MINUTES

Name of the meeting: Board of Studies.

of

held on 07/06/2013, at 9:30 A.M./P.M. under the chairmanship of Sri Dr. Habibulla Khan

at principal Conference hall.

The Board of Studies meeting of ECE Dept held on 07/06/2013 at 9:30A.M @ principal Conference hall.

The following members attended the meeting.

1. Dr. Habibulla Khan - Chairman (BOS) - HC
2. Dr. M. Madhavi Latha - member. - professor in ECE, JNTU, Hyderabad
3. Dr. N.V.S.N. Sarma - Member. - professor, in ECE, NIT, warangal
4. Dr. M. Venu Gopala Rao - Member -
5. Dr. V. RAJESH - Member -
6. Dr. T.V. Rama krishna - Member -
7. Dr. M.S.G. Prasad - Member -
8. Dr. ASCS Sastry - Member -
9. Dr. K.S. Ramesh - Member -
10. Dr. P.S. Srinivas Babu - Member -
11. Prof. N. Venkat Ram - Member -
12. Dr. Fazal Noorbasha - Member -
13. Mr. B. Murali Krishna - Member -

BOOK

. General Body, Board or as the case may be.

. The name of the Company.

. The place at which the meeting was held.

. At the end of the minutes. Chairman to sign mentioning the number of correction made, if any, in recording the minutes of the meeting.

It is resolved to start M.Tech program in "~~Systems~~ Signal processing" from the A.Y. 2013-14.

It is resolved to adopt the modifications suggested by the members

It is resolved to approve the syllubus suggested for the students' joined in year 2013 as per the DAC recommendation held on 31/05/13.

Chairman
Board of Studies in ECE
KL University

K L UNIVERSITY

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

MINUTES OF DEPARTMENT ACADEMIC COMMITTEE MEETING

The Department Academic Committee meeting is convened at HOD's chamber, Electronics and Communication Engineering, on 31st May 2013 at 3:30 pm.

Agenda:

1. Academic curriculum for 2013-2017 admitted batch.
2. Discussions on feedback report collected from stakeholders.
3. Any other points with the permission of the DAC chairman.

The following members were present:

1. Dr. Habibulla Khan	Professor & Head of the Department
2. Dr. T. V. Rama Krishna	Professor
3. Dr. M. Venugopala Rao	Professor
4. Dr. Ch. Srinivasu	Professor
5. Dr. V. Rajesh	Professor
6. Dr. G. V. Subbarao	Professor
7. Swarna Sunil (9101061)	Student
8. Kolli Ravi Chandra (9101039)	Student
9. R Sneha (9100979)	Student
10. Lakshmi Pratyuha (10100808)	Student
11. M. Rama Krishna (10010918)	Student
12. Vishnu Pattayil (11004381)	Student

The following points were discussed and resolved:

1. The DAC discussed the feedback analysis report taken from stake holders.
2. It is resolved to approve the course structure and syllabus of B. Tech curriculum for 2013-17 admitted batch. (Annexure - I)
3. Upon considering the feedback taken from stake holders, it is resolved to approved include advanced topics are included in new courses 13EC301 Design of Electronic Systems and 13EC205 Analog Circuit Design, 13EC311 Microprocessors and processors.
4. Upon considering the feedback taken from stake holders, practicality on current technologies are included in Electronic Measurements and Instrumentation course with inclusion of new topics to meet current needs. Syllabus of Microprocessors and micro-controllers modified with advanced topics.
5. Based on feedback from stakeholder and research group head, it is resolved to approve to offer a new course 13EC415 DSP Processors and Architecture.
6. After discussion with group heads, it is resolved to approve to offer new core courses 13EC313 Antenna & Wave Propagation and 13EC314 Microwave engineering.

Dr. HABIBULLA KHAN
Professor & Head
Dept. of ECE
KL University
Green Fields, Vaddeswaram
Guntur Dist. A.P, PIN-522 502

7. After discussions based on feedback report from stake holders, it is resolved to approve the new professional electives in the VLSI, Communications systems, and Digital signal processing domains of course structure 2013-14.
8. Upon considering above mentioned feedbacks and surveying through the policy documents in relevance to APIIC, Human Resource Development Policy, Govt. of India, National Skill Development Corporation, Govt. of India, Confederation of Indian Industries, The Associated Chambers of Commerce of India (Assocham), The National Association of Software and Services Companies (NASSCOM), ABET, NBA norms, AICTE statutory norms and Institute of Electrical and Electronics Engineers (IEEE), it is resolved to propose enclosed Program development documents and curriculum for B. Tech Electronics and Communication Program for 2013-14 for BOS approval (Annexure 1).

Dr. Habibulla Khan
(Head of the Department)

Dr. HABIBULLA KHAN
Professor & Head
Dept. of ECE
KL University
Green Fields, Vaddeswaram
Guntur Dist. A.P, PIN-522 502

K L University

Department of Electronics and Communication Engineering

Department Academic Committee (DAC)

The following members attended the meeting on 31st May 2013 at 3:30 pm.

S.No	Name of the member	Designation	Signature
1	Dr. Habibulla Khan	Professor, HOD	
2	Dr.T. V. Rama Krishna	Professor	
3	Dr. M. Venugopala Rao	Professor	
4	Dr. Ch. Srinivasu	Professor	
5	Dr. V. Rajesh	Professor	←ABSENT→
6	Dr. G. V. Subba Rao	Professor	
7	Swarna Sunil (9101061)	Student	
8	Kolli Ravi Chandra (9101039)	Student	
9	R Sneha (9100979)	Student	
10	Lakshmi Pratyuha (10100808)	Student	
11	M. Rama Krishna (10010918)	Student	
12	Vishnu Pattayil (11004381)	Student	

ANNEXURE-1

B. Tech course structure 2013-14

S. No.	Course Code	Course Name	LTP	CR	Added / Modified/ Retained
I – HUMANITIES & SOCIAL SCIENCES					
1	13HS101	English	2-0-2	3	**Modified**
2	13HS102	Language and Reasoning skills	2-0-2	3	**Added**
3	11BS101	Ecology & Environment	2-0-0	2	**Modified**
4	13HS 104	Human Values	2-0-0	2	**Added**
II		**BASIC SCIENCES**			
5	13BS101	Linear Algebra & Multivariant Calculus	3-0-2	4	**Added**
6	13BS102	Differential Equations	3-1-0	4	**Added**
7	13BS103	Engineering Physics	3-0-2	4	**Modified**
8	11BS104	Engineering Chemistry	3-0-2	4	**Modified**
9	13BS201	Mathematical Methods	3-0-0	3	**Added**
10	13BS202	Complex Variables & Discrete Mathematics	3-0-0	3	**Added**
11	13ES101	Problem Solving through Programming	3-0-2	4	**Modified**
12	13ES102	Measurements	3-0-2	4	**Modified**
13	13ES103	Engineering Materials	3-0-0	3	**Modified**
14	11ES104	Engineering Graphics with CAD	0-0-4	2	**Modified**
15	13ES105	Workshop Practice	0-0-4	2	**Retained**
16	13ES106	Engineering Mechanics	3-0-2	4	**Added**
17	13ES201	Thermodynamics	3-0-0	3	**Added**
18	13ES202	Object Oriented Programming	3-0-2	4	**Added**
19	13ES203	Network Theory	3-0-2	4	**Added**
20	13ES204	Data Structures	3-0-2	4	**Added**
21	13ES205	Signal processing	3-0-2	4	**Added**
		PROFESSIONAL CORE COURSES			
22	13EC201	Design of Electronic Systems	3-0-2	4	**Added**
23	13EC202	Electromagnetic Field Theory	3-0-2	4	**Modified**
24	13EC203	Basics of Digital Systems	3-0-2	4	**Modified**
25	13EC205	Analog Electronic Circuits	3-0-2	4	**Added**
26	13EC206	CMOS VLSI Design	3-0-2	4	**Retained**
27	13EC207	Analog Communication	3-0-2	4	**Retained**
28	13EC308	Digital Communications	3-0-2	4	**Retained**
29	13EC312	Design with PLDs and FPGAs	3-0-2	4	**Retained**
30	13EC313	Antenna and Wave Propagation	3-0-2	4	**Retained**
31	13EC314	Microwave Engineering	3-0-2	4	**Retained**

DR. HABIBULLA
Professor & Head
Dept. of ECE
KL University
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32	13EC415	DSP Processors and Architecture	3-0-2	4	**Added**
33	11EC311	Micro-Processors & Micro Controllers	3-0-2	4	**Modified**
34	11EE304	Control Systems	3-0-2	4	**Retained**
35	13CS205	Computer Networks	3-0-2	4	**Retained**
		Professional electives			
		COMMUNICATION SYSTEMS			
36	13EC340	Information Theory & Coding	3-0-0	3	**Added**
37	13EC341	TV and Video Engineering	3-0-0	3	**Added**
38	13EC342	Optical Communications	3-0-0	3	**Added**
39	13EC443	Satellite Communications	3-0-0	3	**Added**
40	13EC444	Cellular Communications	3-0-0	3	**Added**
41	13EC345	EMI/EMC	3-0-0	3	**Added**
42	13EC346	RF System Design	3-0-0	3	**Added**
43	13EC447	Radar & Navigational Aids	3-0-0	3	**Added**
44	13EC448	Microwave and Millimetric Wave Circuits	3-0-0	3	**Added**
45	13EC349	Radiating Systems	3-0-0	3	**Added**
		VLSI			
46	13EC461	Analog VLSI Design	3-0-0	3	**Added**
47	13EC362	Low Power VLSI Design	3-0-0	3	**Added**
48	13EC363	ASIC Design	3-0-0	3	**Added**
49	13EC364	Design for Testability	3-0-0	3	**Added**
50	13EC465	Mixed Signal Circuits & Systems	3-0-0	3	**Added**
		DIGITAL SIGNAL PROCESSING			
51	13EC470	Array Signal Processing	3-0-0	3	**Added**
55	13EC371	Modern Digital Signal Processing	3-0-0	3	**Added**
52	13EC372	Digital Image Processing	3-0-0	3	**Added**
53	13EC373	Multi-rate Signal Processing	3-0-0	3	**Added**
54	13EC474	Speech Processing	3-0-0	3	**Added**

Dr. HABIBULLA KHAN
Professor & Head
Dept. of ECE
KL University
Green Fields, Vaddeswaram
Guntur Dist. A.P, PIN-522 502

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

List of Courses Modified in B. Tech Curriculum 2013-14

Syllabus before revision	Syllabus after revision
11 HS 101 English 3-1-0 LEXIS & Recap of Language Skills: Basic word list, Antonyms, Synonyms, Analogies, Eponyms, One word substitutes. English Usage and Mechanics: Correction of sentences, Sentence completion, jumbled sentences, Office communication: Letter writing, Formats of letter writing – full block and semi block models, Types of letters – formal and informal letters Personal, business, Sales, collection, regret letters, Memo writing, Office memos, Routing slips, Note making and note taking, English skills for the media, News Papers, Writing advertisement captions, Writing headlines, punch lines, cut lines, tag lines, Writing Brites and blurbs, Profiling, briefing and proof reading skills, Catch phrases, Tabloidese, Radio and T.V talks, New media films and pod casts, Reading skills: Reading comprehension, Reading for information, Reading for specifics, Skimming and scanning.	13 HS 101 English 2-0-2 Kinesics: Body language: Postures, Gestures, Eye Contact How they work in social context, Kinesics-The Psychological aspect, Personality traits, Self-awareness, Self-confidence, Self-esteem, Self-image-Hubris, Evaluation Components: i) Case Studies involving application of concepts. ii) Quiz questions Lexis & Language Proficiency, Gre: word list 800 words and 200 foreign expressions, Synonyms, Analogies, Antonyms, One word, substitutes, Idioms and Phrases, English Usage and Mechanics, Correction of sentences Sentence completion (GRE model : each blank should be filled with two synonyms out of six choices) Jumbled sentences Office communication Letter writing Formats of letter writing – full block and semi block models----Types of letters – formal and informal letters----Personal, business, Sales, collection, regret letters. Routine Forms Of Communication: Writing Circulars, writing product and process descriptions, Brochures and handouts, Writing/ designing User manuals, Memo writing Office memos, Routing slips, Note making and note taking Reading skills, Reading comprehension Reading for information Reading for specifics Skimming and scanning. Reading speed – Practice and tests Reading recall
11 BS 105 Ecology And Environment 2-0-0 Scope, importance, Need for public awareness, Institutions and people in Environment, Environmental movements. Environmental calendar. Concept of ecomark. **Natural Resources: Forest resources**: Forest distribution, importance of forests, causes, effects and control of deforestation. JFM. **Water resources:** Nature of water resources, distribution of water resources, floods, drought, conflicts over water, dams- benefits and problems, **Water conservation,** rain water harvesting, watershed management, Cloud seeding. **Mineral resources**: Types of Mines, Environmental effects of mining. **Food resources:** World food problems, effects of modern agriculture, water logging, salinity. **Energy resources:** Growing energy needs, renewable and non renewable energy sources. **Land resources:** land degradation, Soil erosion and desertification. Case studies, Role of an individual in conservation of natural resources. **Ecosystems:** Structure and function of an ecosystem, Energy flow, ecological pyramids, Biogeochemical cycles, Types of ecosystem, Ecological succession, Threats to ecosystems. **Biodiversity and its Conservation:** Levels and Values of biodiversity, India as a mega diversity nation, Biogeographical classification of India, Hotspots, threats and conservation methods of biodiversity, IUCN Red data book. Endangered and endemic species. **Environmental Pollution:** Pollution, Causes, effects and control of pollutions (Air, water, soil, Noise, Marine, Thermal, and Nuclear), Soil waste management. Global warming, Acid rains, Ozone layer depletion. Environmental Legislation (Air, Water, Forest, Wildlife, Environment Protection Act), EIA, Pollution case studies. Disaster management: Cyclones, Floods, Earth quacks, landslides. Role of an individual in prevention of pollution. **Field visits:** Field study of local Industrial,	11 BS 105 Ecology And Environment 2-0-0 The Multidisciplinary nature of Environmental Studies Environment: Definition – scope – importance – Need for public awareness. Institutions and people in Environment; Natural Resources: Renewable and Non- Renewable Resources: Forest resources: Use – over exploitation – deforestation – case studies- mining, dams and their effects on forests and tribal people. Water resources: Use – over utilization of surface and ground water – floods – drought – conflicts over water, dams- benefits and problems, Water conservation – rain water harvesting – watershed management, Cloud seeding Mineral resources: Use – exploitation – environmental effects – case studies. Food resources: World food problems – changes caused by agriculture and overgrazing – effects of modern agriculture – fertilizer-pesticide problems – water logging – salinity – case studies. Energy resources: Growing energy needs – renewable and non renewable energy sources – case studies. Land resources: Land as a resource – land degradation – man induced landslides – soil erosion and desertification. Role of an individual in conservation of natural resources. Ecosystems: Concept of an ecosystem: Structure and function of an ecosystem -Producers – consumers – decomposers, Energy flow in the ecosystem – Ecological succession – Food chains – food webs and ecological pyramids. Types of ecosystem. Biodiversity and its Conservation: Introduction – Definition, Levels, Values of biodiversity: India as a mega diversity nation. Hotspots of biodiversity. Threats to biodiversity: Endangered and endemic species of India. Conservation of biodiversity: Assessment of Biodiversity and its impact on Environment. Environmental Pollution: Definition – Causes – effects – control measures of Air pollution – Water pollution – Soil

Dr. HABIBULLA KHAN
Professor & Head
Dept. of ECE
KL University
Green Fields, Vaddeswaram
Guntur Dist. A.P, PIN-522 502

