHCP); Traditional TCP, Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/fast recovery, Transmission/time-out freezing, Selective retransmission, Transaction oriented TCP.

Unit IV: Database Issues 8 lecture hours

Hoarding techniques, caching invalidation mechanisms, client server computing with adaptation, power-aware and context-aware computing, transactional models, query processing, recovery, and quality of service issues.

Text Books

1. Jochen Schiller, “Mobile Communications”, Addison-Wesley.
2. Stojmenovic and Cacute, “Handbook of Wireless Networks and Mobile Computing”, Wiley, 2002,

Reference Books

1. Reza Behravanfar, “Mobile Computing Principles: Designing and Developing Mobile Applications with UML and XML”, ISBN: 0521817331, Cambridge University Press, October 2004

13040609	Industrial Training –II	Learning Schedule			
		L	T	P	C
	Pre-requisites: -- Industrial exposure –I	-	-	-	1

COURSE OBJECTIVES:

1. To gain first-hand experience of working as an engineering professional, including the technical application of engineering knowledge.
2. To experience the discipline of working in a professional organization and multidisciplinary team.
3. To develop technical, interpersonal and communication skills.

Course Outcomes

On completion of this course, the students will be able to get the structure of industry. He will know the various departments of industry & how industry works.

Course Content

1. After 6th semester & before 7th semester during summer vacation period
2. Duration for training should be Twenty days to thirty days.
3. It can be either in Industry for study the functioning of organization or one certification course from some government approved/certified body.
4. At the end of training students have to submit a project or assignment allotted by industry.
5. Students have to submit three spiral binding report & PPT presentation along with project.

	Microprocessors and Microcontrollers	L	T	P	C
	Pre-requisites//Exposure : Digital Design/Computer Organization and Architecture	3	0	0	3

Course Objectives

1. To gain an in-depth understanding of the operation of microprocessors and microcontrollers, machine language programming & interfacing techniques with peripheral devices
2. To gain an understanding of applications of microprocessors in designing processor-based automated electronics system.

Course Outcomes

On completion of this course, the students will be able to

5. Explain the internal organization and operation of microprocessors/microcontrollers.
6. Program 8086 Microprocessor, 8051 and PIC Microcontrollers for application specific solution
7. Implement and develop new experiments on microprocessor/microcontroller based systems.

Course Description

Microprocessor and microcontrollers are the most useful electronic chips which are used to design and develop processor and computer based automatic smart electronics systems for home and industry application. Students learn CPU architecture, memory interfaces and management, coprocessor interfaces, bus concepts, bus arbitration techniques, interfacing of systems using AD/DA, serial I/O devices, DMA, interrupt control devices, including design, construction, and testing of dedicated microprocessor systems (static and real-time

Course Content

Unit I: Introduction 8 lecture hours

Introduction to Microprocessors, Microcontrollers and system design – Assembly and High-Level language programming – System Development Environment: assembler, compiler and integrated development environment.

Unit II: 8086 Microprocessor & interfacing 12 lecture hours

Architecture and Programming of 8086 microprocessor: pipelining, Instruction sets, addressing modes – Memory addressing, decoding and Memory interfacing – Interrupts and interrupts handling. **I/O Interfacing:** 8255 PPI interface, DMA controller interface.

Unit III: 8051 Microcontroller 12 lecture hours

Introduction to single chip Microcontrollers, Intel MCS-51 family features –8051/8031-architecture – 8051 assembly language programming, addressing modes – Programming interrupts, timers and serial communication – system design with 8051.

Applications of microprocessor and Microcontrollers in data acquisition systems, process control, signal processing, data communication and distributed computing and networking.

Unit IV: Introduction to Embedded Systems: 12 lecture hours

System level interfacing design; Advanced Microprocessor Architectures- 286, 486; Introduction to RISC processors; ARM microcontrollers; Embedded system design methodologies.

Text Books

1. Barry B Brey, The Intel microprocessor: architecture, programming and interfacing, Prentice hall of India, NewDelhi, 2003.ISBN-0138027455, 4th Edition

2. Mohammad Ali Mazidi and Janice Gillispie Maszidi "The 8051 Microcontroller and Embedded Systems" Pearson education, 2003, ISBN- 9788131710265, 2ndEdition

Reference Books

1. Kenneth J. Ayla, "The 8051 Micro controller", Thomson learning, 3rd edition, 2004, ISBN-140186158X

2. Alan Clements, "Principles of Computer Hardware", OxfordUniversity Press, 3rd Edition, 2003, ISBN-9780198564539

13040606	VLSI Design	L	T	P	C
	Pre-requisites//Exposure: Digital Design	3	1	0	3

Course Objectives: The student will learn and understand

1. Transistor-Level CMOS Logic Design.
2. Estimation and Optimization of combinational circuits using RC delay models and logical efforts.

Course Outcomes: The students will be able to

1. Create models of moderately sized CMOS circuits that realize specified digital functions.
2. Have an understanding of the characteristics of CMOs circuit construction.

Course Description

A course in VLSI semiconductor devices for designing of Various IC circuits.

Course Content

Unit – I: MOS transistor **9 lecture hours**

NMOS & PMOS - Enhancement & Depletion Mode, MOSFET as a Switch, Threshold voltage, Body effect. MOS Device Design Equations, Basic DC equations, Short Channel Effects and Device Models - Scaling Theory, Threshold Voltage Variation, Mobility Degradation with Vertical Field, Velocity Saturation, Hot Carrier Effects, Output Impedance Variation with Drain- Source Voltage, MOS Device Models, Small Signal AC Characteristics and Modelling of MOS Transistors using SPIC; **MOS Inverters(Static Characteristics): V**voltage Transfer Characteristic (VTC), Noise Immunity and Noise margins, Resistive-Load Inverter, NMOSFET and CMOS Inverter: DC Characteristics of CMOS Inverter, Analysis: Scaling in CMOS Inverters, Power and Area considerations.

Unit – II: MOS inverters: Switching Characteristics & Interconnect Effects 9 lecture hours

CMOS Propagation Delay, Calculation of Delay times, Estimation of Interconnect parasitic-Interconnect Capacitance Estimation, Interconnect Resistance Estimation, Layout of an Inverter, Calculation of Interconnect Delay- RC Delay Models, Elmore Delay, Buffer Chains, Low Swing Drivers, Power Dissipation-Switching, Short - Circuit & Leakage Components of Energy & Power, Power-Delay Product, Power Distribution and Performance Optimization of Digital Circuits by Logical Effort Sizing; CMOS Ring Oscillator ckt.

Unit – III: CMOS Logic Structures and Subsystem Design **9 lecture hours**

CMOS Logic gate Circuits, Transmission Gates, Pseudo nMOS logic, Dynamic logic, Clocked logic and CMOS Domino logic. Behaviour of Bistable Elements, SR Latch Circuit, Clocked Flip-Flop Circuits, CMOS D-FF; 4-bit shifter, adders, multipliers and ALU.

Unit – IV: Semiconductor Memories and Low-Power CMOS Logic Circuits 9 lecture hours

Semiconductor memories: non-volatile and volatile memory devices, flash memories, SRAM Cell Design, Differential Sense Amplifiers, DRAM Design, Single Ended Sense Amplifier, Overview of Power Consumption, Low-Power Design Through Voltage Scaling, Estimation and Optimization of Switching Activity, Reduction of Switched Capacitance and Adiabatic Logic Circuits

Text Books

1. Sung-Mo Kang & Yusuf Leblebici, "CMOS Digital Integrated Circuits – Analysis and Design", 3rd Edition, Tata McGraw-Hill, New Delhi, 2003.

2. Jan M. Rabaey, Anantha Chandrakasan and Borivoje Nikolic, "Digital Integrated Circuits: a design perspective", 2nd Edition, Pearson Education, 2003.

Reference Books

1. David A. Hodges, Horace G. Jackson, Resve A. Saleh, "Analysis and Design of Digital Integrated Circuits: In Deep Submicron Technology", McGraw, 2003.

2. David A. Johns and Ken Martin, "Analog Integrated Circuit Design" John Wiley and Sons Inc., 1997.

3. Neil Weste and David Harris, "CMOS VLSI Design: A Circuits and Systems Perspective", 4th Edition, Addison-Wesley, 2010

	Microprocessors and Microcontrollers Lab	L	T	P	C
	Pre-requisites//Exposure: Digital Design/Computer Organization and Architecture	0	0	2	1

Course Objectives

1. Understanding and implementation of the operation of microprocessors and microcontrollers, machine language programming & interfacing techniques with peripheral devices

Course Outcomes

On completion of this course, the students will be able to:

1. Program 8086 Microprocessor, 8051 and PIC Microcontrollers for application specific solution
2. Design microprocessors/microcontrollers-based systems
3. Implement and develop new experiments on microprocessor/microcontroller based systems.

Course Description

Students will be able to design, construct, program, verify, analyze, and troubleshoot fundamental microprocessor interface and control circuits using related equipments.

List of Experiments:

1. To Add Two Binary Number Each 2 Bytes Long.
2. To Find The Maximum Number. In A Given String (16 Bytes Long) and Store It in Location 0510.
3. To Sort A String of A No. of Bytes In Descending Order.
4. To Multiply An ASCII String Of Eight Numbers By A Single ASCII Digit. The Result Is A String Of Unpacked BCD Digits.
5. To Divide A String Of Unpacked ASCII Digit.
6. A Data String of No. Of bytes (to be specified in CX reg.) Is located From the Starting Address 0500. The Data String Is To Be Converted To Its Equivalent 2's Complement From And The Result Is Be Stored From 0600 Onwards.

Microcontroller Lab (Additional Programs)

5. Addition of 2 numbers and stored result at 3012
6. Subtraction of 2 numbers and stored result at 3012
7. Division of 2 numbers and stored result at 3012
8. Multiplication of 2 numbers and stored result at 3012

Text Books

1. Barry B Brey, The Intel microprocessor: architecture, programming and interfacing, Prentice hall of India, New Delhi, 2003.ISBN-0138027455, 4th Edition

2. Mohammad Ali Mazidi and Janice Gillespie Mazidi "The 8051 Microcontroller and Embedded Systems" Pearson education, 2003, ISBN- 9788131710265, 2ndEdition

Reference Books

1. Kenneth J. Ayla, "The 8051 Micro controller", Thomson learning, 3rd edition, 2004, ISBN-140186158X

2. Alan Clements, "Principles of Computer Hardware", Oxford University Press, 3rd Edition, 2003, ISBN-9780198564539

13040608	VLSI Design Lab	L	T	P	C
	Pre-requisites//Exposure: Digital Design	0	0	2	1

Course Objectives

The student will learn and understand

3. Transistor-Level CMOS Logic Design.
4. Estimation and Optimization of combinational circuits.

Course Outcomes

The students will be able to

2. Create models of moderately sized CMOS circuits that realize specified digital functions.

Course Description

A course in VLSI design laboratory will provide a practical knowledge for the implementation of analog and digital VLSI circuits.

List of Experiments:

1. Design the schematic for the different logic gates using NMOS technology.
2. Design the different adder circuits using NMOs technology.
3. Design the schematic for the different logic gates using CMOS technology.
4. Design the different adder circuits using CMOS technology.
5. Do the Transient, AC & DC analysis for the NMOS & CMOS Logic Gates.
6. Do the Transient, AC & DC analysis for the NMOS & CMOS full adder.
7. Design the 4bit parallel adder using CMOS Technology & determine its simulation result for transient analysis.
8. Design the layout for Universal logic gates using NMOS Technology.
9. Design the layout for Half Adder using CMOS Technology.
10. Design the layout for 4bit parallel adder using CMOS Technology.
11. Design the counter using CMOS technologies.
12. Design the shift registers for CMOs technologies & analysis their function. 4 bit
13. Design the different digital IC's for different technologies like 180nanometer, 100 micrometer etc.

Text Books

1. Sung-Mo Kang & Yusuf Leblebici, "CMOS Digital Integrated Circuits – Analysis and Design", 3rd Edition, Tata McGraw-Hill, New Delhi, 2003.
2. Jan M. Rabaey, Acanthi Chandrakasan and Borivoje Nikolic, "Digital Integrated Circuits: a design perspective", 2nd Edition, Pearson Education, 2003.

Reference Books

1. David A. Hodges, Horace G. Jackson, Resve A. Saleh, "Analysis and Design of Digital Integrated Circuits: In Deep Submicron Technology", McGraw, 2003.
2. David A. Johns and Ken Martin, "Analog Integrated Circuit Design" John Wiley and Sons Inc., 1997.
3. Neil Weste and David Harris, "CMOS VLSI Design: A Circuits and Systems Perspective", 4th Edition, Addison-Wesley, 2010
4. John P. Uyemura, "CMOS Logic Circuit Design", Springer International Edition.2005.Logic Circuit Design", Springer International Edition.2005.

	VLSI Design	L	T	P	C
	Pre-requisites//Exposure: Digital Design	3	1	0	3

Course Objectives: The student will learn and understand

3. Transistor-Level CMOS Logic Design.
4. Estimation and Optimization of combinational circuits using RC delay models and logical efforts.

Course Outcomes: The students will be able to

3. Create models of moderately sized CMOS circuits that realize specified digital functions.
4. Have an understanding of the characteristics of CMOs circuit construction.

Course Description

A course in VLSI semiconductor devices for designing of Various IC circuits.

Course Content

Unit – I: MOS transistor **9 lecture hours**

NMOS & PMOS - Enhancement & Depletion Mode, MOSFET as a Switch, Threshold voltage, Body effect. MOS Device Design Equations, Basic DC equations, Short Channel Effects and Device Models - Scaling Theory, Threshold Voltage Variation, Mobility Degradation with Vertical Field, Velocity Saturation, Hot Carrier Effects, Output Impedance Variation with Drain- Source Voltage, MOS Device Models, Small Signal AC Characteristics and Modelling of MOS Transistors using SPIC; **MOS Inverters(Static Characteristics): V**voltage Transfer Characteristic (VTC), Noise Immunity and Noise margins, Resistive-Load Inverter, NMOSFET and CMOS Inverter: DC Characteristics of CMOS Inverter, Analysis: Scaling in CMOS Inverters, Power and Area considerations.

Unit – II: MOS inverters: Switching Characteristics & Interconnect Effects 9 lecture hours

CMOS Propagation Delay, Calculation of Delay times, Estimation of Interconnect parasitic-Interconnect Capacitance Estimation, Interconnect Resistance Estimation, Layout of an Inverter, Calculation of Interconnect Delay- RC Delay Models, Elmore Delay, Buffer Chains, Low Swing Drivers, Power Dissipation-Switching, Short - Circuit & Leakage Components of Energy & Power, Power-Delay Product, Power Distribution and Performance Optimization of Digital Circuits by Logical Effort Sizing; CMOS Ring Oscillator ckt.

Unit – III: CMOS Logic Structures and Subsystem Design **9 lecture hours**

CMOS Logic gate Circuits, Transmission Gates, Pseudo nMOS logic, Dynamic logic, Clocked logic and CMOS Domino logic. Behaviour of Bistable Elements, SR Latch Circuit, Clocked Flip-Flop Circuits, CMOS D-FF; 4-bit shifter, adders, multipliers and ALU.

Unit – IV: Semiconductor Memories and Low-Power CMOS Logic Circuits 9 lecture hours

Semiconductor memories: non-volatile and volatile memory devices, flash memories, SRAM Cell Design, Differential Sense Amplifiers, DRAM Design, Single Ended Sense Amplifier, Overview of Power Consumption, Low-Power Design Through Voltage Scaling, Estimation and Optimization of Switching Activity, Reduction of Switched Capacitance and Adiabatic Logic Circuits

Text Books

1. Sung-Mo Kang & Yusuf Leblebici, "CMOS Digital Integrated Circuits – Analysis and Design", 3rd Edition, Tata McGraw-Hill, New Delhi, 2003.
2. Jan M. Rabaey, Anantha Chandrakasan and Borivoje Nikolic, "Digital Integrated Circuits: a design perspective", 2nd Edition, Pearson Education, 2003.

Reference Books

1. David A. Hodges, Horace G. Jackson, Resve A. Saleh, "Analysis and Design of Digital Integrated Circuits: In Deep Submicron Technology", McGraw, 2003.
3. Neil Weste and David Harris, "CMOS VLSI Design: A Circuits and Systems Perspective", 4th Edition, Addison-Wesley, 2010

	Arduino	Learning Schedule			
		L	T	P	C
	Pre-requisites: Microprocessor knowledge & understanding	3	0	0	3

Course objectives:

1. The main objective of this training course is to equip participant of fundamental understanding of embedded systems with Arduino.
2. Have good understanding of microcontroller, specifically of Arduino microcontrollers
3. Confidently construct and troubleshoot a microcontroller circuit for various applications
4. Participants will get the skills of how to communicate with Arduino boards over different interfaces

Course Outcomes

1. Understand the basic principle of how to communicate with the Arduino
2. Understand the conditions for Arduino & Processing

Course Description

This workshop aims to demystify the Arduino microcontroller through hands-on work in the lab creating simple machines with embodied behaviors. The Arduino is a versatile resource for physical projects for students in all disciplines. This course brings students over the beginner's threshold to a basic understanding of the use, terminology, and potential of the Arduino.

Course Content

Unit-I: - Introduction **6 hours**

An Introduction to Embedded System, Overview about Open Hardware and Software
Types of Arduino, Arduino board Layout, Atmega Micro Controller

6 hours

Unit-II: Getting started with Arduino IDE to write programs, Programming with Analog, Digital I/Os and Serial communication, Interfacing simple peripherals like LED, Switches and Buzzers

6 hours

Unit-III: Arduino Peripherals and Project essentials, Introduction to various sensors and project essentials, Temperature Sensing , Potentiometer, Servo Motor, LDR, LCD Display, Introduction to SPI communication(Theory)Introduction to Arduino shields(Theory)

Unit-IV: Interfacing for real time applications **6 hours**

Interfacing LED, Interfacing Button, Interfacing Analog LED, Interfacing Analog LDR, Interfacing L293D, Interfacing LCD, Interfacing Serial, Interfacing EEPROM

Text Books:

1 Beginning Arduino – Michael McRoberts
2 Arduino Cookbook by Michael Margolis

	VLSI Design Lab	L	T	P	C
	Pre-requisites//Exposure: Digital Design	0	0	2	1

Course Objectives

The student will learn and understand

1. Transistor-Level CMOS Logic Design.
2. Estimation and Optimization of combinational circuits.

Course Outcomes

The students will be able to create models of moderately sized CMOS circuits that realize specified digital functions.

Course Description

A course in VLSI design laboratory will provide a practical knowledge for the implementation of analog and digital VLSI circuits.

List of Experiments:

1. Design the schematic for the different logic gates using NMOS technology.
2. Design the different adder circuits using NMOs technology.
3. Design the schematic for the different logic gates using CMOS technology.
4. Design the different adder circuits using CMOS technology.
5. Do the Transient, AC & DC analysis for the NMOS & CMOS Logic Gates.
6. Do the Transient, AC & DC analysis for the NMOS & CMOS full adder.
7. Design the 4bit parallel adder using CMOS Technology & determine its simulation result for transient analysis.
8. Design the layout for Universal logic gates using NMOS Technology.
9. Design the layout for Half Adder using CMOS Technology.
10. Design the layout for 4bit parallel adder using CMOS Technology.
11. Design the counter using CMOS technologies.
12. Design the shift registers for CMOs technologies & analysis their function. 4 bit
13. Design the different digital IC's for different technologies like 180nanometer, 100 micrometer etc.