Agricultural and ecologically important sites.	pollution – Marine pollution – Noise pollution – Thermal pollution – Nuclear hazards. Soil waste management. Role of an individual in prevention of pollution - case studies. Disaster management: floods – earthquake – cyclone – landslides. Climate change – global warming – acid rain – ozone layer depletion – case studies. Environmental Legislation and objectives of 1. Environment Protection Act, 2. Air (Prevention and Control of Pollution) Act, 3.Water (Prevention and control of Pollution) Act, 4. Wildlife protection Act, 5. Forest conservation Act, 6. Biodiversity Act – Public awareness. Environmental Impact Assessment - overview.
11 BS 103 Engineering Physics 3-0-2 Interference: Principle of superposition, interference, conditions for maxima and minima, Interference in thin films (reflected and transmitted lights); Interference in thin wedge shaped film, Newton's rings determination of wavelength. Polarisation: Differences between un-polarized light and polarized light , representation of polarized light (Brewster's law), polarization by reflection, polarization by double refraction, Nicol's prism, concept of QWP and HWP, superposition of o – ray and e – ray and concept of CPL and EPL. Ultrasonics: Properties, production – Magnetostriction, Piezoelectric methods, detection – piezoelectric detector, acoustic grating, Kundt's tube method. Applications – Industrial (drilling, welding, soldering, cleaning, SONAR, NDT (pulse echo, transmission, resonance technique), Medical (echo cardiogram, ultrasonic imaging). Electrostatics: Coulomb's law (vector form), definition of electric field for a point charge, concept of electric flux, flux density, statement of Gauss's law (no proof). Applications of Gauss's law - line of charge, sheet of charge, spherical charge distribution (solid sphere and spherical shell). Magnetostatics: Magnetic force on a moving charge, Lorentz force equation, applications, Cyclotron, Hall Effect, Biot-Savart's law, B due to straight conductor carrying current, and circular loop, Ampere's law and applications- straight conductor carrying current, magnetic flux, Gauss's law of magnetostatics, Maxwell's equations (statement only) for static fields, LCR series resonant circuit. Electrodynamics & Maxwell's Equations: Faraday's laws with experiments, Lenz's law, motional e.m.f, and transformer e.m.f with examples, induced electric fields, concept of displacement current, Maxwell's equations (statement only) for time varying fields. Semiconductor Physics: Types of solids – conductors, semiconductors, insulators; bonding in semiconductors; types of semiconductors; construction and working of PN junction diode. Opto Electronic Devices: Photo electric effect, light emitters – LED; light detectors – Photo diode, Photo transistor; solar cells – principle, fabrication and its applications. Superconductivity: Introduction, properties, Experimental facts – resistance Vs temperature, Meissner effect, Josephson Effect, critical parameters, type I and II superconductors, HTS, applications. Lasers: Characteristics, stimulated & spontaneous emission, population inversion, metastable states, pumping mechanisms, Ruby, He:Ne, GaAs lasers, application of lasers in engineering & medicine.	13 BS 103 Engineering Physics 3-0-2 Electromagnetism: Coulomb's law, Gauss's law, Electric current and equation of continuity, motion of charged particles in electric and magnetic fields, Lorentz force, Hall effect, Cyclotron, Biot- Savart's law, Ampere's law, Faraday's law of induction, Generalization of Ampere's law. Opto Electronic Devices: Introduction – working of PN junction diode, light emitters – LED; light detectors – Photo diode, Photo transistor, photovoltaic effect, solar cells – principle and its applications. Optics: Ray Optics – Lens aberrations (chromatic, achromatic, spherical, distortion, astigmatism, coma), measures of correct aberrations. Interference – coherence (spatial, temporal) in thin films of uniform thickness (derivation); Newton's rings, Application – wavelength, refractive index; Fiber Optics including Introduction, Optical fiber as a dielectric wave guide- total internal reflection, Numerical aperture and various fiber parameters, losses associated with optical fibers, step index and graded index fibers, application of optical fibers. Infrared principles and devices (Thermal Imaging) and Night vision devices. Superconductivity: Introduction, properties, Experimental facts – Resistance Vs Temperature, Meissner effect, Josephson Effect, critical parameters, type I and II superconductors, HTS, applications. Ultrasonics: Properties, phenomenon of Magnetostriction, production – Piezoelectric methods, detection – piezoelectric detector, acoustic grating, Kundt's tube method. Applications – Industrial (drilling, welding, soldering, cleaning, SONAR), NDT (pulse echo, transmission, resonance technique), Medical (echo cardiogram, ultrasonic imaging). Lasers: Fundamentals of LASER- absorption of light, spontaneous emission of light, Stimulated emission of light – population of energy levels, Einstein A and B coefficients, Metastable state, population inversion, resonant cavity, excitation mechanisms, Lasing action; Properties of laser, characteristics of different types of laser; Types of laser- Solid State Laser: Ruby Laser, Gas Laser – 49, He-Ne, Semiconductor Laser: GaAs Laser; Applications of Laser in Engineering – drilling, welding, cutting, measurement of long distances, in Medicine as a surgical tool (blood less surgery).
11 BS 104 Engineering Chemistry 3-0-2 Water Technology: Sources, impurities, hardness, types of hardness, estimation of hardness by EDTA, alkalinity – numericals, ill effects of water in steam generation, preventive measures - internal and external treatments (cold and hot lime soda processes, numericals and ion exchange process), Quality standards and treatment for drinking water desalination methods: Electrodialysis and	11 BS 104 Engineering Chemistry 3-0-2 Electrochemical energy systems: Basics, electrode potential, emf of a cell, reference electrodes (calomel, glass), determination of pH. Concentration cell. Conversion and storage of electrochemical energy: Zn-C dry cell, lead acid, nickel-cadmium, Lithium cells. Chemistry of H2, H2-O2 fuel cell, future batteries, powered car and solar cell. Corrosion Science: Definition,

Dr. ABDUL KHAN
Professor & Head
Dept. of ECE
KL University
Green Fields, Vaddeswaram
Guntur Dist. A.P, PIN-522 502

reverse osmosis. Polymers: Polymers – definition - polymerisation – types - addition and condensation polymerization-free radical and coordination polymerisation mechanisms – plastics, classification – preparation, properties and uses of PVC, Teflon, Bakelite, UF resin and PET. Chemistry and applications of conducting polymers (poly acetylene and poly aniline), FRP composites and abrasives – classification, properties and uses. Electrochemical energy systems: Basics, electrode potential, emf of a cell, reference electrodes (calomel, glass), determination of pH. Concentration cell. Conversion and storage of electrochemical energy: Zn-C dry cell, lead acid, nickel-cadmium, Lithium cells. Chemistry of H2, H2-O2 fuel cell, future water powered car and solar cell. Corrosion Science: Definition, atmospheric corrosion-mechanism, electrochemical corrosion-mechanism, microscopic galvanic cell corrosion, concentration galvanic cells, galvanic cells created by differences in composition, structure and stress, factors affecting corrosion, Corrosion control-material selection, design, alteration of environment, cathodic and anodic protection, Electroplating of Cu. Phase Rule: Statement and explanation of terms involved – one component system – water system condensed phase rule- construction of phase diagram by thermal analysis – simple eutectic system (Pb-Ag).	atmospheric corrosion-mechanism, electrochemical corrosion-mechanism, microscopic galvanic cell corrosion, concentration galvanic cells, galvanic cells created by differences in composition, structure and stress, factors affecting corrosion, Corrosion control-material selection, design, alteration of environment, cathodic and anodic protection, Electroplating of Cu. Water Technology: Sources, impurities, hardness, types of hardness, estimation of hardness by EDTA, alkalinity – numericals, ill effects of water in steam generation, preventive measures - internal and external treatments (cold and hot lime soda processes, numericals and ion exchange process), Quality standards and treatment for drinking water desalination methods: Electrodialysis and reverse osmosis. Polymers: Polymers – definition - polymerisation – types - addition and condensation polymerization-free radical and coordination polymerisation mechanisms – plastics, classification – preparation, properties and uses of PVC, Teflon, Bakelite, UF resin and PET. Chemistry and applications of conducting polymers (poly acetylene and poly aniline), FRP composites and abrasives – classification, properties and uses. Phase Rule: Statement and explanation of terms involved – one component system – water system – condensed phase rule – construction of phase diagram by thermal analysis – simple eutectic system (Pb-Ag).
11 ES 101 Problem Solving Through Programming 3-0-2 Introduction: Character set, Integers, Floating point, Boolean, Pointer data types, Declaration, Introduction to Formatted input and output. Operators and Expressions: Assignment, Arithmetic operators, Implicit type conversions, Precedence and associatively of operators, Relational, Logical, Compound assignment, Increment and Decrement, Cast and conditional operators. Statements and Control Flow: Flow charts for Algorithm Development, simple and compound statements, Null and Expression statements, Selection statements, Repetition statements, Jump statements. Functions: Function Definition, Function prototypes, calling functions, Standard C Header files and libraries, Mathematical functions, Recursive functions, Global and local variables, Storage classes. Formatted Input and Output: Formatting output for functions in the printf() family, Formatting input for functions in the scanf() family. Characters and Strings : Character Code, Character input and output, character handling functions, Stings, string input and output, The continuation character, string manipulation-length, copy, append, compare. Structures, Enumerations, Unions: Structures, Enumerations, unions. Arrays: Declaration of Arrays, Processing Data in Arrays, Passing Arrays to Functions, Introduction to Vectors and Matrices. Pointers: Pointer variables, pointer Arithmetic, calling functions by Reference using pointers, Relation between pointers and arrays, using pointers to pass One-Dimensional arrays to functions, Dynamic Allocation of Memory, Functions Returning pointers, Array of pointers. File Processing: Opening and closing files, reading and writing sequential files.	13 ES 101 Problem Solving Through Programming 3-0-2 Scalar Types and Input/output: Character set, Declaration, Integer types, Boolean type, Character type, Pointer type, Real floating-Point types, The pointer type, Typedefs, Initialization, Introduction to formatted input and output: the printf(), scanf() function. Operators and Expressions: Assignment, Arithmetic operators, Implicit type conversions, Precedence and associativity of operators, Relational, Logical, Compound assignment, Increment and Decrement, Cast operators type conversions, size of operator, Conditional operators. Comma operator, bitwise operators. Statements and Control Flow: Flow charts for Algorithm Development, simple and compound statements, Null and Expression statements, Selection statements, Repetition statements, Jump statements. Pseudo code for Procedures and algorithm development. Functions: Function Definition, Function prototypes, calling functions, Standard C Header files and libraries, Mathematical functions, and Recursive functions. Arrays: Declaration of Arrays, How arrays are stored in memory, Initialization of arrays , Processing Data in Arrays, Passing Arrays to Functions, Introduction to Vectors and Matrices. Pointers: Pointer variables, pointer Arithmetic, calling functions by Reference using pointers, constant pointer, Relation between pointers and arrays, using pointers to pass One-Dimensional arrays to functions, Dynamic Allocation of Memory, Functions Returning pointers, Pointers to pointers, Array of pointers, Pointers to functions: Functions with arguments of pointers to functions, functions returning pointers to functions. Generic pointer for passing arguments with different data types, Pointer to arrays, Dynamic allocation of 2D arrays. File Processing: Opening and closing files, reading and writing sequential files and random access files. Structures, Enumerations, Unions: Structures, Enumerations, Unions, Characters and Strings : Character Code, Character input and output, character-Handling functions, Stings, string input and output, The continuation character converting

Dr. HABIBULLA, Ph.D.
Professor & Head
Dept. of ECE
KL University
Green Fields, Vaddeswaram
Guntur Dist. A.P, PIN-522 502

	strings to numerical values, string manipulation: length, copy, append, compare. Searching strings. The main() function and command line arguments. Formatted Input and Output: Formatting output for functions in the printf() family: Printing Integers, Floating point Numbers, Characters and Strings. Formatting input for functions in the scanf() family: Input an Integer, floating point Number, Characters and Strings. Storage classes. Global and local variables, storage classes, External functions and variables Preprocessing Directives: Macro replacement, Predefined Macros, Source file inclusion, Conditional inclusion.
11 ES 102 Measurements 3-0-2 Fundamentals of Measurement: General terms of measurements, Calibration, Standards, Dimensions and Units, Generalized measurement system, Basic concept in dynamic measurement system, System response, Distortion, Causes and Types of Experimental Errors, Transducers and Types of Transducers. Basic Electrical Parameters and Sensing Devices: Measurement of Current, Voltage, Power, Power factor, Frequency, Phase, RLC Parameters, Ranges of various meters, various applications using their suitable transducers. Displacement and Pressure Measurements: Dimensional Measurements, Gauge block, Optical methods, Pneumatic displacement gauge, Pressure measurement, Dynamic response considerations, mechanical pressure measurement devices, Dead weight tester, Bourdon tube pressure gauge, Diaphragms, Bellows gauges, The McLeod gauge. Flow and Temperature Measurement: Classification of flow measurement system, Rotameter, Turbine flow meter, Hot wire anemometer, Introduction to temperature measurement, Ranges, Various principles of measurement, Electrical resistance, Thermistor, Thermocouple, Radiation pyrometers, Temperature Indicators. Stress and Strain Measurements: Various types of stress and strain measurements, Electrical Strain gauge, Gauge factor, Method of usage of resistance strain gauge for bending, compressive and tensile strain, usage for measuring torque and strain gauge rosettes, Elastic elements for force measurement, Torque measurement.	13 ES 102 Measurements 3-0-2 Fundamentals of Measurements: Introduction, types of measurements, generalized measurement system with examples, static & dynamic characteristics of measurement system, types of Errors, error sources and remedies, statistical analysis of data, regression analysis (using excel) of data, distortion. Electrical measurements: Fundamentals: Basic parameters like Current, Voltage, RMS value, Average value, Power, Power factor, Resistance, Impedance, Inductance, and Capacitance. Transduction principles: Magnetic, Induction, Electrostatic, Thermoelectric, Hall Effect. Measurements using: PMMC, Extension of range, Rectifier type, MI, EDM, Electrostatic, Thermocouple type, Wheatstone bridge, Anderson's bridge, Maxwell's and Schering Bridge. Project ideas. Electronic measurements Fundamentals of Cathode Ray Oscilloscope: Block diagram, CRO probes, Delay line, types of Oscilloscopes. Measurement of: Signal voltage, Current, Phase & Frequency using Lissajous patterns, Industrial applications of CRO. Electro-physiological measurements: Electrodes, ECG – EEG – EMG – ERG typical waveforms. Project ideas. Mechanical measurements Fundamentals: Displacement, Velocity, Speed, Force, Moment, Torque, Stress, Strain, Pressure, Flow, Temperature, Viscosity, Humidity. Measurement of Displacement – Flapper-Nozzle technique, LVDT, Interferometer. Speed – Tachometer, Magnetic & Photo pick up. Force & Torque – Load cells, Prony brake. Stress & Strain – Mechanical Strain gauge, Resistance strain gauge. Pressure – Manometers, McLeod gauge, Bourdon pressure gauge. Flow – Notches, Orifice meter, Rotameter, Turbine meter, Hot-wire anemometer. Temperature – Thermometer, Thermocouples, Thermistors, Pyrometers. Viscosity – Psychrometers, Falling ball type, Rotating vane type. Humidity – Hygrometers. Project ideas.
11 ES 103 Engineering Materials 3-0-0 Magnetic materials: Basic concepts – magnetic moment, susceptibility, permeability; Types of materials – Dia, para, ferro, anti ferro and ferri; Hysteresis of ferromagnetic materials; Soft and hard magnetic materials; Magnetic materials for transformers, motors, magnetic storage, magnetic memories, magnetic tapes, magnetic recorder, relays, sensors and electromagnets. Electrical materials: Types of materials – conducting materials, semiconducting materials, insulating materials, dielectric materials; Electrical conduction – Ohm's law, electrical conductivity, resistivity. Dielectric polarization – Piezo electricity, ferro electricity; materials for winding of motors, transformers. Mechanical and Thermal properties of materials: Stress, strain, strength, hardness, ductility and malleability, toughness, brittleness; relationship between stress and strain; elasticity and plasticity; deformation – creep, fatigue and fracture. Temperature, specific heat and thermal conductivity. Classification of ferrous and nonferrous materials, types of steels, cast irons, aluminum alloys,	13 ES 103 Engineering Materials 3-0-0 Crystal Structure And Crystallography: Crystal lattice – primitive and unit cell – crystal systems – Bravais lattice – Miller indices – Structure of Crystal – Simple Cubic, Body Centered Cubic, Face centered Cubic and Hexagonal Close Packed structure. Sodium chloride structure, X ray Spectrum – Moseley's law – diffraction of X-rays by crystals – Bragg's law in one dimension – Experimental methods in X-ray diffraction – Laue's method, rotating crystal method – powder photograph method – point defects - line, surface and volume defects – effects of crystal imperfections, Applications. Magnetic Properties Of Materials: Basic concepts – magnetic moment, susceptibility, permeability; Types of materials – Diamagnetic, paramagnetic, ferromagnetic, anti ferromagnetic and ferrimagnetic materials, Weiss theory of ferromagnetism, domain theory of ferro magnetism, Ferrites, Hysteresis effect; Soft and hard magnetic materials; Applications- Fabrication of transformers, motors, magnetic storage devices- magnetic memories,