Text Books

1. Sung-Mo Kang & Yusuf Leblebici, "CMOS Digital Integrated Circuits – Analysis and Design", 3rd Edition, Tata McGraw-Hill, New Delhi, 2003.
2. Jan M. Rabaey, Acanthi Chandrakasan and Borivoje Nikolic, "Digital Integrated Circuits: a design perspective", 2nd Edition, Pearson Education, 2003.

Reference Books

1. David A. Hodges, Horace G. Jackson, Resve A. Saleh, "Analysis and Design of Digital Integrated Circuits: In Deep Submicron Technology", McGraw, 2003.
2. David A. Johns and Ken Martin, "Analog Integrated Circuit Design" John Wiley and Sons Inc., 1997.
3. Neil Weste and David Harris, "CMOS VLSI Design: A Circuits and Systems Perspective", 4th Edition, Addison-Wesley, 2010
4. John P. Uyemura, "CMOS Logic Circuit Design", Springer International Edition.2005.Logic Circuit Design", Springer International Edition.2005.

	Aurdino Lab	L	T	P	C
	Pre-requisites//Exposure: Microcontroller	0	0	2	1

Course Objectives

At the end of this lab you should be able to:

1. Describe the basic functioning of the "standard" Arduino microcontroller board
2. Describe the capabilities of the Spartronics Experimenter Shield (any version), and how it relates to the Arduino.

Course Outcomes

1. Configure the Arduino IDE to communicate with the Arduino hardware
2. Use the Arduino IDE to load, compile, download and execute (provided samples and user-written) programs

Course Description

The Arduino is a versatile resource for physical projects for students in all disciplines. This course brings students over the beginner's threshold to a basic understanding of the use, terminology, and potential of the Arduino. The skills and concepts taught in this course are presented from an interdisciplinary approach which merges practices in arts and technology.

List Of Experiments

1. Introduction to C Programming
2. Using Standard I/O
3. Using Conditionals
4. Using Loops
5. Intro to Addresses, Pointers and Handles
6. Hello Arduino
7. Arduino Digital Output
8. Arduino Digital Input
9. Arduino Analog Input
10. Arduino Reaction Timer

Text Books:

1 Beginning Arduino – Michael McRoberts

2 Arduino Cookbook by Michael Margolis

	PIC Microcontroller & Application	L	T	P	C
	Pre-requisites//Exposure : Analog & Digital Electronics	3	0	0	3

Course Objectives

1. Understand the general architecture for microprocessors and microcontrollers.
2. Understand the logical steps in interfacing and programming mechatronic systems.
3. Program and download PIC microcontrollers using Assembly and C Languages.
4. Design mechatronic systems using PIC16F84 and PIC16F877.
5. Understand the Arduino architecture and its associated programming.

Course Outcomes

The theory should be taught and practical should be carried out in such a manner that students are able to acquire required learning out comes in cognitive, psychomotor and affective domain to demonstrate following course outcomes:

1. Identify and understand function of different blocks of PIC microcontroller.
2. Develop programs for data transfer, arithmetic, logical and I/O port operations.
3. Develop programs for PIC18 using "C".

Course Description

The internal structure and operation of microcontrollers will be studied. The design methodology for software and hardware applications will be developed through the labs and design projects. Additional projects for graduate students.

Text Books

1. The 8051 Microcontrollers and Embedded Systems: Muhammed Ali Mazidi.
2. The 8051 Microcontrollers Architecture, Programming & Applications Kenneth J. Ayala.
3. Interfacing PIC Microcontroller: Embedded Design by Interactive Simulation by Martin Bates Elsevier 2006 2. Microcontroller Based Applied Digital Control by Dogan Ibrahim. Wiley 2006.

Reference Books

1. Design with PIC Microcontroller: John Petman.

Course Content

Unit I: PIC Microcontrollers: History, Features and Architecture 10 lecture hours

Microcontrollers and Embedded Processors, Overview of the PIC18 Family, PIC18 PIN connection, PIC18 Configuration Registers, The WREG Register in PIC18, The PIC18 File Register and access Bank, Use of Instructions with the Default Access Bank, PIC18 Data Format and Directives, The Program Counter and Program ROM Space in the PIC18, RISC Architecture in the PIC18, Arithmetic Instructions.

Unit II: Classification of Instructions and I/O Port Programming 8 lecture hours

Arithmetic Instructions, Arithmetic Instructions, Logic and Compare Instructions, Rotate Instruction and Data Serialization, BCD and ASCII Conversion, Branch Instructions and Looping, Call Instructions and Stack, PIC18 Time Delay and Instruction Pipeline, I/O Port Programming in PIC18, I/O Bit Manipulation Programming.

Unit III: PIC18 Programming in C 8 lecture hours

Data Types and Time Delays in C, I/O Programming in C, Logic Operations in C, Data Serialization in C, Program ROM Allocation in C, Data RAM Allocation in C.

Unit IV: PIC18 Programming in C: Timer, Serial Port and Interrupt 8 lecture hours

Programming Timers 0, 1, 2 and 3 in C, Counter Programming, Basics of Serial Communication, PIC18 connection to RS232, PIC18 Serial Port Programming in C, PIC18 Interrupts, Programming Timer, External Hardware, Serial communication and Port B change.

	VHDL Programming	L	T	P	C
	Pre-requisites//Exposure: Digital Logic Design	3	1	0	4

Course Objectives

1. Electronic circuit design hierarchy and the role of methodology.
2. Application specific integrated circuits. Hardware description languages.
3. Behavioral and structural circuit modeling.
4. Design algorithms and design tools.
5. Design projects.

Course Outcomes

On completion of this course, the students will be able to

1. Work with Hardware Descriptive Language like Verilog/VHDL.
2. Work with various EDA tools used in chip design process.
3. Work with EDA tools of VLSI.
4. Test and analysis of digital design on simulator that support HDL compiler.
5. Verification of soft code implemented in HDL through verification tools.

Course Description

This is a comprehensive VHDL Course for FPGA & ASIC designers who would like to learn the most effective VHDL coding styles for synthesis and simulation. In this course, participants will learn VHDL from working environment level, to project planning and definition stages and through commands and syntax. Much of what is taught is followed up by hands-on exercises on PC stations.

Text Books

1. C.H. Roth, Jr. and L.K. John, Digital Systems Design Using VHDL, Second Edition, Thomson Engineering, Inc., 2008.

Reference Books

1. Verilog HDL A Guide to Digital Design and Synthesis, By Samir Palnitkar Publication: Pearson Education.
2. VHDL Primer, By J. Bhaskar, Publication: PHI.

Course Content

Unit I: Introduction to digital design **13 lecture hours**

Introduction to hardware descriptive language (HDL), Difference between computer programming languages and HDLs Examples and HDL based digital design flow based on FPGA and CPLD, Basic concepts of HDL (Verilog/VHDL), Level of abstractions supported by HDLs, Data types and syntaxes of HDLs. Instantiation concepts. Switch level modeling and its example.

Unit II: Structural modeling: **14 lecture hours**

Component declaration, component instantiation, Generics and Configuration, Packages and libraries, Gate level modeling and its example, Dataflow level modeling and its example.

Behavioral Level modeling: Entity declaration, Architecture body, process statement, variable and signal assignment statements, Wait statements, If statements, case statements, Loop statements etc.

Unit III: User Defined Primitives: **12 lecture hours**

UDPs and its examples, Finite State Machine (FSM) implementation by HDL, FSM implementation example in HDL. Synthesis and simulation of combinational and sequential logic, FPGA and CPLD based Implementation.

Unit IV: Hardware modeling examples: **8 lecture hours**

ALU, Binary multiplier, Pulse counter, Barrel shifter, UART, Traffic light controller, DRAM Model etc.

	PIC Microcontroller Application Lab	L	T	P	C
	Pre-requisites//Exposure :Microcontroller	0	0	2	1

Course Objectives

The objective of this course is to teach students design and interfacing of microcontroller-based embedded systems. High-level languages are used to interface the microcontrollers to various applications. There are extensive hands-on labs/projects. Embedded system for sensor applications will be introduced. GUI using C# will be introduced. Students will be expected to develop independence and learn much of the material on their own.

Course Outcome

After learning the course the students should be able to:

Upon completion of this course, students will understand the architecture of the PIC microcontrollers and how to write high-level languages, and embed the code in flash memory for stand-alone system for embedded system designs.

Course Description

The internal structure and operation of microcontrollers will be studied. The design methodology for software and hardware applications will be developed through the labs and design projects. Additional projects for graduate students.

Text book

1. "The PIC Microcontroller and Embedded systems – Using Assembly and C for PIC18," Muhammad Ali Mazidi, Rolin D. McKinlay, and Danny Causey, Prentice Hall, 2007
2. Design reference notes and data sheets of Microchips.

Reference book

1. Lecture notes on D2L.

List of Experiments

1. Write an alp to generate 10 khz square wave
2. Write an alp to generate 10 kHz freq. using interrupts.
3. Write an alp to interface one microcontroller with other serial/parallel communication.
4. Write an alp for temperature measurement to display on intelligent LCD display.
5. Write an alp for temperature measurement to display on intelligent LCD display.
6. Develop an embedded system for traffic light controller using microcontroller.
7. Develop an embedded system for automatic motion of a car & subsequent display on LCD using microcontroller.
8. Write an alp to add two numbers & display the result on led
9. Write an alp to add two numbers & display the result on LCD
10. Write an alp to multiply two numbers & display the result on led
11. Write an alp to multiply two numbers & display the result on LCD

	VHDL Programming Lab	L	T	P	C
	Pre-requisites//Exposure :Digital system design	0	0	2	1

Course Objectives:

Chip design is a computer aided design process in current scenario. To design chip now a day's industry prefers to test it carefully on computer aided software tools. The software tools support hardware descriptive language (HDL) compiler. The chip designer can able to program and test the programs on simulator. The front end design can also, be tested on FPGA/CPLD development kits.