Dr. H. ABDUL KHADER
Professor & Head
Dept. of ECE
KL University
Green Fields, Vaddeswaram
Guntur Dist. A.P, PIN-522 502

copper alloys, super alloys. automotive engine parts. Construction materials: Classification and applications of cement, bricks, stones, wood, glasses and paints. Refractories for furnaces. Composite materials: Laminates, properties of laminates, copper clad laminates, filler, resin, copper foil, phenolic, epoxy, polyester, silicon, polynide laminates. Nano materials and Nanotechnology: Basic concepts of nanotechnology. Properties and technological advantage of nano materials. Carbon nano tubes and applications. Nano material preparation by sol-gel method and chemical vapor deposition.	magnetic tapes, magnetic recorder, relays and sensors. Electrical Properties Of Materials: Introduction to electrical materials – Band theory of solids-conducting materials -Ohm's law, electrical conductivity, electrical resistivity –, semiconducting materials, types – properties and effects of impurities and temperature. Insulating materials –. Requirements of good insulating materials: Some insulating materials – glass, mica, ceramics, asbestos, resins, rubber, transformer oil. Introduction to Dielectric materials – Polar and non-polar dielectrics, Dielectric constant, Dielectric Polarization – electronic, ionic, orientation or dipolar and space charge polarizations(qualitative treatment), frequency and temperature dependence of polarization, ferro electricity-spontaneous polarization and structure of barium titanate .Piezo electricity & Piezo electric materials- applications. Mechanical And Thermal Properties Of Metals:Definitions – elasticity, plasticity, Stress, strain, strength, hardness, brittleness, ductility, creep, fatigue, fracture, and toughness. Relationship between stress and strain; Hardness – Hardness tests, Heat treatment processes (Tempering, Quenching Nitriding, Hardening), specific heat and thermal conductivity. Micro And Nano Materials: Agile materials for microwave components, Terahertz meta materials and its applications (Radar Sensors, and Future wireless communications), Basic concepts of Nano Science and technology, Size effects of materials, Nano materials classification and Properties, Nano material preparation by sol-gel method and Chemical Vapor Deposition method. Introduction to Carbon nano tubes (CNT's), Synthesis of CNT's by bottom up Approach, Properties of Carbon nano tubes and their applications in science and techno technology.
11 ES 104 Engineering Graphics with CAD 0-0-4 Introduction to Computer Aided Drafting, AutoCAD Commands, Theory of Projection – Elements of projection, planes of projection, methods of projection. Orthographic Projection – Lines used in general engineering drawing, types of surfaces, invisible lines, precedence of lines, selection of views, principles of multi view drawing, steps to draw orthographic views, orthographic projection of different objects. Isometric Drawing – Divisions of pictorial projection, divisions of axonometric projection, theory of isometric projection, isometric drawing, non-isometric drawing, isometric drawing from orthographic views for simple objects. Projection of straight Lines – Projection of points, various positions of straight lines w.r.t. reference planes, skew line, traces of line, projection of straight lines and traces. Projection of Planes – Types of planes, projection of planes, traces of planes. Projection of Solids – Divisions of solids, Polyhedra, solids of revolution, projection of solids in simple position, projection of solids with axis inclined to one reference plane and parallel to other.	11 ES 104 Engineering Graphics with CAD 0-0-4 Introduction to Computer Aided Drafting, AutoCAD Commands, Types of lines, Dimensioning, Theory of Projection – Elements of projection, planes of projection, methods of projection. Projection of Points and Straight Lines – Projection of points, projections of straight lines, various positions of straight lines w.r.t. reference planes, traces of lines. Projection of Planes – Types of planes, projection of planes, various positions of planes w.r.t reference planes (Use First angle method of projection) Projection of Solids – Types of solids, projection of solids in simple position, projection of solids with axis inclined to one reference plane and parallel to other. (Use First angle method of projection) Orthographic Projection – Introduction to Orthographic projections, types of surfaces, invisible lines, precedence of lines, steps to draw orthographic views, orthographic projection of different objects. (Use First angle method of projection) Isometric projection – Theory of isometric projection, isometric view, isometric views from orthographic views for simple objects. (Use First angle method of projection)
11 EC 202 Electromagnetic Field Theory 3-1-0 Vector Analysis: Introduction to vector analysis, co-ordinate systems Electrostatics: Types of charge distributions, Coulomb's Law, Electric field intensity, Electric-field intensity due to different charge distributions, electric flux, electric flux density, Gauss's Law and applications, Divergence, Divergence theorem , Potential and Potential difference, Potential field of a point charge and a system of charges, Potential gradient, electric dipole,Poisson's and Laplace's equations. Capacitance of different configurations. Boundary conditions on E and D, Energy density in Electrostatic field Steady Magnetic Field: Electric current, current densities, equation of	13 EC 202 Electromagnetic Field Theory 3-0-2 Vector Analysis: Introduction to vector analysis, co-ordinate systems Electrostatics: Types of charge distributions, Coulomb's Law, Electric field intensity, Electric-field intensity due to different charge distributions, electric flux, electric flux density, Gauss's Law and applications, Divergence, Divergence theorem , Potential and Potential difference, Potential field of a point charge and a system of charges, Potential gradient, electric dipole, Poisson's and Laplace's equations. Capacitance of different configurations. Boundary conditions on E and D , Energy density in Electrostatic field Steady Magnetic Field: Electric current, current densities, equation of

Dr. HARIBELLA KL
Professor & Head
Dept. of ECE
KL University
Green Fields, Vaddeswaram
Guntur Dist. A.P, PIN-522 502

continuity. Fundamentals of steady magnetic field, Faraday's Law of Induction, Magnetic flux density, Magnetic field strength, Biot-savart's Law and applications, Ampere's circuital law, differential form of Ampere's circuital law, Curl, Stoke's theorem, Lorentz force equation, force on a current element in magnetic field, Ampere's force law, Boundary conditions on H and B, scalar and vector magnetic potentials, energy density in magnetic field. Maxwell's Equations: Introduction, equation of continuity for time - varying fields, Faraday's law, Inconsistency of Ampere's Law, the concept of displacement current, modified Ampere's circuital Law, Maxwell's equations for static fields and time – varying fields both in differential form and integral form. Maxwell's equations in phasor form, Boundary conditions. Electromagnetic Waves: Introduction, wave equations for free space, Uniform plane wave-general solution and propagation. Wave equations for conducting medium. Wave equations in phasor form, wave propagation in loss less medium, conducting medium, good dielectrics and good conductors, skin effect, polarization. Pointing theorem and pointing vector, complex Pointing vector. Guided Waves: Introduction, Waves between parallel plates, Derivation of field equations between parallel plates and propagation parameters, field components for TE waves, field components of TM waves, Propagation parameters of TE and TM waves, Guided wavelength. Transverse electromagnetic wave (TEM wave), velocities of propagation. Attenuation in parallel plane guides, wave impedances. Wave Guides: waves in rectangular wave guides, Derivation of field equations in rectangular wave guides, propagation parameters of TE and TM waves in rectangular wave guides.	continuity. Fundamentals of steady magnetic field, Faraday's Law of Induction, Magnetic flux density, Magnetic field strength, Biot-savart's Law and applications, Ampere's circuital law, differential form of Ampere's circuital law, Curl, Stoke's theorem, Lorentz force equation, force on a current element in magnetic field, Ampere's force law, Boundary conditions on H and B, scalar and vector magnetic potentials, energy density in magnetic field. Maxwell's Equations: Introduction, equation of continuity for time - varying fields, Faraday's law, Inconsistency of Ampere's Law, the concept of displacement current, modified Ampere's circuital Law, Maxwell's equations for static fields and time – varying fields both in differential form and integral form. Maxwell's equations in phasor form, Boundary conditions. Electromagnetic Waves: Introduction, wave equations for free space, Uniform plane wave-general solution and propagation. wave equations for conducting medium. wave equations in phasor form, wave propagation in loss less medium, conducting medium, good dielectrics and good conductors, skin effect, polarization. Poynting theorem and pointing vector, complex Poynting vector. Guided Waves: Introduction, Waves between parallel plates, Derivation of field equations between parallel plates and propagation parameters, field components for TE waves, field components of TM waves, Propagation parameters of TE and TM waves, Guided wavelength. Transverse electromagnetic wave (TEM wave), velocities of propagation. Attenuation in parallel plane guides, wave impedances Wave Guides: waves in rectangular wave guides, Derivation of field equations in rectangular wave guides, propagation parameters of TE and TM waves in rectangular wave guides.
11 EC 311 Microprocessors and Microcontrollers 3-0-2 8086 ARCHITECTURE: Introduction to 8085 microprocessor, 8086 Microprocessor internal architecture, Register organization, Memory segmentation, system bus structure, pipelining process8086 pin diagram, Minimum & maximum mode of operation, Timing diagrams, Stackstructure and subroutines, procedures and macros, 8086 interrupts & interrupt responses.(9) INSTRUCTION SET & ASSEMBLY LANGUAGE PROGRAMMING: Addressing modes of8086, Instruction set descriptions, Assembler directives; Assembly Language programs involving Logical branch & call instructions, sorting, and evaluation of arithmeticexpressions, String manipulation instructions, programming using procedures and macros,Timing and delays. PROGRAMMABLE INTERFACING USING 8086: Addressing memory & ports, parallel datatransfer schemes, programmable parallel I/O 8255, modes of 8255.Digital interfacing: Interfacing p to 7-segment display, keyboard, stepper motor anddisplay. Analog interfacing: D/A and A/D converter interfacing and applications. PERIPHERAL DEVICES & INTERFACING: 8237 programmable DMA, 8253 programmable interval timer, 8251A programmable communication, 8259A programmable ,interrupt controller,RS-232C Serial data standard. INTRODUCTION TO MICROCONTROLLERS: Microcontroller families, Architecture of 8051 micro controller, Register organization. Addressing modes, Instruction set, Interrupts, Timer/counter, Serial communication, simple programs on 8051 microcontroller	13 EC 311 Microprocessors and Microcontrollers 3-0-2 8086 Microprocessor: Introduction to Microprocessor, Intel Microprocessor families ,8086 Microprocessor architecture, Register Organization, Pin Description, Physical Memory Organization, Modes of operation. 8086 Instruction set & Assembly Language programming: Addressing modes, Instruction set, Assembler directives, simple Programs, Procedures and Macros, 8086 Interrupts. 8051 Microcontroller: Microcontroller families, 8051 Architecture, Signal Description, Register organization, Internal RAM, Special Function Registers, Interrupt control flow, Timer/Counter Operation, Serial Data Communication, and RS-232C Standard.8051 Programming & Interfacing: Addressing modes, Instruction set, Simple Programs involving Arithmetic and Logical Instructions, Timers/Counters, Serial Communication & Interrupts. Interfacing: Matrix Key Board, Stepper Motor, LCD's, DAC & ADC. Introduction to ARM Processor: Architecture, Registers, Pipe Line, Interrupts, Architecture revisions, ARM Instructions, LPC 2148 Architecture, GPIO.

Dr. HABIBULLA KHAN
Professor & Head
Dept. of ECE
KL University
Green Fields, Vaddeswaram
Guntur Dist. A.P, PIN-522 502

KL UNIVERSITY
ELECTRONICS AND COMMUNICATION ENGINEERING

ANALOG ELECTRONIC CIRCUITS

Course Code:13EC205 **L –T – P: 3-0-2**

Credits: 4

Feedback Amplifiers: Introduction, Feedback, Characteristics of Feedback, feedback topologies, Analysis of Feedback Amplifiers, Series-Shunt feedback, Series-Series Feedback, Shunt-Shunt Feedback, Shunt-Series Feedback, Feedback Circuit Design, Stability Analysis, Compensation Techniques. **Operational Amplifiers:** Introduction, Internal Structure of Op-Amps, Parameters and Characteristics of Practical Op-Amps, BJT Op-Amps, Analysis of the LM741 Op-Amps, Design of Op-Amps Differential Amplifiers: Introduction, Internal Structure of Differential Amplifiers, MOSFET Current Sources, MOS Differential Amplifiers, Depletion MOS Differential Amplifiers, Frequency Response of Differential Amplifiers, Design of Differential Amplifiers. **Power Amplifiers:** Introduction, Classification of Power Amplifiers, Power Transistors, Class A Amplifiers, Class B push-pull Amplifiers, Complementary Class AB push-pull Amplifiers, Class C Amplifiers, Class D Amplifiers, Class E Amplifiers, Short-Circuit and Thermal Protection, Power Op-Amps, Thermal Considerations, Design of Power Amplifiers. **Oscillators:** Introduction, Principles of Oscillators, Audio Frequency Oscillators, Radio Frequency Oscillators, Crystal Oscillators, Active-Filter Tuned Oscillators, Design of Oscillators. **Active Filters:** Introduction, Active versus Passive Filters, Types of Active Filters, First-Order Filters, The Biquadratic Function, Butterworth Filters, Transfer Function Realizations, Low pass Filters, High-Pass Filters, Band-Pass Filters, Band-Reject Filters, All- Pass Filters, Switched Capacitor Filters, Filter Design Guide Lines. **Integrated Analog Circuits and Applications:** Introduction, Circuits with Op-Amps and Diodes, Comparators, Zero Crossing Detectors, Schmitt Triggers, Square-Wave Generators, Triangular-Wave Generators, Sawtooth- Wave Generators, Voltage Controlled Oscillators, The 555 Timer, Phase Lock Loops, Voltage-to-

Frequency and Frequency-to-Voltage Converters, Sample-and-hold Circuits, Digital-to-Analog Converters, Analog-to-Digital Converters, Circuit Design Using Analog Integrated Circuits.

TEXT BOOK

1. Muhammad H. Rashid "Microelectronics Circuits Analysis and Design" 2nd Edition, Cengage Learning.

REFERENCES

1. Sedra Smith " Micro-electronic circuits theory and applications", Oxford press
2. Donald A. Neamen,"Microelectronics: Circuit Analysis and Design", McGraw Hill.
3. J Millman," Microelectronics", McGraw Hill.
4. Richard C. Jaeger, Travis N. Blalock," Microelectronic Circuit Design", Mc Graw Hill
5. J J Cathey," Electronic Devices and circuits', Schaum's Outline.
6. Loxton, "Problems and Solutions in Electronics', Chapman & Hall.