Course Outcome:

After learning the course the students should be able to:

2. Work with Hardware Descriptive Language like Verilog /VHDL.
3. Work with various EDA tools used in chip design process.
4. Work with EDA tools of VLSI.
5. Test and analysis of digital design on simulator that support HDL compiler.
6. Verification of soft code implemented in HDL through verification tools.
7. Implement various digital logic blocks on FPGA/CPLD boards.
8. System design and implementation on FPGA/CPLD boards.
9. Develop project based on FPGA/CPLD through HDL language.

Course Description

This course is about the design of digital systems using a hardware description language, VHDL. The student will learn the basics of number representation and conversion, Boolean algebra, combinational circuit design and sequential circuit design with VHDL, and synchronous /asynchronous finite state machines. They will be given instruction on the measurement of performance, and testing, of digital systems. Lab exercises make use of the Xilinx ISE Webpack, which is a powerful state-of-the-art CAD tool for designing and implementing digital systems. The Circuit Lab (Sci III 313) is equipped with the Xilinx ISE Webpack software tools.

Text book

1. Sudhakar Yalamanchili, VHDL: A Starter's Guide, 2/e Edition, Prentice Hall, 2005, ISBN-0131457357, ISBN-13: 978-0131457355.
2. Peter J. Ashenden, Digital Design: An Embedded Systems Approach Using VHDL, 3rd Edition, Morgan Kaufmann, 2007, ISBN-10: 0123695287, ISBN-13: 978-0123695284.

Reference book

1. Thomas L. Floyd, Digital Fundamentals with VHDL, Prentice Hall, 2003. ISBN-10: 0130995274, ISBN-13: 9780130995278.

List Of Experiments:

1. Introduction to HDL language Verilog/VHDL.
2. Implement basic digital logic gates and simulate with HDL.
3. Design and implement half adder logic with HDL and simulate the same.
4. Design and implement full adder logic with HDL and simulate the same.
5. Design and implement fast adder logic with HDL and simulate the same.
6. Design and implement multiplexers with HDL and simulate the same.
7. Design and implement multiplier with HDL and simulate the same.
8. Design and implement 4-bit counter with HDL and simulate the same.
9. Multiplier logic with HDL and simulate the same.
10. Design and simulate the Finite State Machine (FSM) design by HDL.
11. Design and simulate the ALU design by HDL.

13040701	Professional Ethics for Electronics	L	T	P	C
	Pre-requisites//Exposure: Technical Knowledge & Profession Skills	2	0	0	2

Course Objectives

1. To create awareness on professional ethics for engineers
2. To respect the rights of others and develop a global perspective

Course Outcomes

1. Identify and analyze an ethical issue in the subject matter under investigation or in a relevant field
2. Identify the multiple ethical interests at stake in a real-world situation or practice
3. Articulate what makes a particular course of action ethically defensible
4. Assess their own ethical values and the social context of problems

Course Description

Intensive study of moral issues and conflicts that arise when one attempts to reconcile the priorities of professional responsibilities and the world of business with those of an ethical frame of mind. Emphasis on issues surrounding the concepts of duty, rights, autonomy, justice, and regulation of business, together with extended reflections on the relationship between moral responsibility and the professions (drawing from specific fields such as engineering, medicine, and law)

Course Content

Unit I: 12 lecture hours

. Understanding Professional Ethics and Human Values Current scenario – contradictions – dilemmas – need for value education and self esteem – Human values – morals – values – integrity – civic virtues - work ethics – respect for others – living peacefully – caring – honesty – courage – valuing time – co operation – commitment – empathy – self confidence - character

Unit II: 12 lecture hours

Ethics for Engineers Ethics – its importance – code of ethics – person and virtues – habits and morals – 4 main virtues – ethical theories – Kohlberg's theory – Gilligan's theory – towards a comprehensive approach to moral behavior – truth – approach to knowledge in technology

Unit III: 12 lecture hours

Environmental Ethics and sustainability problems of environmental ethics in engineering - engineering as people serving profession – engineer's responsibility to environment – principles of sustainability - industrial, economic, environmental, agricultural and urban sustainability - Sustainable development.

Unit IV: 12 lecture hours

Social Experimentation, Responsibility and Rights Engineers as responsible experiments – safety and risk – confidentiality – knowledge gained confidentiality – experimental nature of engineering – Intellectual Property Rights – professional rights – employee rights – occupational crime

Text Books

1 Mike W Martin, Roland Schinzinger, "Ethics in Engineering", Tata McGraw -Hill, 2003

Reference Books

1. Govindarajan M, Natarajan S, Senthil Kumar V S, "Engineering Ethics" PHI India, 2004
2. P Aarne Vesblind, Alastair S Gunn, "Engineering Ethics and the Enviornment"
3. Edmund G Seebauer, Robert L Barry, "Fundamentals of Ethics for scientists and engineers" Oxford University Press 2001

13040708	Wireless Sensor Network	L	T	P	C
	Pre-requisites//Exposure: Sensors & Transducers	3	1	0	3

Course Objectives

Wide range of applications such as disaster management, military and security have fueled the interest in sensor networks during the past few years. Sensors are typically capable of wireless communication and are significantly constrained in the amount of available resources such as energy, storage and computation. Such constraints make the design and operation of sensor networks considerably different from contemporary wireless networks, and necessitate the development of resource conscious protocols and management techniques. This course provides a broad coverage of challenges and latest research results related to the design and management of wireless sensor networks. Covered topics include network architectures, node discovery and localization, deployment strategies, node coverage, routing protocols, medium access arbitration, fault-tolerance, and network security.

Learning Objectives:

By the completion of the course, you should be able to:

- Architect sensor networks for various application setups.
- Explore the design space and conduct trade-off analysis between performance and resources.
- Assess coverage and conduct node deployment planning.
- Devise appropriate data dissemination protocols and model links cost.
- Determine suitable medium access protocols and radio hardware.
- Prototype sensor networks using commercial components.
- Provision quality of service, fault-tolerance, security and other dependability requirements while coping with resource constraints.
- Evaluate the performance of sensor networks and identify bottlenecks.

Course Content

Unit I: Applications and Design Model **12 lecture hours**

Examples of available sensor nodes, Sample sensor networks applications, Design challenges, Contemporary network architectures, Operational and computational models, Performance metrics, Software and hardware setups.

Unit II: Network Bootstrapping **8 lecture hours**

Sensor deployment mechanisms, Issues of coverage, Node discovery protocols, Localization schemes, Network clustering,

Unit III: Data dissemination and routing **6 lecture hours**

Query models, In-network data aggregation, robust route setup, coping with energy constraints,

Unit IV: Physical and Link layers & Dependability Issues **8 lecture hours**

Radio energy consumption model, Power management, Medium access arbitration, Optimization mechanisms; **Dependability Issues:** Security challenges, Threat and attack models, Quality of service provisioning, Clock synchronization, Supporting fault tolerant operation

Reference Books

1. **Protocols and Architectures for Wireless Sensor Networks;**
   Holger Karl, Technical University of Berlin,, Andreas Willig, University of Potsdam, *Wiley, ISBN:* 0-470-09510-5, June 2005

13040709	Sensors & Transducers	L	T	P	C
	Pre-requisites//Exposure: Measurement & Instrumentation	3	1	0	3

Course Objectives

1. Educate students to understand the functioning of different types of sensors & their role in order to sense various parameter.
2. To utilize the status of different signal parameters in the real time application to conrol the working.

Course Outcomes

On completion of this course, the students will be able to

1. Select the correct sensor for an given problem.
2. And also capable to interface that sensor with the processor for further processing.

Course Description

This course deals with the different type of sensors and transducers. This also describe their role to know the domain status. It alos deals with the process to further processing of sensing elements.

Course Content

Unit I: **12 lecture hours**

Principle of sensing & transduction , classification 1 Mechanical and Electromechanical sensor; Resistive (potentiometric type): Forms, material, resolution, accuracy, sensitivity; Strain gauge: Theory, type, materials, design consideration, sensitivity, gauge factor, variation with temperature, adhesive, rosettes.; Inductive sensor: common types- Reluctance change type, Mutual inductance change type, transformer action type, Magnetostrictive type, brief discussion with respect to material, construction and input output variable, Ferromagnetic plunger type, short analysis; LVDT: Construction, material, output input relationship, I/O curve, discussion; Proximity sensor.

Unit II: **8 lecture hours**

Capacitive sensors: variable distance-parallel plate type, variable area- parallel plate, serrated plate/teeth type and cylindrical type, variable dielectric constant type, calculation of sensitivity; Stretched diaphragm type: microphone, response characteristics; Piezoelectric element: piezoelectric effect, charge and voltage co-efficient, crystal model, materials, natural & synthetic type, their comparison, force & stress sensing, ultrasonic sensors.

Unit III: **6 lecture hours**

Thermal sensors: Material expansion type: solid, liquid, gas & vapor; Resistance change type: RTD materials, tip sensitive & stem sensitive type, Thermister material, shape, ranges and accuracy specification;

Thermo emf sensor: types, thermoelectric power, general consideration, Junction semiconductor type IC and PTAT Type; Radiation sensors: types, characteristics and comparison; Piezoelectric type.

Unit IV: **8 lecture hours**

Magnetic sensors: Sensor based on Villari effect for assessment of force, torque, proximity, Wiedemann effect for yoke coil sensors, Thomson effect, Hall effect, and Hall drive, performance characteristics; Radiation sensors: LDR, Photovoltaic cells, photodiodes, photo emissive celltypes, materials, construction,, response, Geiger counters, Scintillation detectors; Introduction to smart sensors;

Text books:

1. Sensor & transducers, D. Patranabis, 2nd edition, PHI
2. Instrument transducers, H.K.P. Neubert, Oxford University press.