SIMULATION BOOKS

1. David Baez-Lopez ," Circuit Analysis with Multisim", Morgan & Claypool Publishers
2. Paul Tobin ,'PSpice for Circuit Theory and Electronic Devices", Morgan and Claypool Publishers
3. Steven T. Karris, "Electronic Devices and Amplifier Circuits with Matlab Applications" Orchrd Publications
4. John Okyere Attia , Electronics and Circuit Analysis Using Matlab, Second Edition, CRC Press

DSP PROCESSORS & ARCHITECTURE

Course Code:13EC415 **L –T – P: 3-0-2**

Credits: 4

Introduction to Digital Signal Processing: Review of a digital signal-processing system, Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), Linear Time Invariant Systems, Digital

Dr. HABIBULLA KHAN
Professor & Head
Dept. of ECE
K.L. University
Green Fields, Vaddeswaram
Guntur Dist. A.P, PIN-522 502

DESIGN OF ELECTRONIC SYSTEMS

Course Code:13EC201

L –T – P: 3-0-2

Credits: 4

Introduction to Electronics and Design: Introduction, History of Electronics, Electronic Systems, Electronic Signal and Notation, Classification of Electronic Systems, Specifications of Electronic Systems, Types of Amplifiers, Design of Electronic Systems, Design of Electronic Circuits, Electronic Devices, Emerging Electronics. **Introduction to Amplifiers and Frequency Response:** Introduction, Amplifier Characteristics, Amplifier Types, Cascaded Amplifiers, Frequency Response of Amplifiers, Miller's Theory, Frequency Response Methods, Amplifiers Design. **Introduction to operational Amplifiers and Applications:** Introduction, Characteristics of Ideal Op-Amps, Analysis of Ideal Op-Amp Circuits, Op-Amp Applications- Integrator, Differentiator Op-Amp Circuit Design. **Semiconductor Diodes:** Introduction, Ideal Diodes, Transfer Characteristics of Diode Circuits, Practical Diodes, Analysis of Practical Diode Circuits, Modeling of Practical Diodes, Zener Diodes, Light-Emitting Diodes, Power Rating, Diode Data Sheets. **Applications of Diodes:** Introduction, Diode Rectifier, Output Filters for Rectifiers, Diode Peak Detectors and Demodulators, Diode Clippers, Diode Clamping Circuits, Diode Voltage multipliers, Diode Function Generators. **Semiconductor and PN Junction Characteristics:** Introduction, Semiconductor Materials, Zero-Biased PN Junction, Reverse-Biased PN Junction, Forward-Biased PN Junction, Junction current Density, Temperature Dependences, High-Frequency AC Model. **Field-Effect Transistors:** Introduction, Junction Field Effect Transistors, Metal Oxide Field-Effect Transistors, Enhancement MOSFETs, Depletion MOSFET's, MOSFET Models and Amplifier, A MOSFET Switch, DC Biasing of MOSFET's, Common-Source (CS) Amplifiers, Common-Drain Amplifiers, Common-Gate Amplifiers, Multistage Amplifiers, DC Level Shifting and Amplifier, Frequency Response of MOSFET Amplifiers, Design of MOSFET Amplifiers. **Bipolar Junction Transistors and Amplifiers:** Introduction, Bipolar Junction Transistors, Principles of BJT Operation, Input and Output Characteristics, BJT Circuit Models, The BJT Switch, DC Biasing of Bipolar Junction Transistors, Common Emitter Amplifiers, Emitter Followers, Common Base Amplifiers, Multistage Amplifiers, The Darlington Pair Transistor, DC Level Shifting and Amplifier, Frequency Model and Response of Bipolar Junction Transistors, Frequency Response of BJT Amplifiers, MOSFETs versus BJTs, Design of Amplifiers.

TEXT BOOKS

1. Muhammad H. Rashid "Microelectronics Circuits Analysis and Design" 2nd Edition, Cengage Learning.

REFERENCES

1. Sedra Smith " Micro-electronic circuits theory and applications", Oxford press
2. Donald A. Neamen, "Microelectronics: Circuit Analysis and Design", McGraw Hill.
3. J Millman," Microelectronics", McGraw Hill.
4. Richard C. Jaeger, Travis N. Blalock," Microelectronic Circuit Design", Mc Graw Hill
5. J J Cathey," Electronic Devices and circuits', Schaum's Outline.
6. R Loxton,"Problems and Solutions in Electronics', Chapman & Hall.

SIMULATION BOOKS

1. David Baez-Lopez ," Circuit Analysis with Multisim", Morgan & Claypool Publishers
2. Paul Tobin ,'PSpice for Circuit Theory and Electronic Devices", Morgan and Claypool Publishers
3. Steven T. Karris, "Electronic Devices and Amplifier Circuits with Matlab Applications" Orchrd Publications
4. John Okyere Attia , Electronics and Circuit Analysis Using Matlab, Second Edition, CRC Press

DR. M. BABULA KHAN
Professor & Head
Dept. of ECE
KL University
Green Fields, Vaddeswaram
Guntur Dist. A.P, PIN-522 502

filters IIR and FIR, Decimation and interpolation. Computational Accuracy in DSP Implementations: Number formats for signals and coefficients in DSP systems, Dynamic range and precision, Sources of error in DSP implementations, ADC and DAC conversion errors, DSP computational errors, Compensating filter. Architectures for Programmable DSP Devices: Basic Architectural features, DSP computational building blocks, Bus architecture and memory, Data addressing capabilities, Address generation unit, Programmability and program execution, Speed issues, Features for external interfacing. Execution Control and Pipelining: Hardware looping, Interrupts, Stacks, Relative Branch support Pipelining and Performance, Pipeline Depth, Interlocking, Branching effects, Interrupt effects, Pipeline Programming models. Programmable Digital Signal Processors: Commercial DSP Devices, Data Addressing modes of TMS320C54XX, DSPs, Data Addressing modes of TMS320C54XX Processors, Memory space of TMS320C54XX Processors, Program Control, TMS320C54XX instructions and programming, On-Chip Peripherals, Interrupts of TMS320C54XX processors, Pipeline operation of TMS320C54XX Processors. Implementations of Basic DSP Algorithms: The Q-notation, FIR Filters, IIR Filters, Interpolation Filters, Decimation Filters, PID Controller, Adaptive Filters, 2-D Signal Processing, An FFT Algorithm for DFT Computation, A Butterfly Computation, Overflow and scaling, Bit-Reversed index generation, An 8-Point FFT implementation on the TMS320C54XX, Computation of the signal spectrum. Interfacing Memory and I/O Peripherals to Programmable DSP Devices: Memory space organization, External bus interfacing signals, Memory interface, Parallel I/O interface, Programmed I/O, Interrupts and I/O, Direct memory access (DMA), A Multichannel buffered serial port (McBSP), McBSP Programming, a CODEC interface circuit, CODEC programming, A CODEC-DSP interface example.

TEXT BOOKS

1. Signal Processing – Avtar Singh and S. Srinivasan, Thomson Publications, 2004..
2. DSP Processor Fundamentals, Architectures & Features - Lapsley et al. S. Chand & Co, 2000.

REFERENCE BOOKS

1. Digital Signal Processors, Architecture, Programming and Applications – B. Venkata Ramani and M. Bhaskar, TMH, 2004.
2. Digital Signal Processing –Principles, Algorithms Applications by J.G. Proakis & D.G. Manolokis, PHI, 2005.
3. Texas Instruments tutorials and notes.

COMMUNICATION SYSTEMS STREAM

INFORMATION THEORY & CODING

Course Code:13EC340

L –T – P: 3-0-0
Credits: 3

Introduction: Measure of information, Average information content of symbols in long independent sequences, Average information content of symbols in long dependent sequences, Entropy calculation for extension of source. Mark-off statistical model for information source, Entropy and information rate of mark-off source. **Encoding of The Source Output,** Shannon's encoding algorithm for dependent and independent sequences. Discrete communication channels, Continuous channels. Source coding theorem, Huffman coding, Discrete memory less Channels, Mutual information, Properties of mutual information, Channel Capacity. Channel coding theorem, Differential entropy and mutual information for continuous ensembles, Channel capacity Theorem **Error Control Coding,** Introduction, Types of errors, examples, Types of codes Linear Block Codes: Matrix description, Error detection and correction, Standard arrays and table look up for decoding. **Binary Cycle Codes,** Algebraic structures of cyclic codes, Encoding using an (n-k) bit shift register, Syndrome calculation, BCH codes ,RS Codes, Golay codes, Shortened cyclic codes, Burst error correcting codes. Burst and Random Error correcting codes. **Convolution Codes:** Block diagram of encoder, Impulse response of encoder, Time domain approach and Transform domain

Dr. HABIBULLA KHAN
Professor & Dean, ECE
KL University
Green Fields, Vaddeswaram
Guntur Dist. A.P, PIN-522 502

approach. State representation and state diagram, Tree diagram, trellis diagram.

TEXT BOOKS

1. K. Sam Shanmugam ,**"Digital and Analog communication systems,** John Wiley, 1996.
2. Simon Haykin ,**"Digital communication,** , John Wiley, 2003.

REFERENCE BOOKS

1. Ranjan Bose ,**"ITC and Cryptography,** TMH, II edition, 2007
2. Wells," Applied Coding and Information Theory for Engineers", Pearson Ed
3. Glover and Grant ,**"Digital Communications** ",Pearson Ed. 2nd Ed 2008
4. Robert H. Morelos-Zaragoza ,"The Art of Error Correcting Coding ,"JOHN WILEY & SONS,
5. Thomas M. Cover& Joy A. Thomas, "Elements Of Information Theory, Second Edition",A John Wiley & Sons, Inc
6. Michael Purser ,"Introduction to Error-Correcting Codes ",Artech House

SIMULATION BOOKS

1. Yuan Jiang, "A Practical Guide to Error-Control Coding Using MATLAB" , Artech House

TV AND VIDEO ENGINEERING

Course Code:13EC341

L –T – P: 3-0-0
Credits: 3

Fundamentals of Television: Geometry form and Aspect Ratio - Image Continuity - Number of scanning lines - Interlaced scanning - Picture resolution, composite video signal, video signal dimension, horizontal sync, vertical sync details, Block diagram of Broad Cost T V Transmitter, T V Receiver. Camera tube Principles, Image orthicon, vidicon, plumbicon. **Television Transmitter and Receiver:** Picture signal transmission, sound signal transmission, standard channel bandwidth, VSB transmission, positive and negative modulation, Low level and High level TV transmitters, TV signal propagation Interference, TV transmission Antennas, Monochrome TV receiver block level, Sync separation. **Essentials of Colour Television:** Compatibility, Colour perception, Three colour theory, luminance, hue and saturation, Values of luminance and colour difference signals, colour signal transmission, Bandwidth, Modulation of colour difference signals, weighting factors, Formation of chrominance signal, I and Q, U and V Signals. **Digital TV:** Introduction to Digital TV, Principle of Digital TV, Digital TV signals and parameters, Digital TV Transmitters, MAC signals, Advanced MAC signal transmission, Digital TV receivers, Principles of Digital Video compression, MPEG1, MPEG2, MPEG4, Video compression ITU-Standards(H),Digital TV recording techniques. **HDTV & Broadcasting systems:** HDTV standards and systems, HDTV transmitter and receiver/encoder, Digital TV satellite Systems, CCTV, CATV, direct to home TV, conditional access system (CAS), Digital Broadcasting

TEXT BOOKS

1.R.R.Gulati, " Monochrome Television Practice, Principles, Technology and servicing , Second edition, New age International Publishes, 2004
2. A. M. Dhake,"Television and video Engineering,TMH Publication
3. Kelth jack ,"Video Demisified, Penram International Publication.
4. R.G. Gupta ,"Audio Video Systems", Technical Education.

REFERENCE BOOKS

1. S. P. Bali, "Color TV Theory and Practice".
2. Bernard Grobb, Charles E, "Basic TV and Video Systems"

Dr. HABIBULLA KHAN
Professor & Head
Dept. of ECE
KL University
Green Fields, Vaddeswaram
Guntur Dist. A.P, PIN-522 502

KL UNIVERSITY
ELECTRONICS AND COMMUNICATION ENGINEERING

OPTICAL COMMUNICATIONS

Course Code:13EC342

L –T – P: 3-0-0
Credits: 3

Introduction: Advantages of Optical fibers, Applications of Optical Fiber, Ray Theory Transmission, Total internal reflection, Acceptance angle, Critical Angle, Numerical Aperture, Fiber types: Step Index, Graded Index: Modes of Propagation: single mode and multimode fibers. **Transmission Characteristics of Optical Fibers**: Attenuation, absorption, scattering and bending losses in fibers, Dispersion: Inter-model and intra-model, Polarization mode dispersion **Optical Transmitters and Detectors**: LED'S: Principles of Light Emission, Light Emitting Diodes: Simple structure and characteristics. LASER: Principle, Simple structures of semiconductor Laser and its characteristics, Optical Transmitter Circuits. Electro Optic Modulation: Kerr effect, Pockle's effect, Amplitude and Phase modulations. Detectors: Principles of photo detection. PIN Photodiode, Avalanche Photodiode and their characteristics, Optical Receiver Circuit. **Optical Fiber Systems**: Digital System planning considerations, Optical power budgeting, Advanced Multiplexing Strategies: WDM,OTDM and SCM. Optical Amplifiers: Semiconductor Optical Amplifiers, Raman Amplifiers, Erbium Doped Fiber Amplifiers. **Optical Fiber Measurements & Instrumentation**: Numerical Aperture, attenuation, refractive index, cutback and OTDR. **Advanced Optical Systems:** Fiber Optic LAN's, Wavelength routing Networks, Optical switching networks, SONET/SDH, FDDI.

TEXT BOOKS

1.Keiser G, "Optical Fiber Communication, " McGraw-Hill.
2.G. P. Agrawal, "Fiber-Optic Communications Systems," 3 rd Edition, John Wiley & Sons.
3. J C Palais ," Fiber Optic Communications", 2nd Edition, PHI

REFERENCE BOOKS

1.W Tomasi ," Advanced Electronic Communication Systems", PHI
2.J Powers, "An introduction to fiber optic systems," 2Nd Edition, Mc. Graw Hill.
3.John Gowar, "Optical communication systems," PHI.
4.John M Senior, "Optical Fiber Communications: Principles and Practice", 2nd Edition, PHI.

SATELLITE COMMUNICATION

Course Code:13EC443

L –T – P: 3-0-0
Credits: 3

Introduction: Basic Concepts of Satellite Communications, Frequency Allocations for Satellite Services, Applications. **Orbital Mechanics And Launchers:** Orbital Mechanics, Look Angle determination, Orbital perturbations, Orbit determination, launches and launch vehicles, Orbital effects in communication systems performance. **Satellite Subsystems:** Attitude and Orbit Control System, Telemetry, Tracking, Command and Monitoring, Power Systems, Communication Subsystems, Satellite Antennas. **Satellite Link Design:** Basic Transmission Theory, System Noise Temperature and G/T Ratio, Design of Down Links, Up Link Design, Design Of Satellite Links For Specified C/N, System Design Examples. **Earth Station Technology:** Introduction, Transmitters, Receivers, Antennas, Tracking Systems, Terrestrial Interface, Primary Power Test Methods. **Multiple Access Techniques and Error Control :** Frequency Division Multiple Access (FDMA), Inter-modulation, Calculation of C/N, Time Division Multiple Access (TDMA), Frame Structure, Satellite Switched TDMA, Onboard Processing, Code Division Multiple Access (CDMA), Error control requirements for satellite link—ARQ, Concatenated Codes, Interleaving, Turbo codes. **Satellite Navigation & Global Positioning System :** Radio and Satellite Navigation, GPS Position Location Principles, GPS Receivers and Codes, Satellite Signal Acquisition, GPS Navigation Message, GPS Signal Levels, GPS Receiver Operation.

TEXT BOOKS

Dr. HABIBULLA KHAN
Professor & Head
Dept. of ECE
KL University
Green Fields, Vaddeswaram
Guntur Dist. A.P, PIN-522 502

1.Timothy Pratt, Charles Bostian and Jeremy Allnutt Satellite Communications, WSE, Wiley Publications, 2nd Edition, 2003.
2.L.Pritchard, Robert A Nelson and Henri G.Suyderhoud,"Satellite Communicati ons Engineering – Wilbur, 2nd Edition, Pearson Publications,

REFERENCES

1.M. Richharia, »Satellite Communications: Design Principles »BS Publications, 2nd Edition.
2.K.N. Raja Rao, "Fundamentals of Satellite Communications", PHI, 2004
3.D.C Agarwal ,"Satellite Communication, Khanna Publications, 5th Ed.
4.Dennis Roddy Satellite Communications , McGraw Hill, 4th Edition, 2009.
5.Robert M Gagliardi, Satellite Communications, DTS Publishers Ltd.