Reference Books:

1. Measurement systems: application & design, E. A. Doebelin, Mc Graw Hill.

13040710	Wireless and Mobile Communication	L	T	P	C
	Pre-requisites//Exposure : Digital Communication	3	0	0	3

Course Objectives

3. Educate students to understand the bandwidth of operation of cellular technology and plan spectrum deployment for cellular systems to provide better customer services as well as earn revenue of service provider
4. Utilize the subject knowledge in specifying the technological problems for evolving cellular technology.
5. Apply the mobile and wireless principles for creating solutions for data and voice communication in various Industries like Banking, Marketing and Automobile.

Course Outcomes

On completion of this course, the students will be able to

1. Design a cellular system in a specific radio and geographic environment with specific frequency range
2. Solve numerical problems pertaining to cell design, GSM and CDMA (IS 95) system designs
3. recognize the various frequency and bandwidth allocations, design concepts of emerging communication systems

Course Description

This course deals with spectrum allocation in a cell and design of cell size. It also covers the problems encountered with the signal propagation between mobile users and base station. It gives the description of complete cellular networks and working principle for call establishment, delivery and forwarding of calls. It focuses on the architecture of advanced cellular technology. The learners will be in a position to appreciate the advantages and limitations of RF wireless as a medium of communication. After the course students will be in a position to understand the wireless communication abnormalities in data and voice receptions and will be able to provide possible solutions to overcome such abnormalities.

Course Content

Unit I: Introduction of Wireless Communication 8 lecture hours

History and evolution of mobile radio systems. Types of mobile wireless services/systems-Cellular, WLL, Paging, Satellite systems, Future trends in personal wireless systems.

Unit II: Cellular Concepts and System Design Fundamentals 10 lecture hours

Cellular concept and frequency reuse, channel assignment, handoff strategies, Interference and system capacity, Trunking and GOS, cell splitting, cell sectoring.

Unit– III: Mobile radio Propagation Models 8 lecture hours

Radio wave propagation issues in personal wireless systems, Propagation models, Multipath fading and Base band impulse respond models, parameters of mobile multipath channels, Antenna systems in mobile radio.

Unit IV: Modulation, Equalization & Diversity Techniques 12 lecture hours

Overview analog and digital modulation techniques, GMSK,QAM,OFDM, Spread spectrum modulation, Equalization, Rake receiver concepts, Diversity Techniques, Linear predictive coders and channel coding; M**multiple Access Techniques, Wireless Systems & Standards:** FDMA, TDMA and CDMA systems, Introduction to 2G,3G Wireless systems and standards.

Text Books

1. Theodore S. Rappaport, "wireless communications Principles and Practices", PHI, 2005
2. Jochen Schiller, "Mobile Communications", Pearson Education, second edition, 2009.

Reference Book

1. Lee W.C.Y, "Mobile communication Engineering
2. Theory and Applications", 2/e McGraw-Hill, New York, 2003
3. Andreas F. Molisch, "Wideband Wireless Digital Communication", Pearson Education 2001.

13040711	Bio medical Electronics	L	T	P	C
	Pre-requisites//Exposure: Instrumentation	3	0	0	3

Course Objectives

1. To study the working of different medical equipments

Course Outcomes

On completion of this course, the students will be able to

1. Introduce the student to the electronic devices and theory of operation in the medical area.
2. Electronic circuits for Biomedical Applications: Apply knowledge of engineering and science to understand the principle of biomedical electronic circuits. Understand how to apply, measure circuit performance, and solve problems in the areas of biomedical signals.
3. Work in Multi-disciplinary teams: Learn to work and communicate effectively with peers on multi-disciplinary teams to attain a common goal.

Course Description

Bio medical electronics (**BME**) is the application of engineering principles and design concepts to medicine and biology for healthcare purposes (e.g. diagnostic or therapeutic). This field seeks to close the gap between engineering and medicine, combining the design and problem solving skills of engineering with medical and biological sciences to advance health care treatment, including diagnosis, monitoring, and therapy. Biomedical engineering has only recently emerged as its own study, compared to many other engineering fields.

Course Content

Unit I: 12 lecture hours

Introduction to the physiology of cardiac, nervous & muscular and respiratory systems. Transducers and Electrodes: Different types of transducers & their selection for biomedical applications. Electrode theory, selection criteria of electrodes & different types of electrodes such as, Ag - Ag Cl, pH, etc

Unit II 12 lecture hour's

Cardiovascular measurement: The heart & the other cardiovascular systems. Measurement of Blood pressure-direct and indirect method, Cardiac output and cardiac rate. Electrocardiography-waveform-standard lead systems typical ECG amplifier, phonocardiography, Ballisto cardiography, Cardiac pacemaker –defibrillator –different types and its selection.

Unit III 12 lecture hours

EEG Instrumentation requirements –EEG electrode –frequency bands – recording systems EMG basic principle-block diagram of a recorder –pre amplifier. Bed side monitor –block diagram- measuring parameters-cardiac tachometer-Alarms-Lead fault indicator-central monitoring. Telemetry – modulation systems – choice of carrier frequency – single channel telemetry systems.

Unit IV 12 lecture hours

Instrumentation for clinical laboratory: Bio electric amplifiers-instrumentation amplifiers isolation amplifiers-chopper stabilized amplifiers –input guarding - Measurement of pH value of Blood-blood cell counting, blood flow, Respiratory transducers and instruments.

Text Books

1. J J Carr, "Introduction to Biomedical Equipment Technology": Pearson Education 4th e/d

Reference Books

1. K S Kandpur, "Hand book of Biomedical instrumentation", Tata McGraw Hill 2nd e/d.
2. John G Webster, "Medical Instrumentation application and design", John Wiley 3rd e/d.
3. Richard Aston, "Principle of Biomedical Instrumentation and Measurement

13040712	Internet of Things	L	T	P	C
Pre-requisites//Exposure	Sensors, Communication, Microcontroller	3	1	0	3

Course Objectives: The objective of the course is to:

1. Vision and Introduction to IoT.
2. Understand IoT Market perspective.
3. Data and Knowledge Management and use of Devices in IoT Technology.
4. Understand State of the Art – IoT Architecture.
5. Real World IoT Design Constraints, Industrial Automation and Commercial Building Automation in IoT.

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

1. Understand the vision of IoT from a global context.
2. Determine the Market perspective of IoT.
3. Use of Devices, Gateways and Data Management in IoT.
4. Building state of the art architecture in IoT.
5. Application of IoT in Industrial and Commercial Building Automation and Real World Design Constraints.

Course Content

Unit I: M2M to IoT **06 Hours**

The Vision-Introduction, From M2M to IoT, M2M towards IoT-the global context, a use case example, Differing Characteristics

Unit II: M2M to IoT – A Market Perspective **08 hours**

Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies.; **Architectural Overview**– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations

Unit III: M2M and IoT Technology Fundamentals **12 Hours**

Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service (XaaS), M2M and IoT Analytics, Knowledge Management

IoT Architecture-– Introduction, State of the art, **Architecture Reference Model-** Introduction, Reference Model and architecture, IoT reference Model

Unit IV: IoT Reference Architecture **15 hours**

Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. **Real-World Design Constraints-** Introduction, Technical Design constraints-hardware is popular again, Data representation and visualization, Interaction and remote control. **Industrial Automation-** Service-oriented architecture-based device integration, SOCRADES: realizing the enterprise integrated Web of Things, IMC-AESOP: from the Web of Things to the Cloud of Things, **Commercial Building Automation-** Introduction, Case study: phase one-commercial building automation today, Case study: phase two- commercial building automation in the future

Textbook:

1. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014.

Reference Books:

1. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)", 1stEdition, VPT, 2014.
2. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications, 2013

13040713	Optical Communication	L	T	P	C
Pre-requisites//Exposure		**3**	**1**	**0**	**3**

Course Objectives

1. To learn the basic elements of optical fiber transmission link, fiber modes configurations and structures.
2. To learn the fiber optical receivers such as PIN APD diodes, noise performance in photo detector, receiver operation and configuration.
3. To learn the fiber optical network components, variety of networking aspects, FDDI, SONET/SDH and operational principles WDM.

Course Outcomes

On completion of this course you should be able to:

1. Explain the principles of operation of various optical fibre communication systems.
2. Calculate various key parameters of optical fibre systems. These include the system optical power budget and system risetime budget, receiver noise power, Q factor, bit error rate and maximum usable bit rate of a digital optical fibre system.
3. Communicate laboratory findings through written reports.

Course Description

Optical fibre systems include long distance backbone or trunk networks, metropolitan and access networks, passive optical networks and radio on fibre or fibre wireless systems. Fibre networks are also used to distribute signals for broadband wireless access networks.

The design of an optical fibre system involves many design factors and trade-offs. The characteristics and limitations of system components (laser diodes, optical modulators, optical fibre, optical amplifiers and optical receivers) and the factors affecting the performance of different optical fibre communication systems will be studied.

Course Content

Unit I: Overview of optical fiber wave guides **12 lecture hours**

General system, transmission link, advantage of optical fiber communication,basic structure of optical fiber waveguide, ray theory transmission, optical fiber modes and configuration, step index & graded index fiber, single mode fiber , fiber materials , fiber fabrication.

Unit II: Signal degradation in optical fiber **12 lecture hours**

Introduction, attenuation, intrinsic & extrinsic absorption losses, linear & nonlinear scattering losses, bending losses, distortion in optical wave guide, intramodal and intermodal dispersion. Power launching and coupling Source to fiber power launching, power calculation, lensing schemes, fiber to fiber joints, fiber splicing technique, fiber connectors.

Unit III: Optical sources and receiver **8 lecture hours**

LASER: Basic concepts of laser, Optical emission from semiconductors, Semiconductor injection laser (ILD), Injection laser characteristics.LED: power and efficiency, LED structures, LED characteristics. Optical detectors: p-n photodiodes, p-i-n photodiodes, Avalanche photodiodes, Quantum efficiency, speed of response, Phototransistor; **Optical receiver:** Receiver operation, digital receiver noise , shot noise , pre-amplifier types , Digital receiver performance, introduction to analog receivers.

Unit IV: **Digital transmission systems** **8 lecture hours**

Point to point links, system considerations, link power budget, rise time budget, modulation formats for analog communication system, introduction to WDM concepts, Introduction to advanced multiplexing strategies.

Text Books

1. 1.G.Keiser: Optical Fiber Communication – MGH
2. Jenkins & White : Fundamentals Of Optics – MGH

13040714	Neural Networks and Fuzzy	L	T	P	C
Pre-requisites//Exposure	Control Systems	3	1	0	3

Course Objectives: After the completion of course the students will

1. Get the exposure to Artificial Neural Networks & Fuzzy Logic.
2. Understand the importance of tolerance of imprecision and uncertainty for design of robust & low cost intelligent machines.

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

1. Identify and describe Fuzzy Logic and Artificial Neural Network techniques in building intelligent machines
2. Apply Artificial Neural Network & Fuzzy Logic models to handle uncertainty and solve engineering problems.
3. Recognize the feasibility of applying a Neuro-Fuzzy model for a particular problem

Course Description

The objective of this course is to present sufficient background in both fuzzy and neural network so that students in future can pursue advanced soft computing methodologies. This course combines knowledge, techniques, and methodologies from various sources, using techniques from neural networks and fuzzy set theory.

Course Content

Unit I: Introduction to Artificial Neural Network 10 lecture hours

Artificial neural networks and their biological motivation: Terminology, Models of neuron, Topology, characteristics of artificial neural networks, types of activation functions; learning methods: error correction learning, Hebbian learning, Perceptron: XOR Problem, Perception learning rule convergence theorem; Adaline.

Unit II: Feedforward and Recurrent Neural Networks 10 lecture hours

Architecture: perceptron model, solution, single layer artificial neural network, multilayer perceptron model; back propogation learning methods, effect of learning rule co-efficient ;back propagation algorithm, factors affecting backpropagation training, applications; Recurrent neural networks: Linear auto associator – Bi-directional associative memory – Hopfield neural network.

Unit III: Fuzzy Logic & Fuzzy Sets 10 lecture hours

Introduction to Fuzzy Logic, Classical and Fuzzy Sets, Membership Function ,Membership Grade, Universe of Discourse, Linguistic Variables, Operations on Fuzzy Sets: Intersections, Unions, Negation, Product, Difference, Properties of Classical set and Fuzzy sets, Fuzzy vs Probability, Fuzzy Arithmetic, Fuzzy Numbers.

Unit IV: Fuzzy Relations & Aggregations 10 lecture hours

Essential Elements of Fuzzy Systems, Classical Inference Rule, Classical Implications and Fuzzy Implications, Crisp Relation and Fuzzy Relations, Composition of fuzzy relations, Cylindrical Extension and Projection. Fuzzy IF-THEN rules, Inference: Scaling and Clipping Method, Aggregation, Fuzzy rule based Model: Mamdani Model, TSK model, Fuzzy Propositions, Defuzzification: MOM, COA

Text Books

1. Ross, Timothy J. Fuzzy logic with engineering applications. John Wiley & Sons, 2009.
2. Yegnanarayana, B. Artificial neural networks. PHI Learning Pvt. Ltd., 2004.

Reference Books

1. Zurada, Jacek M. Introduction to artificial neural systems, West St. Paul, 1992.
2.Hagan, Martin T., Howard B. Demuth, and Mark H. Beale. Neural network design. Boston: Pws

13040715	Robotics & Automation Engg	L	T	P	C
Pre-requisites//Exposure	Microprocessor & Microcontroller, Instrumentation	3	1	0	3

Course Objectives

1. Demonstrate an ability to apply spatial transformation to obtain forward kinematics equation of robot manipulators.
2. To develop the student's knowledge in various robot structures and their workspace
3. To provide the student with some knowledge and skills associated with robot control.

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

1. Have sound knowledge of Basic Robotic model.
2. Differentiate types of control and the standardization for some robotic system.
3. Critically evaluate robots for particular applications.
4. Analyze particular industrial applications and evaluate possible solutions in terms of automated dedicated / flexible) or mixed manual/ automated systems.

Course Description: Students skilled to design, develop, implement and supervise automation systems for industrial processes and to design, control and operate with industrial robotic systems and mobile robots. Automation is an important aspect of modern manufacturing and is a very interesting area for engineers and developers. Studying this course will give you sufficient knowledge to analyze simple manufacturing automation systems, in particular automatic assembly, and to design such systems. Robot manipulators are numerous in industry and found in a verity of applications.

Course content

Unit I: Introduction Robotics **10 Hours**

Robotics - Basic components - Classification - Performance characteristics - Actuators- Electric actuator- DC motor horse power calculation, magneto-astrictive hydraulic and pneumatic actuators. Sensors and vision systems: Different types of robot transducers and sensors - Tactile sensors - Proximity and range sensors -ultrasonic sensor-touch sensors-slip sensors-sensor calibration- vision systems - Image processing and analysis - image data reduction - segmentation feature extraction - Object recognition.

Unit II: Robot Control **10 Hours**

Control of robot manipulators- state equations-constant solutions-linear feedback systems-single axis PID control- PD gravity control- computed torque control- variable structure control- Impedance control.

Unit III: End Effectors **10 Hours**

End effectors and tools- types - Mechanical grippers - Vacuum cups - Magnetic grippers - Robot end effectors interface, work space analysis work envelope-workspace fixtures-pick and place operation-continuous path motion-interpolated motion-straight line motion.

Unit IV: Robot Motion Analysis & Application: **12 Hours**

Robot motion analysis and control: Manipulator kinematics -forward and inverse kinematics- arm equation-link coordinates- Homogeneous transformations and rotations and Robot dynamics; **Robot Applications:** Industrial and Non industrial robots, Robots for welding, painting and assembly - Remote Controlled robots - Robots for nuclear, thermal and chemical plants - Industrial automation - Typical examples of automated industries

Text Books

1. Mikell P Grover et. al. "Industrial Robots: Technology, Programming and Applications", 2nd Edition, Tata McGraw Hill, 1980, ISBN 9781259006210.

2. Robert J. Schilling, "Fundamentals of Robotics-Analysis and Control", PHI Learning, 2009, ISBN 9788120310476 (Unit-II and Unit-III)

Reference Books

1. K.S. Fu, Ralph Gonzalez, C.S.G. Lee, "Robotics: control, sensing, vision and Intelligence", 1st Edition, Tata Mcgraw-Hill, 2008, ISBN 9780070265103

13040702	Satellite Communication & Broadcasting	L	T	P	C
Pre-requisites//Exposure	Digital Communication	3	0	0	3

Course Objectives

1. This course describes orbital mechanism of satellites.
2. The multiplexing and multiple access techniques of Satellite communication are also discussed.
3. GPS and other applications of satellite communication are covered in this course.

Course Outcomes

On completion of this course, the students will be able to

1. Discuss various multiplexing and multiple access techniques.
2. Design satellite uplink and downlink under various conditions.
3. Demonstrate the GPS concepts for ethical usage in society.

Course Description

The courses cover the most relevant aspects of satellite communications, with emphasis on recent applications and developments. The course begins with a review on the history and basic concepts of satellite communications. Next it covers the orbital aspects, with emphasis on the geostationary orbit followed by a discussion of satellite subsystem and launching methods. The design of a digital satellite link is discussed in detail, including link budget, modulation, error control and multiple access methods. Frequency assignments and propagation aspects that affect the satellite link are then discussed. Antennas and earth station technology are presented, including the design of very small aperture terminals (VSATs).

Course Content

Unit I: Introduction to Satellite Communication 10 lecture hours

Satellite Systems, Orbital description and Orbital mechanics of LEO, MEO and GSO, Placement of a Satellite in a GSO, Satellite – description of different Communication subsystems, Bandwidth allocation.

Unit II: Multiplexing and Multiple Access Techniques 8 lecture hours

Different modulation and Multiplexing Schemes, Multiple Access Techniques – FDMA, TDMA, CDMA, and DAMA, Coding Schemes

Unit III: Satellite Link Design 10 lecture hours

Basic link analysis, Interference analysis, Rain induced attenuation and interference, Ionospheric characteristics, Link Design with and without frequency reuse.

Unit IV: Global Positioning System 12 lecture hours

Radio and Satellite Navigation, GPS Position Location Principles, GPS Receivers and Codes, Satellite Signal Acquisition, GPS Receiver Operation and Differential GPS

Text Books

1. Wilbur L. Pritchard, H.G. Suyderhoud, Robert A.Nelson, Satellite Communication Systems Engineering, Prentice Hall, New Jersey, 2006. ISBN-013-791468-7
2. Timothy Pratt and Charles W. Bostain, Satellite Communications, John Wiley and Sons, 2003. ISBN- 047137007X
3. D. Roddy, Satellite Communication, McGrawHill, 2006 ISBN- 0071486895

Reference Books

1. Tri T Ha, Digital Satellite Communication, McGrawHill, 1990. ISBN-978-0-07-007752-2
2. B. N. Agarwal, Design of Geosynchronous Spacecraft, Prentice Hall, 1993. ISBN- 0132001144

13040704	Broadcasting Lab	L	T	P	C
Pre-requisites//Exposure	Satellite Communication	0	0	2	2

Course Objectives

1. This course describes orbital mechanism of satellites.
2. The multiplexing and multiple access techniques of Satellite communication.
3. GPS and other applications of satellite communication are covered in this course.

Course Outcomes

On completion of this course, the students will be able to

1. To learn various multiplexing and multiple access techniques.
2. To learn satellite uplink and downlink under various conditions.
3. To Learn the GPS concepts for ethical usage in society.