CELLULAR COMMUNICATIONS

Course Code:13EC344 **L –T – P: 3-0-0**
Credits: 3

Introduction to Mobile Communication: Evolution of Mobile Radio Communication, Examples of Wireless Communication Systems, Cellular telephone Systems, 2G & 3G wireless networks, Cellular concept, frequency reuse, Channel Assignment strategies, Hand off strategies, Interference and system capacity, improving coverage and capacity in cellular systems. **Mobile Radio Propagation:** Large Scale Fading, Free space propagation model, Three basic propagation mechanisms: Reflection, diffraction, scattering, Small Scale Fading, Multipath Propagation, Types of small scale fading, Parameters of Mobile Multipath channels, fading effects due to multipath delay Spread and Doppler spread, Statistical models for multipath fading channels. **Equalization& Diversity:** Fundamentals of Equalizers, Linear equalizers, nonlinear equalizers, Decision feedback equalizers, MLSE, Algorithms for adaptive equalization, Space diversity, MRC, EGC, selection diversity, Polarization diversity, Frequency diversity, Time diversity, Rake receiver. **Wireless Systems & Standards:** GSM Services, Features, Architecture, channel types, Frame Structure, Signal processing in GSM, CDMA Digital cellular Standards IS-95. **OFDM for Wireless Communications:** Basic OFDM, FFT Implementation, Cyclic Extension, Power Spectrum, and Efficiency, Comparison with Single-Carrier, Design Example, Baseband versus Passband, Impairments of Wireless Channels to OFDM Signals: Time-Varying Impairments, Effect of Sampling Clock Offset, Effect of Timing Offset, Effect of Delay Spread, System Nonlinearity.

TEXT BOOKS

1. Theodore S. Rappaport, "Wireless Communications Principles and Practice", 2nd Edition, Pearson Education, 2003.
2. David Tse and Pramod Viswanath "Fundamentals of Wireless Communication" Cambridge University Press, 2005
3. Ye (Geoffrey) Li, Gordon Stuber, "Orthogonal Frequency Division Multiplexing for Wireless Communications", Springer, 2006.

REFERENCE BOOKS

1. W. C. Y. Lee, "Mobile Cellular Communications, 2nd Edition", Mc Graw Hill,
2. Gottapu Sasi Bhushana Rao" Mobile Cellular Communication", Pearson Education
3. Andrea Goldsmith, "Wireless Communications", Cambridge University Press,
4. Simon R. Saunders, Alejandro Aragon Zavala, "Antennas and Propagation for Wireless Communication Systems", 2nd Edition, John Wiley & Son,
5. Vahid Tarokh "New Directions in Wireless Communications Research", Springer

DR. HABIBULLA KHAN
Professor & Head
Dept. of ECE
KL University
Green Fields, Vaddeswaram
Guntur Dist. A.P, PIN-522 502

KL UNIVERSITY
ELECTRONICS AND COMMUNICATION ENGINEERING

EMI/EMC

Course Code:13EC345

L –T – P: 3-0-0

Credits: 3

EMI Environment: Sources of EMI, Conducted and Radiated EMI, Transient EMI, EMI –EMC Definitions and Units of Parameters. EMI Specifications/Standards/Limits: Units of specifications, Civilian Standards and Military Standards **EMI Control Techniques:** Shielding, Filtering, Grounding, Bonding, Isolation Transformer, Transient Suppressors, Cable Routing, Signal control, Component Selection and mounting. **EMC Design Guidelines and Choice of passive components for EMC:** EMC Design Guidelines: Typical Sub systems in Electronic Equipment, Transmitters, Receivers, Antenna Systems, Power Supplies, Motors, Control Devices, Digital Circuits, Digital Computers. **Choice of Passive Components for EMC:** Capacitors, Inductors, Transformers, Resistors, Conductors, Ferrite Beads, Coaxial Connectors, Conductive Gaskets. **EMI Measurements:** EMI Test Instrument / Systems, EMI Test, EMI Shielded Chamber, Open Area Test Site, TEM cell Antennas

TEXT BOOKS

1.V P Kodali, "Engineering EMC Principles, Measurements and Technologies", IEEE press,
2.Bernard Kieser, "Principles of Electromagnetic Compatibility", Artech House 3rd Edition,
3.Henry W.Ott, "Electromagnetic Compatibility Engineering" , A John wiley & sons publication

REFERENCE

1.Clayton R Paul, "Electromagnetic Compatibility, John Wiley
2.Tim Williams, "EMC for Product Designer", Elsevier
3. PR Chatterton, "Electromagnetic Theory to practical design", Wiley
4. Sonia Ben Dhia," Electromagnetic Compatibility as Integrated Circuits, Springer

RF SYSTEM DESIGN

Course Code:13EC346

L –T – P: 3-0-0

Credits: 3

Introduction: Importance of RF and Microwave Circuit Design-Dimensions and Units-Frequency Spectrum - RF Behavior of Passive Components: High Frequency Resistors, High Frequency Capacitors, High Frequency Inductors, General Introduction, Types of Transmission Lines-Equivalent Circuit representation. **The Smith Chart:** Introduction, Derivation of Smith Chart, Description of two types of smith chart, Z-Y Smith chart, Distributed Circuit Applications, Lumped Element Circuit Applications. **Single And Multiport Networks:** Basic Definitions, Interconnecting Networks, Scattering Parameters related problems **RF Filter Design:** Scattering Parameters: Definition, Meaning, Chain Scattering Matrix, Conversion Between S- and Z-parameters, Signal Flow Chart Modeling, Generalization-Basic Resonator and Filter Configurations: Low Pass, High Pass, Band Pass and Band Stop type Filters-Filter Implementation using Unit Element and Kuroda's Identities Transformations. **Stability and Gain Considerations – RF Design** RF Source, Transducer Power Gain, Additional Power Relations-Stability Considerations: Stability Circles, Unconditional Stability, and Stabilization Methods-Unilateral and Bilateral Design for Constant Gain- Noise Figure Circles- Constant VSWR Circles. **RF Amplifiers – Small Signal Design** Introduction, Types and Characteristics of Amplifiers, Small Signal Amplifiers, Design of different types of amplifiers (NBA, HGA, MGA, LNA, MNA, BBA)

TEXT BOOKS

1. Mathew M. Radmanesh, "Radio Frequency & Microwave Electronics", Pearson Education Asia, Second Edition,
2. Reinhold Ludwig and Powel Bretchko," RF Circuit Design – Theory and Applications", Pearson

DR. HABIBULLA KHA
Professor & Head
E.C.E.
KL University
Green Fields, Vaddeswar
Guntur Dist. A.P, PIN-52

Education Asia, First Edition.

REFERENCES

1. Joseph . J. Carr, "Secrets of RF Circuit Design", McGraw Hill Publishers, Third Edition.
2. Ulrich L. Rohde and David P. New Kirk, "RF / Microwave Circuit Design", John Wiley & Sons USA, 2000.
3. Roland E. Best, "Phase - Locked Loops: Design, simulation and applications", McGraw Hill Publishers 5th edition
4. Devendra K.Misra ,"Radio Frequency and Microwave Communication Circuits – Analysis and Design "John Wiley & Sons, Inc.
5. Jon B. Hagen, " Radio Frequency Electronics ", Cambridge university press, Cambridge, 1996.
6. James Hardy, " High Frequency Circuit Design ", Resto Publishing Co., NewYork, 1979.
7. Ian Hickman, " RF HandBook ", Butter Worth Heinemann Ltd., Oxford, 1993.
8. Ulrich L.Rohde, T.T.N.Bucher, " Communication Recievers ", McGraw-Hill, New York, 1998.

RADAR AND NAVIGATIONAL AIDS

Course Code:13EC447 **L –T – P: 3-0-0**

Credits: 3

Introduction, Basic Radar , Advantage of Basic Radar, Block Diagram of Pulse Radar, simple form of Radar equation, Detection of signals in noise, Receiver noise and signal to noise ratio, integration of Radar pulses, RCS: RCS of simple targets, RCS of multiple targets, PRF and Range Ambiguities, Doppler Effect, Limitations of CW Radar, FMCW Radar, Altimeter. **MTI Radar,** Delay line cancellers: Frequency response of single delay line cancellers, Clutter Attenuation, MTI improvement factor, N-pulse delay line canceller, Non recursive and Recursive filters, staggered PRF, Doppler filter banks **Tracking:** Types of tracking Radar Systems, Sequential Lobing Radar, Conical Scan and Mono pulse Tracking Radar Super heterodyne Receiver, Types of Duplexers and receiver protectors, types of Displays, Radomes. **Radar Transmitter:** Introduction, Linear- Beam Power Sources, Magnetron, Crossed- Field Amplifiers, Other RF Power Sources. **Radar Receivers:** The Radar Receivers, Receiver Noise Figure, Super heterodyne Receivers, Duplexers and Receiver Protectors, Radar Displays **Electronic Warfare:** Objectives an definitions, Noise jamming, Types of Electronic counter measures and Electronic counter to counter measures, Stealth applications. **Elementary ideas of Navigational Aids,** DME, VOR, DVOR, TACAN, ILS, MLS, GPS, Automatic Direction Finder, Hyperbolic Navigational (LORAN, DECA, OMEGA).

TEXT BOOKS

1. Merrill I Skolnik, " Introduction to Radar Systems", 3rd Edition, TMH, 2003
2. GSN Raju,"Radar Engineering and Fundamentals of Navigational Aids", I K International

REFERENCE BOOKS

1. Peyton Z Peebles Jr, "Radar Principles", John Wiley Inc., 2004
2. Hamish Meikie," Modern Radar Systems", Artech House
3. AK Sen and Dr AB Bhattacharya, "Radar Systems and Radio Aids to Navigation"

SIMULATION BOOK

1. Bassem R.Mahafza "Radar systems Analysis and design using Matlab" Chapman & Hall

Dr. HABIBULLA KHAN
Professor & Head
Dept. of ECE
KL University
Green Fields, Vaddeswaram
Guntur Dist. A.P, PIN-522 502

KL UNIVERSITY
ELECTRONICS AND COMMUNICATION ENGINEERING

MICROWAVE AND MILLIMETRIC WAVE CIRCUITS

Course Code:13EC448

L –T – P: 3-0-0

Credits: 3

Analysis of Microwave Circuits: Introduction, Microwave Components – E-plane Tee, H-plane Tee, Magic Tee, Directional Coupler, Isolator, Circulator & their Scattering **Transformers & Resonators:** Parameters, Impedance Transformers – Quarter wave Transformers, Microwave Resonators – Rectangular and Cylindrical Resonators. **Filters And Periodic Structures:** Design of Narrow Band Low Pass, Band Pass and High Pass Filters, Maximally flat and Chebyshev Designs, Introduction to Periodic Structures, Floquet's Theorem, Circuit Theory Analysis of Infinite and Terminated Structures, **Obstacles in Wave Guides:** Introduction, Posts in Waveguides, Diaphragms in Waveguides, Waveguide Junctions, Waveguide Feeds, Excitation of Apertures **Millimeter Wave Circuits:** Wave Propagation in microstriplines, Discontinues in Microstrips, Parallel Coupled lines, Power Dividers and Directional Couplers, Microwave and Millimeter Wave Integrated Circuits.

TEXT BOOKS

1.Roger F. Harrington, "Time-Harmonic Electromagnetic Fields", Mc graw-hill
2.Robert E Collin, "Foundation For Microwave Engineering", Mc Graw-Hill.

REFERENCE BOOKS

1.Analysis Methods for RF, Microwave, and Millimeter-Wave Planar Transmission Line Structures by Cam Nguyun

RADIATION SYSTEMS

Course Code:13EC349

L –T – P: 3-0-0

Credits: 3

Basics Concepts Of Radiation: Radiation from surface current and current line current distribution, Basic antenna parameters, Radiation mechanism-Current distribution of Antennas, Impedance concept-Balanced to Unbalanced transformer **Radiation From Apertures** Field equivalence principle, Rectangular and circular apertures, Uniform distribution on an infinite ground plane, Aperture fields of Horn antenna-Babinets principle, Geometrical theory of diffraction, Reflector antennas, and Design considerations - Slot antennas **Synthesis Of Array Antennas** Types of linear arrays, current distribution in linear arrays, Phased arrays, Optimization of Array patterns, Continuous aperture sources, Antenna synthesis techniques **Micro Strip Antennas** Radiation mechanisms, Feeding structure, Rectangular patch, Circular patch, Ring antenna. Input impedance of patch antenna, Microstrip dipole, Microstrip arrays **EMI/EMC/Antenna Measurements:** Log periodic, Bi-conical, Log spiral ridge Guide, Multi turn loop, Traveling Wave antenna, Antenna measurement and instrumentation, Amplitude and Phase measurement, Gain, Directivity, Impedance and polarization measurement, Antenna range, Design and Evaluation

TEXT BOOKS

1. Kraus.J.D.,"Antennas"II Edition, John wiley and Sons.
2. Balanis.A, "Antenna Theory Analysis and Design", John Wiley and Sons, New York, 1982

REFERENCES

1. RF System Design, Peter Kinget Bell Laboratories, Lucent Technologies Murray Hill,
2. Practical RF system design, Wiley-IEEE, 2003 - Technology & Engineering

H. HABIBULLA KHAN
Professor & Head
Dept. of ECE
KL University
Green Fields, Vaddeswaram
Guntur Dist. A.P, PIN-522 502

KL UNIVERSITY
ELECTRONICS AND COMMUNICATION ENGINEERING
VLSI STREAM

ANALOG VLSI DESIGN

Course Code:13EC461 **L –T – P: 3-0-0**
Credits: 3

Introduction to Analog Design: General Concepts, **Basic MOS Device physics:** General considerations of MOS devices, second order effects, MOS device models. **Amplifiers design:** Single Stage (CS, CG and CD) configurations, Cascade Stage; **Differential pair:** Operation, Basic Differential Pair, differential pair with MOS loads, Gilbert cell. **Passive & Active Current Mirrors:** Basic current mirrors, Cascode current mirror, Active Current Mirrors- large signal analysis, small signal analysis and common mode properties. **Frequency response of Amplifiers:** General Considerations, Common-Source Stage, Source Followers, Common Gate Stage, Cascode Stage, Differential Stage. **Operational Amplifiers:** Op-Amp topologies, single stage, two stages, Gain Boosting, Slew rate.

TEXT BOOKS

1. Behzad Razavi, "Design of Analog CMOS Integrated Circuits", Tata McGraw Hill, 2005
2. Phillip E. Allen, Douglas R. Holberg, "CMOS analog circuit design" Oxford University Press

REFERENCE

1. Jacob Baker, "CMOS Mixed Signal Circuit Design", John Wiley, 2008
2. Gray & Mayer, Analysis & Design of Analog Integrated Circuits, 4th edition, Wiley, 2001
3. David A. Johns, Ken Martin "Analog Integrated Circuit Design, John Wiley

LOW POWER VLSI DESIGN

Course Code:13EC362 **L –T – P: 3-0-0**
Credits: 3

Introduction: Need for low power VLSI chips, Sources of power dissipation on Digital Integrated circuits. Emerging Low power approaches, Physics of power dissipation in CMOS devices. **Device & Technology Impact on Low Power:** Dynamic dissipation in CMOS, Transistor sizing& gate oxide thickness, Impact of technology Scaling, Technology & Device innovation **Simulation Power Analysis**: SPICE circuit simulators, gate level logic simulation, capacitive power estimation, static state power, gate level capacitance estimation, architecture level analysis, data correlation analysis in DSP systems, Monte Carlo simulation. **Probabilistic power analysis**: Random logic signals, probability & frequency, probabilistic power analysis techniques, signal entropy. **Low Power Design Circuit Level**: Power consumption in circuits. Flip Flops & Latches design, high capacitance nodes, low power digital cells library **Logic level:** Gate reorganization, signal gating, logic encoding, state machine encoding, precomputation logic **Low Power Architecture & Systems:** Power & performance management, switching activity reduction, parallel architecture with voltage reduction, flow graph transformation, low power arithmetic components, low power memory design. **Low power Clock Distribution:** Power dissipation in clock distribution, single driver Vs distributed buffers, Zero skew Vs tolerable skew, chip & package co design of clock network . **Algorithm & Architectural Level Methodologies:** Introduction, design flow, Algorithmic level analysis & optimization, Architectural level estimation &synthesis.

TEXT BOOKS

Dr. HABIBULLA KHAN
Professor & Head
Dept. of ECE
KL University
Green Fields, Vaddeswaram
Guntur Dist. A.P, PIN-522 502

1. Gary K. Yeap, "Practical Low Power Digital VLSI Design", KAP, 2002
2. Rabaey, Pedram, "Low Power Design Methodologies" Kluwer Academic

REFERENCE BOOKS

1. Kaushik Roy, Sharat Prasad, "Low-Power CMOS VLSI Circuit Design" Wiley,2000
2. Yeo, "CMOS/BiCMOS ULSI Low Voltage Low Power" Pearson Education

ASIC DESIGN

Course Code:13EC363

L –T – P: 3-0-0
Credits: 3

Types of Asics: Design flow - CMOS transistors CMOS Design rules - Combinational Logic Cell – Sequential logic cell - Data path logic cell - Transistors as Resistors - Transistor Parasitic Capacitance- Logical effort - Library cell design - Library architecture. Anti fuse - static RAM - EPROM and EEPROM technology - PREP benchmarks - Actel ACT - Xilinx LCA -Altera FLEX - Altera MAX DC & AC inputs and outputs - Clock & Power inputs - Xilinx I/O blocks. Actel ACT -Xilinx LCA - Xilinx EPLD - Altera MAX 5000 and 7000 - Altera MAX 9000 - Altera FLEX Design systems - Logic Synthesis - Half gate ASIC -Schematic entry - Low level design language - PLA tools - EDIF- CFI design representation. **Synthesis and Simulation:** Verilog and logic synthesis -VHDL and logic synthesis - types of simulation -boundary scan test - fault simulation - automatic test pattern generation. **Data Logic Cells:** Data Path Elements, Adders, Multiplier, Arithmetic Operator, I/O cell, Cell Compilers. **System partition:** FPGA partitioning -partitioning methods - floor planning - placement - physical design flow - global routing - detailed routing - special routing - circuit extraction - DRC.

TEXT BOOK

1.M.J.S .Smith, " Application - Specific Integrated Circuits " - Addison -Wesley Longman

REFERENCES BOOKS

1.S.D. Brown, R.J. Francis, J. Rox, Z.G. Uranesic, " Field Programmable Gate Arrays " -Kluever Academic Publishers, 1992.

2.Mohammed Ismail and Terri Fiez, " Analog VLSI Signal and Information Processing ", Mc Graw Hill, 1994.

3.S. Y. Kung, H. J. Whilo House, T. Kailath, " VLSI and Modern Signal Processing ", Prentice Hall, 1985.

DESIGN FOR TESTABILITY

Course Code:13EC364

L –T – P: 3-0-0
Credits: 3

Basic Concepts: Need for testing, Reliability concepts, Reliability and failure rate, Relation between reliability and MTBF, Maintainability, Availability, series and parallel systems, Failure and faults, Modeling of faults, Temporary faults **Fault Diagnosis and Test Generation:** Fault diagnosis and testing, Test generation for combinational logic circuits: Fault table method, Path sensitization, Boolean difference, D-Algorithm, PODEM, Kohavi algorithm, Detection of multiple faults in combinational logic circuits, Test generation for sequential logic circuits, Random testing, Transition continuous testing, Signature analysis **PLA Testing:** Faults in PLA, PLA minimization, EPC Theorems, PLA folding, Foldable

Dr. HABIBULLA
Professor & Head
Dept. of ECE
KL University
Green Fields, Vaddeswaram
Guntur Dist.

compatibility matrix, the Compact algorithm, the maximum folding. **Fault Tolerant Design:** Importance of fault tolerance, Basic concepts of fault tolerance, Static redundancy, Dynamic redundancy, Hybrid redundancy, Self purging redundancy, Sift-out reconfiguration scheme, 5MR reconfigurable scheme, Time redundancy, Software redundancy, Fail-Safe Operation, A Scheme for fault tolerant Design of VLSI chips, Fault tolerant VLSI processor arrays **Design for Testability:** Controllability and Observability, Design of testable combinational circuits, Design of testable sequential circuits: Scan path technique, LSSD, RAS technique; Built in self test: BIST concepts, TPG for BIST, BIST architectures-CSBL, BEST, RTS, LOCST, STUMPS, CBIST,CEBS, RTD, SST, CATS, CSTP, BILBO.

TEXT BOOKS

1.P.K. Lala, "Digital Circuit Testing and Testability", Academic Press. 2.N.N.Biswas, "Logic Design Theory", Prentice-Hall.

REFERENCES

1.M. Abramovici, M.A. Breuer and A.D. Friedman, "Digital Systems and Testable Design", Jaico Publishing House.
2.M.L. Bushnell and V.D. Agrawal, "Essentials of Electronic Testing For Digital, Memory And Mixed-Signal VLSI Circuits", Kluwer Academic Publishers.
3.A.L Crouch, "Design Test For Digital Ics And Embedded Core Systems", Prentice - Hall International.

MIXED SIGNAL CIRCUITS & SYSTEMS

Course Code:13EC465 **L –T – P: 3-0-0**
Credits: 3

Data Converter Fundamentals: Analog versus Digital Discrete Time Signals, Converting Analog Signals to Data Signals, Sample and Hold Characteristics, DAC Specifications, ADC Specifications, Mixed-Signal Layout Issues. **Analog To Digital Conversion:** Performance Metrics of Analog-to- Digital Converters, Sampling, Band-pass Sampling Quantization, Types of Analog-to-Digital Converters, Sigma-Delta Analog-to-Digital Converters, **Data Converters Architectures:** DAC Architectures, Digital Input Code, Resistors String, R-2R Ladder Networks, Current Steering, Charge Scaling DACs, Cyclic DAC, Pipeline DAC, ADC Architectures, Flash, 2-Step Flash ADC, Pipeline ADC, Integrating ADC, Successive Approximation ADC. **Data Converter SNR:** Improving SNR Using Averaging, Decimating Filters for ADCs, Interpolating Filters for DAC, B and pass and High pass Sync filters, **Amplifier Design For Wireless Communication Systems:** Amplifier Design, Low Noise Amplifier, Automatic Gain Control Amplifiers, Power amplifiers, **PLL:** Operation of the Phase Locked Loop, Phase Detectors, Frequency Dividers, Oscillator Design, **Frequency Synthesizers:** Frequency synthesizer parameters, Frequency Synthesizer Techniques, Analyzing phase noise in frequency synthesizers.

TEXT BOOKS

1. R. Jacob Baker, "CMOS mixed signal circuit design" IEEE series on microelectronic systems, Wiley publications.
2. Emad N. Farag and Mohamed I. Elmasry, "Mixed signal VLSI Wireless Design Circuits and Systems", Kluwer academic Publishers.

REFERENCE BOOKS

1. Yichuang Sun, "Test and Diagnosis of Analogue, Mixed-signal and RF Integrated Circuits", Published by The Institution of Engineering and Technology, London, United Kingdom.

Dr. HABIBULLA KHAN
Professor & Head
Dept. of ECE
KL University
Green Fields, Vaddeswaram
Guntur Dist. A.P, PIN-522 502

2. Walt Kester, "Mixed-Signal and DSP Design Techniques", Analog Devices, Inc
3.R. Best, "Phase-Locked Loops Design, Simulation,& Applications," 6th Edition, McGraw-Hill 4.Edgar Sánchez-Sinencio ,"Low-Voltage/Low-Power Integrated Circuits and Systems: Low-Voltage Mixed-Signal Circuits", Wiley Publications
5.Yichuang Sun,"Test and Diagnosis of Analogue, Mixed-Signal and RF Integrated Circuits: The System on Chip Approach", IET
6Marc Tiebout ,"Low Power VCO Design in CMOS" , Springer
7.H R Rategh, T H Lee, "Frequency Synthesizer Design for 5GHz wireless LAN Systems", Kluwer Academic Publishers

SPECIALIZATION STREAM - SIGNAL PROCESSING ARRAY SIGNAL PROCESSING

Course Code : 13EC470

L – T – P: 3-0-0
Credits: 3

Spatial Signals, Signals in space and time. Spatial frequency, Direction vs. frequency. Wave fields. Far field and Near field signals. **Sensor Arrays,** Spatial sampling, Nyquist criterion. Sensor arrays. Uniform linear arrays, planar and random arrays. Array transfer (steering) vector. Array steering vector for ULA. Broadband arrays. **Spatial Frequency,** Aliasing in spatial frequency domain. Spatial Frequency Transform, Spatial spectrum. Spatial Domain Filtering. Beam Forming. Spatiall y white signal. **Direction Of Arrival Estimation,** Non parametric methods - Beam forming and Capon methods. Resolution of Beam forming method. Subspace methods - MUSIC, Minimum Norm and ESPRIT techniques. Spatial Smoothing.

TEXT BOOKS

1. Dan E. Dugeon and Don H. Johnson.," Array Signal Processing: Concepts and Techniques. Prentice Hall.
2. Petre Stoica and Randolph L. Moses. "Spectral Analysis of Signals. Prentice Hall.

MODERN DIGITAL SIGNAL PROCESSING

Course Code : 13EC371

L – T – P: 3-0--0
Credits : 3

Multirate Digital Signal Processing: Decimation by an factor D- Interpolation by a Factor I - Sampling Rate Conversion by a Rational Factor I/D Filter Design and Implementation for sampling rate Conversion: Direct form FIR filter structures – Poly-phase filter structures - Time Variant filter structure, Multistage Implementation of Sampling Rate Conversion. **Non Parametric Power Spectrum Estimations:** Spectral Analysis of deterministic Signals, Estimation of the Autocorrelation of Stationary Random Signals, Estimation of the Power Spectrum of Stationary Random Signals, Joint signal analysis. **Parametric Method of Power Spectrum Estimation:** Parametric Methods for power spectrum estimation, Relationship between Auto-Correlation and Model Parameters, AR (Auto-Regressive) Process and Linear Prediction, Yule-Walker, Burg and Unconstrained Least Squares Methods, Sequential Estimation, Moving Average (MA) and ARMA Models, Minimum

D. HARIBABU L. KHAN
Professor & Head
Dept. of ECE
KL University
Green Fields, Vaddeswaram
Guntur Dist. A.P, PIN-522 502

variance spectral estimation, Pisarenko Harmonic Decomposition Methods, MUSIC algorithm, ESPIRIT algorithm. **DFT Filter Banks and Trans-multipliers:** Maximally decimated DFT Filter Banks, Two channel perfect reconstruction conditions, Lattice implementation of orthonormal filter banks, trans-multiplexer **Applications:** Design of phase shifters – interfacing of Digital Systems with different sampling rates- Narrow band low pass filters– Digital filter banks – Spectrum estimation, Sub band coding of speech signal/Sensor application.

TEXT BOOKS

1 Roberto cristi, "Modern Digital Signal Processing ", Thomson Learning
2. Proakis JG and Manolakis DG, "Digital Signal Processing Principles, Algorithms and Application", Pearson Education.
3. Dimitris G Manolakis, Vinak K Ingle and Stephen M Kogan, "Statistical and adoptive si gnal processing " Artech House, London

REFERENCE BOOKS

1.Openheim AV & Schafer RW, "Discrete Time Signal Processing", Pearson Education, Asia. 2.Raghuveer M. Rao, Ajit S Bopardikar," Wavelet Transform, Introduction to Theory and Applications", Pearson Education, Asia
3.Orfanadis S, "Introduction to Digital Signal Processing", Pearson Education, 4.Sanjit K.Mitra , "DSP computer Based Approach ", 2nd Edition, MC Graw Hill 5.Hams Georg stark "Wavelet & Signal Processing", Springer, 2005.

SIMULATION TEXT BOOKS

1. Samuel D Stearns, "Digital Signal Processing with examples in Matlab", CRC Press, 2000.
2. ES Gopi. "Algorithm collections for Digital Signal Processing Applications using Matlab ", Springer, 2007.
3. Taan S. Elali, "Discrete Systems and Digital Signal Processing with Matlab", CRC Press,2005.

DIGITAL IMAGE PROCESSING

Course Code : 13EC372

L – T – P:3-0-0
Credits: 3

Introduction: Origin of Digital Image Processing, Fields that uses Digital Image Processing, Fundamental steps in Digital Image Processing, Components of an Image Processing System. Digital Image Fundamentls: Elements of Visual perception, Image sampling and Quantization, Basic relationships between Pixels, Linear and Non-linear operations. **Digital Image Transforms:** Image Transforms – The Discrete Fourier Transform, Walsh, Hadamard, Discrete Cosine Transform, Haar Transform, the Slant Transform, **Image Enhancement in Spatial Domain:** Some basic Grey level transformations, histogram processing, enhancement using Arithmetic/Logic operations, Smoothing Spatial Filters, Sharpening Spatial Filters. **Image Enhancement in Frequency Domain:** Introduction to Fourier Transform and the Frequency Domain, Smoothing Frequency Domain Filters, Sharpening Frequency Domain Filters. **Image Restoration:** Noise models, Restoration in the presence of Noise, only Spatial Filtering, Periodic Noise reduction by Frequency Domain Filtering, Linear, Position-Invariant Degradations, Inverse Filtering, Wiener Filtering. **Image Compression:** Fundamentals – Image Compression models – Error Free

DR. HABIBULLA KHAN
Prof. & Head
Dept. of ECE
KL University
Green Fields, Vaddeswaram
Guntur Dist. A.P. PIN-522 502

Compression, Lossy Compression. **Image Segmentation:** Detection of discontinuities, Thresholding, Edge based Segmentation and Region based Segmentation. **Image Representations and Description:** Representation schemes, Boundary Descriptors, Regional Descriptors.

TEXT BOOKS

1. Rafael C Gonzalez, Richard E Woods," Digital Image Processing", Second Edition, Pearson Education Asia, 2002. (Chapter 3)
2. Gonzalez. R & Woods B.E.," Digital Image Processing", Addison Wesley Longman Pearson Education, 2000. (Chapter 1, 2, 4, 5, 6, 7, 8, 9)

REFERENCE BOOKS

1. Milan Sonka, Vaclav Hlavac and Roger Boyle, Image Processing Analysis and Machine Vision, Thomson learning, Second Edition, 2001.
2. William J Prati, "Digital Image Processing", John Wiley & sons
3. Alasdair McAndrew, " Introduction to Digital Image Processing" CENGAGE Learing.

MULTI-RATE SIGNAL PROCESSING

Course Code : 13EC373

L – T – P: 3--0--0
Credits: 3

Fundamentals Of Multirate Theory: The sampling theorem - sampling at subnyquist rate - Basic Formulations and schemes. Basic Multirate operations- Decimation and Interpolation - Digital Filter Banks- DFT Filter Bank- Identities- Polyphase representation **Maximally Decimated Filter Banks:** Polyphase representation - Errors in the QMF bank- Perfect reconstruction (PR) QMF Bank

- Design of an alias free QMF Bank **M-Channel Perfect Reconstruction Filter Banks:** Uniform band and non uniform filter bank - tree structured filter bank- Errors created by filter bank system- Polyphase representation- perfect reconstruction systems **Perfect Reconstruction (Pr) Filter Banks:** Paraunitary PR Filter Banks- Filter Bank Properties induced by paraunitarity- Two channel FIR paraunitary QMF Bank- Linear phase PR Filter banks- Necessary conditions for Linear phase property- Quantization Effects: -Types of quantization effects in filter banks. - coefficient sensitivity effects, dynamic range and scaling. **Cosine Modulated Filter Banks:** Cosine Modulated pseudo QMF Bank- Alias cancellation phase - Phase distortion- Closed form expression- Polyphase structure- PR Systems

TEXT BOOKS

1. P.P. Vaidyanathan. Multirate systems and filter banks. Prentice Hall. PTR.
2. N.J. Fliege. Multirate digital signal processing . John Wiley 1994.

REFERENCES

1.Sanjit K. Mitra. Digital Signal Processing: A computer based approach. McGraw Hill. 1998.
2.R.E. Crochiere. L. R. "Multirate Digital Signal Processing", Prentice Hall.
3J.G. Proakis. D.G. Manolakis, "Digital Signal Processing: Principles. Algorithms and Applications" , 3rd Edn. Prentice Hall India, 1999

SPEECH PROCESSING

Course Code : 13EC474

L – T – P: 3-0-0
Credits: 3

Speech Fundamentals: Articulatory Phonetics – Production and Classification of Speech

Dr. HABIBULLA KHAN
Professor & HOD
Dept of ECE
KL University
Green Fields, Vaddeswaram
Guntur Dist. A.P. PIN-522 502

Sounds; Acoustic Phonetics – acoustics of speech production; Review of Digital Signal Processing concepts. **Digital models for the speech signal** - Lossless tube models - digital models - linear predictive coding of speech - auto correlation - formulation of LPC equation - solution of LPC equations - Levinson Durbin algorithm - Levinson recursion - Schur algorithm -lattice formulations and solutions - PARCOR coefficients. **Spectral analysis of speech** - short time fourier analysis - filter bank design - speech coding – subband coding of speech - transform coding - channel vocoder - formant vocoder - cepstral vocoder – vector quantizer coder. **Speech synthesis** - pitch extraction algorithms - Gold Rabiner pitch trackers - autocorrelation pitch trackers - voice/unvoiced detection - homomorphic speech processing - homomorphic systems for convolution - complex cepstrums - pitch extraction using homomorphic speech processing. **Automatic speech recognition systems** - isolated word recognition - connected word recognition – large vocabulary word recognition systems - pattern classification - DTW, HMM - speaker recognition systems - speaker verification systems - speaker identification systems.