Course Description

Broadcasting laboratory concerns the with the implementation of basic principles and applications analog and digital satellite Communication Link, C/N Ratio, S/N Ratio. PC to PC Sat. Com. Link using RS –232 ports.

List of experiments:

1. To Study the process of Transmitting Signal.
2. To Study the Base band Signal in a Satellite Link.
3. To estimate C/N Ratio.
4. To estimate S/N Ratio.
5. To setup digital satellite Communication Link.
6. To plot radiation pattern of parabolic reflector.
7. To Study Satellite Communication Receiver.
8. To set up a PC to PC Sat. Com. Link using RS –232 port.
9. To measure the propagation delay of signal in a Sat.Com. Link.
10. To transmit & receive the function generator waveform through a Sat.Com. Link.
11. To set up a active & passive satellite communication link & study their difference.

	Robotics	L	T	P	C
	Pre-requisites//Exposure : Basic embedded	3	0	0	3

Course Objectives

1. To introduce the basic concepts, parts of robots and types of robots.
2. To make the student familiar with the various drive systems for robot, sensors
3. To discuss about the various applications of robots, justification and implementation of robot.

Course Outcomes

The student must be able to design automatic manufacturing cells with robotic control using the principle behind robotic drive system, end effectors, sensor, machine vision robot kinematics and programming.

Course Description:

This course will involve students in the development, building and programming of a LEGO Mindstorm robot. Students will work hands-on in teams to design, build, program and document their progress.

Unit I : **9 hours**

Specifications of robots- classifications of robots – work envelope - flexible automation versus robotic technology – applications of robots robot kinematics and dynamics positions, orientations and frames, mappings: changing descriptions from frame to frame, operators: translations, rotations and transformations - transformation arithmetic - d-h representation -forward and inverse kinematics of six degree of freedom robot arm – robot arm dynamics

Unit II: **9 hours**

Robot drive mechanisms, hydraulic – electric – servomotor- stepper motor - pneumatic drives, mechanical transmission method - gear transmission, belt drives, cables, roller chains, link - rod systems - rotary-to-rotary motion conversion, rotary-to-linear motion conversion, rack and pinion drives, lead screws, ball bearing screws

Unit III : **9 hours**

construction of manipulators, manipulator dynamic and force control, electronic and pneumatic manipulators

Unit IV: **9 hours**

Trajectory planning and avoidance of obstacles, path planning, skew motion, joint integrated motion – straight line motion-robot languages -.computer control and robot software. .

Text books:

1. Deb s. r. and deb s., “robotics technology and flexible automation”, tata mcgraw hill education pvt. ltd, 2010.
2. John j.craig , “introduction to robotics”, pearson, 2009.
3. Mikell p. groover et. al., "industrial robots - technology, programming and applications", mcgraw hill, new york, 2008.

References:

1. Richard d klafter, thomas a chmielewski, michael negin, "robotics engineering – an integrated approach", eastern economy edition, prentice hall of india pvt. ltd., 2006.

	Industrial Automation	Learning Schedule			
		L	T	P	C
	Pre-requisites: --Microcontroller	3	0	0	3

Course objectives

The course will enable the students to:

1. Know the tools like PLC, and SCADA.
2. Know the configuration of PLC and DCS

Course outcomes

At the end of the course, the students should be able to:

1. Understand the application of tools like PLC, DCS, and SCADA in automation
2. . Configure of PLC and DCS.

Course Description

This course introduces you to practical methods of automatic control of machines, processes and systems. All major parts of a modern industrial control system will be described and their principles explained. These include the Programmable Logic Controller (PLC), as the system 'brain', various field devices, which allow the system to 'sense' and 'affect' the controlled environment, and communication between the system components.

Course Content

Unit I: Introduction & PLC Programming 9 hours

Introduction to automation tools PLC, DCS, SCADA, Hybrid DCS/PLC.

PLC - Ladder diagram – Programming timers and counters – Design of PLC-Instructions in PLC – Program control instructions, math instructions and sequencer instructions.

Unit II: Programmable Logic Controllers 9 hours

Introduction of Advanced PLC programming, Selection of processor, Input/output modules, Interfacing of Input/output devices, Operator Interface, OPC, study of SCADA software, Interfacing of PLC with SCADA software.

Unit III: Automation specifications 9 hours

DCS Project: Development of User Requirement Specifications, Functional Design Specifications for automation tool, GAMP, FDA.

Unit IV: Distributed Control System 9 hours

Introduction to architecture of different makes, DCS Specifications, configuration of DCS blocks for different applications, Interfacing of protocol based sensors, actuators and PLC systems, Plant wide database management, Security and user access management, MES, ERP Interface.

Text Books

1.Gary Dunning, Introduction to Programmable logic Controllers, Thomson / Delmar Learning, 2005.

2.Webb, Reis, Programmable logic Controllers: principles and applications, Prentice Hall of India, 2002.

3.Jose A. Romagnoli, Ahmet Palazoglu, Introduction to process Control, CRC Tylor and Francisgroup, 2005.

Reference Books

1.John. S. Oakland, Statistical Process Control, Butterworth – Heinemann, 2007.

	Robotics LAB	L	T	P	C
	Pre-requisites//Exposure: Embedded Programming	0	0	2	1

Course Objectives:

1. To understand the different robotic configurations and their subsystems.

Course Outcomes

1. Ability to visualize the configurations of various types of robots.
2. Understanding the components of robots like arms, linkages, drive systems and end effectors.

List of experiments

1. Study of different types of robots based on configuration and application.
2. Study of different type of links and joints used in robots
3. Study of components of robots with drive system and end effectors.
4. Determination of maximum and minimum position of links.
5. Verification of transformation (position and orientation) with respect to gripper and world Coordinate system
6. Estimation of accuracy, repeatability and resolution.
7. Robot programming exercises

Text books:

1. deb s. r. and deb s., “robotics technology and flexible automation”, tata mcgraw hill education pvt. ltd, 2010.
2. john j.craig , “introduction to robotics”, pearson, 2009.
3. mikell p. groover et. al., "industrial robots - technology, programming and applications", mcgraw hill, new york, 2008.

References:

1. richard d klafter, thomas a chmielewski, michael negin, "robotics engineering – an integrated approach", eastern economy edition, prentice hall of india pvt. ltd., 2006.

	Industrial automation lab	L	T	P	C
	Pre-requisites//Exposure	0	0	2	1

Course Objectives
The course will enable the students to:
Have basic understanding of PLC and DCS Programming for Various Control Applications.

Course Outcome
The course will enable the students to:
Have basic understanding of PLC and DCS Programming for Various Control Applications.

Course Description
This course aims to provide students with a wide perspective of Electronics. The course takes the most important topics from several courses and joins them together in one course. Topics such as , Diodes, Rectifiers, filters, BJT, FET and operational amplifiers will be covered.

LIST OF EXPERIMENTS
1. Study of different PLCs and their specifications.
2. Ladder diagram implementation of basic logic gates, relay sequencer, timers and counters.
3. Development of Ladder diagram for any one automation system.
4. Study of Interfacing between PLC and Process loop.
5. Programming of HMI interface with PLC.
6. Study of installation and troubleshooting of PLC.
7. Develop an application on SCADA system.
8. Creating and Configuring a Project and tags in SCADA.
9. Configuring Screens and Graphics in SCADA.
10. Case study of Industrial DCS/DCS trainer.
11. Solving different examples by FBD in DCS.
12. Study of Alarm management system and different I/O cards in DCS.
13. Develop communication between DCS and stand-alone controller.
14. DCS based PID control for temperature loop.
15. Interfacing DCS with SCADA/PLC using protocol/fieldbus.

13040703	Real time Embedded System	L	T	P	C
Pre-requisites//Exposure	Embedded System	3	1	0	4

Course Objectives

1. To learn the basic concepts of Embedded Systems
2. To gain an understanding of applications of embedded systems involving real-time programming of microcontrollers.

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

1. Apply the concepts of embedded system.
2. Design and program for Embedded Systems.
3. Explain and work on Real time operating systems.

Course Description

Introduces microcontrollers and embedded processors. Gives knowledge of embedded system programming. Students can independently design and develop a hardware platform encompassing a microcontroller and peripherals.

Course Content

Unit I: PIC Microcontroller **7 lecture hours**

Architecture - Features – Resets –Memory Organizations: Program Memory, Data Memory – Instruction Set – simple programs. Interrupts –I/O Ports –Timers- CCP Modules- Master Synchronous serial Port (MSSP)- USART –ADC- I2C

Unit II: Embedded Processors **9 lecture hours**

ARM processor- processor and memory organization, Data operations, Flow of Control, CPU Bus configuration, ARM Bus, Memory devices, Input/output devices, Component interfacing, designing with microprocessor development and debugging, Design Example: Alarm Clock.

Unit III: Embedded Programming **10 lecture hours**

Programming in Assembly Language (ALP) Vs. High level language – C program elements, Macros and Functions – Use of pointers – NULL pointers – use of function calls – multiple function calls in a cyclic order in the main function pointers – Function queues and interrupt service Routines queues pointers – Concepts of Embedded programming in C++ - Object oriented programming – Embedded programming in C++, C program compilers – Cross compiler – optimization of memory codes.

Unit IV: Real Time Operating Systems **8 lecture hours**

Operating system services –I/O subsystems – Network operating systems –Interrupt Routines in RTOS Environment – RTOS Task scheduling models, Interrupt – Performance Metric in Scheduling Models –IEEE standard POSIX functions for standardization of RTOS and inter-task communication functions–List of Basic functions in a Preemptive scheduler – Fifteen point strategy for synchronization between processors, ISRs, OS Functions and Tasks – OS security issues- Mobile OS**.**

Text Books

1. Raj Kamal , Embedded Systems Architecture, Programming and Design, Tata McGraw-Hill, New Delhi, 2003.ISBN 0-07-049470-3

2. Wayne Wolf, Computers as Components: Principles of Embedded Computing System Design, Morgan Kaufman Publishers, 2001.ISBN=0123884365

Reference Books

1. Frank Vahid and Tony Givargi Embedded System Design: A Unified Hardware/Software Introduction's, John Wiley & Sons, 2000.