TEXT BOOKS

1. Rabiner L.R. & Schafer R.W., "Digital Processing of Speech Signals", Prentice Hall Inc.
2. Thomas Parsons, "Voice and Speech Processing", McGraw Hill Series .
3. Saito S. & Nakata K., "Fundamentals of Speech Signal Processing", Academic Press, Inc.

REFERENCE BOOKS

1. Steven W. Smith, "The Scientist and Engineer's Guide to Digital Signal Processing", California Technical Publishing.
2. Thomas F Quatieri, "Discrete-Time Speech Signal Processing – Principles and Practice", Pearson Education.
3. Claudio Becchetti and Lucio Prina Ricotti, "Speech Recognition", John Wiley and Sons.
4. Ben gold and Nelson Morgan, "Speech and audio signal processing", processing and perception of speech and music, Wiley- India Edition, 2006 Edition.
5. Frederick Jelinek, "Statistical Methods of Speech Recognition", MIT Press.
6. Owens F.J., "Signal Processing of Speech", Macmillan New Electronics
7. Papamichalis P.E., "Practical Approaches to Speech Coding", Texas Instruments, Prentice Hall . Rabiner L.R. & Gold, "Theory and Applications of Digital Signal Processing", Prentice Hall of India.

Dr. HABIBULLA KHAN
Professor & Head
Dept. of ECE
KL University
Green Fields, Vaddeswaram
Guntur Dist. A.P, PIN-522 502

MINUTES

Name of the meeting: Board of studies

of ECE dept

held on 8/1/13 2013, at 3:00 A.M./P.M. under the chairmanship of Sri Dr. Habibulla Khan

at HOD's Chamber, ECE dept.

The Bos meeting of ECE dept was held on 8/1/13 at 3.00 pm in ECE HOD Chamber to finalize the course structure and syllubus for M.Tech by research Specilization.

The following members were present

1) Dr. Habibulla Khan
2) Dr. M. Madhavi Latha — Absent.
3) D.S Ram Kiran - member -
4) Dr. P.S. Srinivas Babu
5) Dr. K. Sarat Kumar
6) Dr. Fatal Noorsahe
7) Prof. CH. SRINIVASU
8. Prof MSG Prasad
9. Dr. TVS Prasad Gupta
10 Dr K & N. Murthy
11. Dr. V. RAJESH
12. Dr. M. Venu Gopala Rao
13. Dr TV RAMA KRISHNA
14. Dr. K.S. Ramesh
15 L. Rajendra Prasad
16. Dr. R. SATHISHKUMAR

eneral Body, Board or as the case may be.

he name of the Company.

he place at which the meeting was held.

t the end of the minutes. Chairman to sign mentioning the number of correction made, if any, in ecording the minutes of the meeting.

It is resolved to approve the 4-semester structure for M.Tech by research program.

It is resolved to approve Dr. R. Satish Kumar as Guide for the existing M Tech by research student.

It is resolved to approve the syllabus and course structure of Tech VLSI for A.Y 2013-15 as per DATE.

Chairman
Board of Studies in ECE
KL University

K L UNIVERSITY

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

MINUTES OF DEPARTMENT ACADEMIC COMMITTEE MEETING

The Department Academic Committee meeting is convened at HOD's chamber, Electronics and Communication Engineering, on 13th November 2012 at 2:30 pm:

Agenda:

1. Discussions on feedback report collected from stakeholders.
2. New course structure and syllabus of M. Tech VLSI.
3. Any other points with the permission of the DAC chairman.

The following members were present:

1. Dr. Habibulla Khan	Professor & Head of the Department
2. Dr. T. V. Rama Krishna	Professor
3. Dr. M. Venugopala Rao	Professor
4. Dr. Ch. Srinivasu	Professor
5. Dr. V. Rajesh	Professor
6. Dr. G. V. Subbarao	Professor

The following points were discussed and resolved:

1. Upon discussing the feedback from students, the committee resolved to recommend the following to BOS.
   a. A new course on the advanced topics of analog VLSI design is discussed and approved to offer as a core course named Advanced Analog IC Design with L-T-P structure of 3-1-2.
   b. A core course on testing of VLSI circuits is introduced with L-T-P structure of 3-1-0.
   c. A core course on ASIC design with titled ASIC design flow is introduced with L-T-P structure of 3-1-0.
2. Upon lengthy discussion, several new courses are introduced, as elective courses as mentioned in Annexure-I.
3. The new course structure and syllabus of M. Tech VLSI is discussed at length.
4. Upon discussion, it was resolved to approve the course structure and syllabus of M. Tech VLSI and forwarded to BOS. (Annexure - I)
5. Upon considering above mentioned feedbacks and surveying through the policy documents in relevance to APIIC, Human Resource Development Policy, Govt. of India, National Skill Development Corporation, Govt. of India, Confederation of Indian Industries, The Associated Chambers of Commerce of India (Assocham), The National Association of Software and Services Companies (NASSCOM), ABET, NBA norms, AICTE statutory norms and Institute of Electrical and Electronics Engineers (IEEE), it is resolved to propose enclosed the curriculum for M. Tech VLSI program for BOS approval (Annexure I).

Dr. Habibulla Khan
(Head of the Department)

Dr. HABIBULLA KHAN
Professor & Head
Dept. of ECE
KL University
Green Fields, Vaddeswaram
Guntur Dist. A.P, PIN-522 502

K L University

Department of Electronics and Communication Engineering

Department Academic Committee (DAC)

The following members attended the meeting on 13th November 2012 at 2:30 pm:

S. No	Name of the member	Designation	Signature
1	Dr. Habibulla Khan	Professor, HOD	
2	Dr. T. V. Rama Krishna	Professor	
3	Dr. M. Venugopala Rao	Professor	
4	Dr. Ch. Srinivasu	Professor	
5	Dr. V. Rajesh	Professor	← ABSENT →
6	Dr. G. V. Subba Rao	Professor	
7	Swarna Sunil (9101061)	Student	
8	Kolli Ravi Chandra (9101039)	Student	
9	R Sneha (9100979)	Student	
10	Lakshmi Pratyuha (10100808)	Student	
11	M. Rama Krishna (10010918)	Student	
12	Vishnu Pattayil (11004381)	Student	

ANNEXURE-1

M. Tech VLSI course structure 2013-14

S. No	Course Code	Course Name	LTP	CR	Added / Modified/ Retained
1	13EC550	MOS CIRCUIT DESIGN	3-1-2	5	Retained
2	13EC551	ALGORITHMS FOR VLSI DESIGN AUTOMATION	3-1-0	4	Retained
3	13EC552	HDL AND PLD ARCHITECTURES	3-1-2	5	Retained
4	13EC553	IC FABRICATION TECHNOLOGY	3-1-0	4	Retained
5	KLU C503	SEMINAR	0-0-4	2	Retained
6	13EC555	LOW POWER VLSI CIRCUITS	3-0-2	4	Retained
7	13EC556	VLSI SYSTEM DESIGN	3-1-0	4	Retained
8	13EC570	ADVANCED ANALOG IC DESIGN	3-1-2	5	Added
9	13EC571	TESTING OF VLSI CIRCUITS	3-1-0	4	Added
10	13EC591	NANO ELECTRONICS	3-1-0	4	Retained
11	13EC562	System On Chip Design	3-1-0	4	Retained
12	13EC568	ASIC Design Flow	3-1-0	4	Added
13	13EC520	IMAGE AND VIDEO PROCESSING	3-0-0	3	Retained
14	13EC560	MEMORY DESIGN AND TESTING	3-0-0	3	Added
15	13EC565	RECONFIGURABLE COMPUTING	3-0-0	3	Added
16	13EC573	BICMOS TECHNOLOGY AND APPLICATIONS	3-0-0	3	Added
17	13EC592	SEMICONDUCTOR DEVICE MODELLING	3-0-0	3	Added
18	13EC562	SYSTEM ON CHIP DESIGN	3-0-0	3	Added
19	13EC563	PROCESS AND DEVICE CHARACTERIZATION & MEASUREMENTS	3-0-0	3	Added
20	13EC564	ADVANCED VLSI DESIGN	3-0-0	3	Added
21	13EC574	VLSI FOR WIRELESS COMMUNICATION	3-0-0	3	Added
22	13EC593	MEMS SYSTEM DESIGN	3-0-0	3	Added
23	13EC558	ADVANCED DIGITAL IC DESIGN	3-0-0	3	Added
24	13EC561	OPTIMIZATION TECHNIQUES AND APPLICATIONS IN VLSI DESIGN	3-0-0	3	Added
25	13EC566	CMOS RF CIRCUIT DESIGN	3-0-0	3	Added
26	13EC568	ASIC DESIGN FLOW	3-0-0	3	Added
27	13EC593	NANO SENSORS AND ITS APPLICATIONS	3-0-0	3	Added

Dr. HABIBULLA KHAN
Professor & Head
Dept. of ECE
KL University
Green Fields, Vaddeswaram
Guntur Dist. A.P, PIN-522 502

ADVANCED ANALOG IC DESIGN

Course Code: 13EC570 **L-T-P:3-1-2**
Prerequisite: **Credits: 5**

Syllabus

Small Signal & large signal Models of MOS & BJT transistor. Analog MOS Process **Passive & Active Current Mirrors:** Basic current mirrors, Cascade current mirror, Active loads, voltage and current Reference **Text Books:;**

Frequency response of integrated circuits: Single Stage (CS,CG,CD) amplifiers, Cascade Stage; frequency response(miller effect) of CG, CS, CD, Operation of Basic Differential Pair, differential pair with MOS loads, Frequency response of Cascade & Differential Pair;

Operational Amplifiers with single ended outputs: Applications of operational amplifiers, basic two stage MOS operational amplifiers, Deviations from ideality in real operational amplifiers, Basic two-stage MOS operational amplifier, MOS Folded –cascode operational amplifiers

Feedback: Ideal feedback equation, gain sensitivity, feedback configurations, practical configuration and effect of loading

Nonlinear Analog circuits & other applications: Precision rectification, phased locked loops, Sampling Switches, switched capacitor integrator, oscillators, ADC, DAC.

Text Books:

1. Gray & Meyer, Analysis & Design of Analog Integrated Circuits, 4th edition, Wiley, 2001.
2. Behzad Razavi, "Design Of Analog CMOS Integrated Circuits", Tata Mcgraw Hill,2005.

Reference Books:

1. Jacob Baker, "CMOS Mixed Signal Circuit Design", John Wiley.
2. Gray, Wooley, Brodersen, " Analog MOS Integrated Circuits "; IEEE Press, 1989.
3. Kenneth R. Laker, Willy M.C. Sansen, William M.C.Sansen, "Design of Analog Integrated Circuits and Systems ", McGraw Hill.

TESTING OF VLSI CIRCUITS

Course Code: 13EC571 **L-T-P:3-1-0**
Prerequisite: **Credits: 4**

Syllabus

Basics of Testing And Fault Modeling Introduction to Testing - Faults in digital circuits - Modeling of faults - Logical Fault Models - Fault detection - Fault location - Fault dominance - Logic Simulation - Types of simulation - Delay models - Gate level Event-driven simulation.

Test Generation For Combinational and Sequential Circuits Test generation for combinational logic circuits - Testable combinational logic circuit design - Test generation for sequential circuits - design of testable sequential circuits.

Design For Testability Design for Testability - Ad-hoc design - Generic scan based design - Classical scan based design – System level DFT approaches.

Self Test and Test Algorithms Built-In Self Test - Test pattern generation for BIST - Circular BIST - BIST Architectures - Testable Memory Design - Test algorithms - Test generation for Embedded RAMs.

Fault Diagnosis Logic Level Diagnosis - Diagnosis by UUT reduction - Fault Diagnosis for Combinational Circuits - Self-checking design - System Level Diagnosis

Dr. HABIBULLA KHAN
Professor & Head
Dept. of ECE
KL University
Green Fields, Vaddeswaram
Guntur Dist. A.P, PIN-522 502

Text Books:

1. M. Abramovici, M.A. Breuer and A.D. Friedman, "Digital Systems and Testable Design", Jaico Publishing House.
2. M.L. Bushnell and V.D. Agrawal, "Essentials of Electronic Testing for Digital, Memory and Mixed-Signal VLSI Circuits", Kluwer Academic Publishers.

Reference Books:

1. P.K. Lala, "Digital Circuit Testing and Testability", Academic Press, 2002.
2. A.L. Crouch, "Design Test for Digital IC's and Embedded Core Systems", Prentice Hall International.

MEMORY DESIGN AND TESTING

Course Code: 13EC560 **L-T-P:3-0-0**
Prerequisite: **Credits: 3**

Syllabus

Random Access Memory Technologies-Static Random Access Memories (SRAMs): SRAM Cell Structures-MOS SRAM Architecture-MOS SRAM Cell and Peripheral Circuit Operation-Bipolar, SRAM Technologies-Silicon On Insulator (SOI) Technology-Advanced SRAM Architectures and Technologies- Application Specific SRAMs. Dynamic Random Access Memories (DRAMs): DRAM Technology Development-CMOS DRAMs-DRAMs Cell Theory and Advanced Cell Structures- BiCMOS DRAMs-Soft Error Failures in DRAMs-Advanced DRAM Designs and Architecture-Application Specific DRAMs.

Non-Volatile Memories-Masked Read-Only Memories (ROMs)-High Density ROMs-Programmable Read-Only Memories (PROMs)- Bipolar PROMs-CMOS PROMs-Erasable (UV) - Programmable Road-Only Memories (EPROMs)-Floating- Gate EPROM Cell-One-Time Programmable (OTP) Eproms-Electrically Erasable PROMs (EEPROMs)- EEPROM Technology And Architecture-Nonvolatile SRAM-Flash Memories (EPROMs or EEPROM)-Advanced Flash Memory Architecture.

Memory Fault Modeling, Testing, And Memory Design For Testability And Fault Tolerance-RAM Fault Modeling, Electrical Testing, Pseudo Random Testing-Megabit DRAM Testing-Nonvolatile Memory Modeling and Testing-IDDQ Fault Modeling and Testing-Application Specific Memory Testing.

Semiconductor Memory Reliability And Radiation Effects-General Reliability Issues-RAM Failure Modes and Mechanism-Nonvolatile Memory Reliability-Reliability Modeling and Failure Rate Prediction-Design for Reliability-Reliability Test Structures-Reliability Screening and Qualification. Radiation Effects-Single Event Phenomenon (SEP)-Radiation Hardening Techniques-Radiation Hardening Process and Design Issues-Radiation Hardened Memory Characteristics-Radiation Hardness Assurance and Testing - Radiation Dosimeter-Water Level Radiation Testing and Test Structures.

Advanced Memory Technologies And High-Density Memory Packaging Technologies-Ferroelectric Random Access Memories (FRAMs)-Gallium Arsenide (GaAs) FRAMs-Analog Memories-Magneto resistive Random Access Memories (MRAMs)-Experimental Memory Devices. Memory Hybrids and MCMs (2D)-Memory Stacks and MCMs (3D)-Memory MCM Testing and Reliability Issues-Memory Cards-High Density Memory Packaging Future Directions.

Text Book:

1. Ashok K.Sharma, " Semiconductor Memories Technology, Testing and Reliability ", Prentice-Hall of India Private Limited, New Delhi, 1997.