2. John B Peatman, Design with PIC Microcontrollers, Prentice Hall of India, 2007ISBN=0130462136

	VLSI Device Modelling	L	T	P	C
	Pre-requisites//Exposure :Semiconductor Devices	3	1	0	4

Course Objectives

Device physics; Short channel effects; Static and dynamic behavior of MOS transistor; Small and large signal modeling of MOS transistor at various frequencies.

Course Outcomes:

On successful completion of this course the students will be able to

1. Demonstrate in-depth knowledge in Static and Dynamic Characteristics.
2. Threshold Variations.
3. Effects of MOS Layers.
4. Modeling at low and High Frequencies.

Course Description:

Students skilled to design, develop, implement and supervise automation systems for industrial processes and to design, control and operate with industrial robotic systems and mobile robots. Studying this course will give you sufficient knowledge to analyze simple manufacturing automation systems, in particular automatic assembly, and to design such systems.

Text books

1. Y. Tsividis, "Operations and Modeling of the MOS Transistor", 2nd edition, Oxford university Press.

Reference books

2. Trond Ytterdal, Yuhua Cheng &Tor A. Fjeldly "Device Modeling for Analog and RF CMOS Circuit Design" Wiley Publication, 2003.

Course content

Unit I: Basic Device Physics-I **12 Lecture Hours**

Two Terminal MOS Structure: Flat-band voltage, Potential balance & charge balance, Effect of Gate-substrate voltage on surface condition, Inversion, Small signal capacitance; C-V Characteristics. Three Terminal MOS Structure: Contacting the inversion layer, Body effect, Regions of inversion, Pinch-off voltage.

Unit II: Basic Device Physics-II **14 Lecture Hours**

Four Terminal MOS Transistor: Transistor regions of operation, general charge sheet models, regions of inversion in terms of terminal voltage, strong inversion, weak inversion, moderate inversion, interpolation models, effective mobility, temperature effects, breakdown p-channel MOS FET, enhancement and depletion type, model parameter values, model accuracy .

Unit III: **14 Lecture Hours**

MOS Transistor with Ion-Implanted Channels: Enhancement of nMOS, Depletion nMOS, Enhancement pMOS.

Small dimension effects: Channel length modulation, barrier lowering, two dimensional charge sharing and threshold voltage, punch-through, carrier velocity saturation, hot carrier effects, scaling, effects of surface and drain series resistance, effects due to thin oxides and high doping. Sub threshold regions, Short channel effects.

Unit IV: Mos Transistor in dynamic operation **14 Lecture Hours**

Large Signal modeling: Quasi static operation, Terminal currents in Quasi static operation, Evaluation of Charges in Quasi static operation, Transit time under DC conditions, Limitations of Quasi static Model, Non Quasi static Analysis. **Small signal modeling for low, medium and high frequencies:** low, Medium frequency small signal model for the intrinsic part, Small signal model for Extrinsic Part, A complete Quasi static Model, Y-Parameter models, Non Quasi static Models.

	Embedded System Lab	L	T	P	C
	Pre-requisites//Exposure : Real time embedded system	0	0	2	2

Course Objectives

The student should be made to:

1. Learn the working of ARM processor
2. Understand the Building Blocks of Embedded Systems
3. Learn the concept of memory map and memory interface
4. Know the characteristics of Real Time Systems
5. Write programs to interface memory, I/Os with processor
6. Study the interrupt performance

Course Outcomes

At the end of the course, the student should be able to:

1. Write programs in ARM for a specific Application
2. Interface memory and Write programs related to memory operations
3. Interface A/D and D/A convertors with ARM system
4. Analyse the performance of interrupt
5. Write programmes for interfacing keyboard, display, motor and sensor.
6. Formulate a mini project using embedded system

Text Book:

1. Frankvahid/Tony Givargis, “Embedded System Design- A unified Hardware/software Introduction”. David E Simon, " An embedded software primer ", Pearson education Asia, 2001.
2. Dreamteach Software team,” Programming for Embedded Systems”. AVR 8515 manual.
3. J.W. Valvano, "Embedded Microcomputer System: Real Time Interfacing".
4. Jack Ganssle, "The Art of Designing Embedded Systems", Newnes, 1999.

List Of Experiments:

1. Study of ARM evaluation system
2. Interfacing ADC and DAC.
3. Interfacing LED and PWM.
4. Interfacing real time clock and serial port.
5. Interfacing keyboard and LCD.
6. Interfacing EPROM and interrupt. Mailbox.
7. Interrupt performance characteristics of ARM and FPGA.
8. Flashing of LEDS.
9. Interfacing stepper motor and temperature sensor.
10. Implementing zigbee protocol with ARM.

	Device modelling lab	L	T	P	C
	Pre-requisites//Exposure :Circuits and Systems	0	0	2	2

Course Objectives: The course will provide adequate understanding of semiconductor device modeling aspects, useful for designing devices in electronic, and optoelectronic applications.

Course Outcomes: After successfully completing this course the student should be able to:

1. Characterize 2 and 3 terminal devices by means of I-V plots.
2. Derive a linearized small-signal model given the large signal characteristics.
3. Describe a circuit and analyze its operation in terms of the bias, mid band small-signal model, or its large signal switching model.
4. Use simulation tools to model a circuit and discuss the difference between the DC, time-domain, and frequency-domain analyses.
5. Analyze various topologies of single-stage amplifiers.
6. Design and analyze circuits that implement simple digital logic gates.
7. Measure the DC characteristics of a 2 or 3 terminal device in the laboratory.
8. Show how three terminal devices can be used as switches or amplifiers.
9. Construct and test small rectifier and transistor circuits in the laboratory.

Course Description:

Modeling, analysis, and simulation of electronic circuits that contain two terminal and three-terminal semiconductor devices. Large-signal, biasing, and small-signal analysis models. Introduction to wave shaping circuits, switching circuits, and amplifiers. Integral laboratory.

Text Book:

1. Donald Neamen, Semiconductors Physics and Devices, Tata Mc Graw Hill, 2003.
2. Tyagi, Introduction to Semiconductor Materials and Devices, Wiley Publications, 2002.

List Of Experiments:

1. Design a CMOS inverter in schematic and simulate for Transient Characteristics.
2. Design a CMOS two input NAND gate, Two input NOR gate, Two input AND gate and Two input OR gate in schematic and simulate for Transient Characteristics.
3. Design the layout of a CMOS Inverter and simulate for DC (Transfer) and Transient characteristics.
4. Design the layout for two inputs NAND gate, two input OR gate, two input AND gate and two input NOR gate and simulate for DC (Transfer) and Transient characteristics.
5. Realized a two input EXOR gate in schematic, draw its layout and simulate for DC (Transfer) and Transient characteristics.
6. To realize a 1 bit full adder in CMOS schematic, design its layout using tool option and simulate for Transient Characteristics.
7. To realize a Boolean expression Y=Not ((A+B) (C+D) E) in schematic, draw its layout and simulate for Transient Characteristics.
8. To realize a 4 X 1 MUX using transmission gates in schematic and simulate for Transient Characteristics.
9. To Realize JK FLIPFLOP in CMOS schematic, design its layout and simulate for Transient Characteristics.
10. To Realize D FLIPFLOP and T FLIPFLOP in CMOS schematic, design its layout and simulate for Transient Characteristics.
11. To realize a four bit asynchronous counter using T flip-flop as a cell in schematic and simulate for Transient Characteristics.

13040706	Industrial/Research Project Phase I	Learning Schedule			
		L	T	P	C
	Pre-requisites: -- Practical knowledge of all labs	0	0	2	1

Course Objectives:

1. To gain first-hand experience of publication.
2. To experience the discipline in the term of research presentation through journals conferences.
3. To know the right publication to present your work in globally acceptable organization.

Course Outcomes

On completion of this course, the students will be able to select the right publication for present & how to select the correct domain to work.

Course Content

1. Select the domain to apply your whole knowledge & skills to improve engineering
2. Choose correct field to work further.
3. Select the few papers & review them either on same software or through different emulator/simulator.
4. Summarize the work and present in national/international conference at least.

13040801	Industrial / Research Project Phase - II	L	T	P	C
Pre-requisites//Exposure	Industrial Exposure & Project Work	0	0	26	13

Course Objectives

The objectives of the Industrial / Research Project Phase – II include:

1. To give students the opportunity to apply the knowledge and skills they have acquired on campus in a real-life work situation.
2. To provide students with opportunities for practical, hands-on learning from practitioners in the students' areas of specialization.
3. To expose students to a work environment, common practices, employment opportunities and work ethics in their relevant field.
4. To enhance the employability skills of the students.
5. To provide opportunities for students to be offered jobs in the organizations in which they undergo their Industrial Training.

Course Outcomes: The learning outcomes can be as follows:

a. Apply theoretical knowledge in industrial applications.
b. Acquire skills in communication, management and team work.
c. Practice ethical and professional work culture.
d. Implement Health and Safety practices in work place.

Course contents:

1. The students are required to undergo Industrial / Research Project work of duration not less than 4 months in a reputed organization or concerned institute.
2. The student who wishes to undergo Industrial project, the industry chosen for should be a private limited company.
3. The final Viva-voca of the Project work will be conducted by the external examiner and one internal examiner appointed by the institute. External examiner will be from penal of examiner.
4. Assessment of project will be based on Seminar, viva-voca, report and certificate of Industrial / Research Project work.
5. The internal marks distribution for students who have undergone Industrial /Institutional project consist of 150 marks from the Industry concern and 350 Marks by the committee members consisting of faculty members of concerned department of the present institute.
6. The teacher engaged for institutional project work shall have a workload of 2 hours per group (at least 4 students per work)