Reference Books:

1. Luecke Mize Care, "Semiconductor Memory design & application", Mc-Graw Hill.

Dr. HABIBULLA KHAN
Professor & Head
Dept. of ECE
K L University
Green Fields, Vaddeswaram
Guntur Dist. AP, PIN-522 502

1. A L ALVAREZ, BICMOS Technology & Applications, Kluwer Academic Publishers.
2. Sherif H.K. Embabi, Abdellatif Bellaouar & Mohamed 1. Elmasry "Digital BiCMOS Integrated Circuit Design" Springer Science+ Business Media, LLC.

Reference Book:

1. Kiat-Seng yeo, Samir S. Rofail, Wang-Ling Goh, CMOS/BiCMOS ULSI, Pearson Education.
2. James C. Daly, Denis P. Galipeau, Analog BiCMOS Design: Practices & Pitfalls, CRC Press
3. Klaas-Jan de Langen, Johan Huijsing, Compact Low-Voltage and High-Speed CMOS, BiCMOS and Bipolar Operational Amplifiers, Springer Science

SEMICONDUCTOR DEVICE MODELING

Course Code: 13EC592 **L-T-P:3-0-0**
Prerequisite: **Credits: 3**

Syllabus

Basic Device Physics: Electrons and holes in silicon, p-n junction, MOS capacitor, Highfield effects.

MOSFET Devices: Long-channel MOSFETs, Short-channel MOSFETs. CMOS Device Design: MOSFET Scaling, Threshold voltage, MOSFET channel length.

CMOS Performance Factors: Basic CMOS circuit elements, Parasitic elements, Sensitivity of CMOS delay to device parameters, Performance factors of advanced CMOS devices.

Bipolar Device: n-p-n Transistors, Ideal current-voltage characteristics, Characteristics of a typical n-p-n transistor, Bipolar device models for circuit and time-dependent analyses, Breakdown voltages.

Bipolar Device Design: Design of the emitter design, Design of the base region, Design of the collector design, Modern bipolar transistor structures.

Text Book:

1. Yuan Taur, Tak.H.Ning, Fundamentals of Modern VLSI Devices, Cambridge University Press

Reference Book:

1. Donald Neamen, Semiconductors Physics and Devices, Tata Mc Graw Hill, 2003
2. Tyagi, Introduction to Semiconductor Materials and Devices, Wiley Publications, 2002.
3. Semiconductor Devices, Basic Principles Jasprit Singh, Wiley Publications, 2001
4. S.M. Sze (Ed), Physics of Semiconductor Devices, 2nd Edition, Wiley Publications, 1998
5. Analysis and Design of Analog Integrated Circuits 4/e, Paul R. Gray, Paul J. Hurst,
6. Robert G Meyer, 2001, Wiley Publications

Dr. HABIBULLA KHAN
Professor & Head
Dept. of ECE
KL University
Green Fields, Vaddeswaram
Guntur Dist. A.P, PIN-522 502

2. Belty Prince, " Semiconductor Memory Design Handbook".
3. Memory Technology design and testing 1999 IEEE International Workshop on: IEEE Computer Society Sponsor (S).

RECONFIGURABLE COMPUTING

Course Code: 13EC565 **L-T-P:3-0-0**
Prerequisite: **Credits: 3**

Syllabus

Introduction Goals and motivations - History, state of the art, future trends - Basic concepts and related fields of study - Performance, power, and other metrics - Algorithm analysis and speedup projections - RC Architectures - Device characteristics - Fine-grained architectures - Coarse-grained architectures.

Fpga Design FPGA Physical Design Tools -Technology mapping - Placement & routing - Register transfer (RT)/Logic Synthesis - Controller/Data path synthesis - Logic minimization

Parallel Processing RC Application Design - Parallelism - Systolic arrays -Pipelining - Optimizations - Bottlenecks - High-level Design - High-level synthesis - High-level languages - Design tools.

Architectures Hybrid architectures- Communication - HW/SW partitioning - Soft-core microprocessors- System architectures -System design strategies - System services - Small-scale architectures - HPC architectures - HPEC architectures - System synthesis - Architectural design space explorations.

Case Study Case Studies- Signal and image processing - Bioinformatics - Security - Special Topics - Partial Reconfiguration - Numerical Analysis -Performance Analysis/Prediction - Fault Tolerance

Text Book:

1. Paul S. Graham and Maya Gokhale "Reconfigurable Computing Accelerating Computation with Field-Programmable Gate Arrays" springer .

BICMOS TECHNOLOGY & APPLICATIONS

Course Code: 13EC573 **L-T-P:3-0-0**
Prerequisite: **Credits: 3**

Syllabus

Device Modeling: Modeling of the MOS Transistor, Modeling of the Bipolar Transistor.
Device Design Considerations: Design Considerations for MOSFET's, Design Considerations for Bipolar Transistors, BiCMOS Device Synthesis.
BiCMOS Device Scaling: MOS Device Scaling, Bipolar Device Scaling.
BiCMOS Process Technology: BiCMOS Isolation Consideration, CMOS Well & Bipolar Collector tradeoffs, CMOS & BiCMOS Processes considerations, Interconnect Processes for submicron BiCMOS, Submicrometer BiCMOS Process for 5V Digital Applications, Analog BiCMOS Process Technology, Process Reliability.
Digital Design: Delay Analysis, Gate Design, Performance Comparisons.
Analog Design: BiCMOS Operational Amplifiers, BiCMOS Analog Subsystems.
BiCMOS Digital Circuit Applications: Adders, Multiplier, Random Access Memory, Programmable Logic Arrays, BiCMOS Logic Cells, BiCMOS Gate Arrays.

Text Books:

DR. HABIBULLA KHAN
Professor & Head
Dept. of ECE
KL University
Green Fields, Vaddeswaram
Guntur Dist. A.P, PIN-522 502

7. Physics of Semiconductor Devices 3/e S. M. Sze, Wiley Publications, 2007.

PROCESS AND DEVICE CHARACTERIZATION & MEASUREMENTS

Course Code: 13EC563 **L-T-P:3-0-0**
Prerequisite: **Credits: 3**

Syllabus

Introduction and Preliminary Concepts: Macro-Meso, Micro and Nanostructure of Materials, Fundamentals of crystallography and Crystal structures Optical Microscopy: Geometry of Optics, Resolution, and Construction of a Microscope, Image Contrast, and Phase Contrast.

Electron Microscopy: SEM: Electron Optics - Interaction of Electrons and Matter - Elastic and Inelastic Scattering, Backscattered Electrons, Secondary Electrons, Scanning Electron Microscopy – Image Formation, EPMA, Magnification, and Depth of Field, Distortion, Detectors, Contrast, and Resolution. TEM: Electron diffraction, different electron Diffraction techniques.

Semiconductor Material Impurity Characterization: Spectroscopic Ellipsometry (SE), X-ray Reflectivity (XRR), X-ray Fluorescence (XRF), X-ray Diffraction (XRD), Secondary Ion Mass Spectrometry (SIMS), Auger Electron Spectrometry (AES), Rutherford Backscattering Spectrometry (RBS), EDAX, FTIR.

Electrical Characterization: Four-probe technique, Hall Effect, sheet resistance C-V measurements, DLTS, Carrier lifetime, impurity profiling, I-V measurements.Process and Spice Model Parameter Extraction

Text /Reference Text Books:

1. W.R. Reunyan, "Semiconductor Measurements and Instrumentation", Mc-Graw Hill
2. Micro structural Characterization of Materials - David Brandon and Wayne Kaplan, John Wiley and Sons, New York, NY.
3. Schroder, "Semiconductor Material and Device Characterization"
4. Philips F. Kare and Greydon B. Lauabee, "Characterization of semiconductor Materials", Mc-Graw Hill.
5. K.V. Ravi, "Imperfections and Impurities in Semiconductor Silicon", John Wiley and Sons.

Dr. HABIBULLA KHAN
Professor & Head
Dept. of ECE
KL University
Green Fields, Vaddeswaram
Guntur Dist. A.P, PIN-522 502

ADVANCED VLSI DESIGN

Course Code: 13EC564 **L-T-P:3-0-0**
Prerequisite: **Credits: 3**

Syllabus

Review of MOS Circuits: MOS and CMOS static plots, switches, comparison between CMOS and BI - CMOS.

MESFETS: MESFET and MODFET operations, quantitative description of MESFETS.

MIS Structures and MOSFETS: MIS systems in equilibrium, under bias, small signal operation of MESFETS and MOSFETS.

Short Channel Effects and Challenges to CMOS: Short channel effects, scaling theory, processing challenges to further CMOS miniaturization

Beyond CMOS: Evolutionary advances beyond CMOS, carbon Nano tubes, conventional vs. tactile computing, computing, molecular and biological computing Mole electronics-molecular Diode and diode- diode logic ,Defect tolerant computing.

Super Buffers, Bi-CMOS and Steering Logic: Introduction, RC delay lines, super buffers-An NMOS super buffer, tri state super buffer and pad drivers, CMOS super buffers, Dynamic ratio less inverters, large capacitive loads, pass logic, designing of transistor logic, General functional blocks - NMOS and CMOS functional blocks.

Special Circuit Layouts and Technology Mapping: Introduction, Talley circuits, NAND-NAND, NORNOR, and AOI Logic, NMOS, CMOS Multiplexers, Barrel shifter, Wire routing and module lay out.

System Design: CMOS design methods, structured design methods, Strategies encompassing hierarchy, regularity, modularity & locality, CMOS Chip design Options, programmable logic, Programmable inter connect, programmable structure, Gate arrays standard cell approach, Full custom Design.

Text Books:

1. Kevin F Brennan "Introduction to Semi-Conductor Device", Cambridge publications
2. Eugene D Fabricius "Introduction to VLSI Design", McGraw-Hill publications

Reference Books:

1. D.A Pucknell "Basic VLSI Design", PHI Publication
2. Wayne Wolf, "Modern VLSI Design" Pearson Education, Second Edition

Dr. HABIBULLA KHAN
Professor & Head
Dept. of ECE
KL University
Green Fields, Vaddeswaram
Guntur Dist. A.P, PIN-522 502

VLSI FOR WIRELESS COMMUNICATION

Course Code: 13EC574 **L-T-P:3-0-0**
Prerequisite: **Credits: 3**

Syllabus

Communication Concepts: Wireless Channel Description, Path Loss, Multipath Fading, Channel Model and Envelope Fading, Frequency Selective and Fast Fading
Receiver Architectures: Receiver Front End: Filter Design, Rest of Receiver Front End, Derivation of NF, IIP3 of Receiver Front End
Low Noise Amplifier: Wideband LNA Design, Narrow Band LNA: Impedance Matching, Core Amplifier
Active Mixer: Balancing, Qualitative Description of the Gilbert Mixer, Distortion, Low Frequency Case: Analysis of Gilbert Mixer, Distortion, High-Frequency Case, Noise
Passive Mixer: Switching Mixer, Distortion in Unbalanced Switching Mixer, Conversion Gain in Unbalanced Switching Mixer, Noise in Unbalanced Switching Mixer, practical Unbalanced Switching Mixer, Sampling Mixer, Conversion Gain in Single-Ended Sampling Mixer
Analog-to-Digital Converters: Demodulators, A/D converters Used in a Receiver, Low-Pass Sigma-Delta Modulators, Implementation of Low-Pass Sigma-Delta Modulators, Bandpass Sigma-Delta Modulators, Implementation of Bandpass Sigma-Delta Modulators

Text Book:

1. Bosco Leung, "VLSI for Wireless Communication, Second Edition, Springer

Reference Text Books:

1. Emad N Farag, M.I Elmasry, "Mixed Signal VLSI Wireless Design Circuits and Systems", KluwerPublication.
2. David Tsee, Pramod Viswanath," Fundamentals of Wireless Communication", Cambridge Univ Press.

NANO SENSORS AND ITS APPLICATIONS

Course Code: 13EC593 **L-T-P:3-0-0**
Prerequisite: **Credits: 3**

Syllabus

Sensor Characteristics And Physical Effects: Active and Passive sensors – Static characteristic - Accuracy, offset and linearity – Dynamic characteristics - First and second order sensors – Physical effects involved in signal transduction- Photoelectric effect – Photo dielectric effect – Photoluminescence effect – Electroluminescence effect – Hal effect – Thermoelectric effect – Peizoresistive effect – Piezoelectric effect – Pyroelectric effect – Magneto-mechanical effect (magnetostriction) – Magneto resistive effect.
Nano Based Inorganic Sensors: Density of states (DOS) – DOS of 3D, 2D, 1D and 0D materials – one dimensional gas sensors:- gas sensing with nanostructured thin films – absorption on surfaces – metal oxide modifications by additives – surface modifications – nano optical sensors – nano mechanical sensors – plasmon resonance sensors with nano particles – AMR, Giant and colossal magneto resistors – magnetic tunneling junctions.
Organic / Biosensors: Structure of Protein – role of protein in nanotechnology – using protein in nanodevices – antibodies in sensing – antibody in nano particle conjugates – enzymes in sensing – enzyme nanoparticle hybrid sensors – Motor proteins in sensing – transmembrane sensors – Nanosensors based on Nucleotides and DNA – Structure of DNA –

Dr. HABIBULLA KHAN
Professor & Head
Dept. of ECE
K L University
Green Fields, Vaddeswaram
Guntur Dist. A.P, PIN-522 502

DNA decoders and microarrays – DNA protein conjugate based sensors – Bioelectronic sensors – DNA sequencing with nanopores – sensors based on molecules with dendritic architectures – biomagnetic sensors.

Nano Sensors: Temperature Sensors, Smoke Sensors, Sensors for aerospace and defense: Accelerometer, Pressure Sensor, Night Vision System, Nano tweezers, nano-cutting tools, Integration of sensor with actuators and electronic circuitry Biosensors. **Applications:** Cantilever array sensors - Cantilever sensors for diagnosis of diabetes mellitus - Cantilever sensors for cancer diagnosis - Nanotube based sensors - Nanotube based sensors for DNA detection - Nanotube based sensors for capnography - Nanowire based sensors - Nanowire based electrical detection of single viruses - Nanowire based electrical detection of biomolecules.

Detectors and Applications: Bio receptors –Bio detectors - Nano array based detector - Nano Particle based detector - Ultra-sensitive detection of pathogenic biomarkers - Ultra-sensitive detection of single bacteria.

Reference Text Books:

1. Kourosh Kalantar – Zadeh, Benjamin Fry, "Nanotechnology- Enabled Sensors", Springer,
2. H.Rosemary Taylor, "Data acquisition for sensor systems", Chapman & Hall, 1997.
3. Jerome Schultz, Milan Mrksich, Sangeeta N. Bhatia, David J. Brady, Antonio J. Ricco, David R. Walt, Charles L. Wilkins, "Biosensing: International Research and Development", Springer,
4. Ramon Pallas-Areny, John G. Webster, "Sensors and signal conditioning" John Wiley & Sons, 2001.
5. Vijay.K.Varadan, Linfeng Chen, Sivathanupillai, "Nanotechnology Engineering in Nano and Biomedicine", John Wiley & Sons, 2010.

ADVANCED DIGITAL IC DESIGN

Course Code: 13EC558 **L-T-P:3-0-0**
Prerequisite: **Credits: 3**

Syllabus

Implementation Strategies for Digital ICs: Introduction, From Custom to Semicustom and Structured Array Design Approaches, Custom Circuit Design, Cell-Based Design Methodology, Standard Cell, Compiled Cells, Macrocells, Megacells and Intellectual Property, Semi-Custom Design Flow, Array-Based Implementation Approaches, Pre-diffused (or Mask-Programmable) Arrays, Prewired Arrays, Perspective—The Implementation Platform of the Future.

Coping with Interconnect: Introduction, Capacitive Parasitics, Capacitance and Reliability—Cross Talk, Capacitance and Performance in CMOS, Resistive Parasitics, Resistance and Reliability—Ohmic Voltage Drop, Electromigration, Resistance and Performance—RC Delay.

Timing Issues in Digital Circuits: Introduction, Timing Classification of Digital Systems,Synchronous Interconnect, Mesochronous interconnect, Plesiochronous Interconnect, Asynchronous Interconnect, Synchronous Design — An In-depth Perspective, Synchronous Timing Basics, Sources of Skew and Jitter, Clock-Distribution Techniques, Synchronizers and Arbiters, Synchronizers— Concept and Implementation, Arbiters, Clock Synthesis and Synchronization Using a Phase-Locked Loop, Basic Concept, Building Blocks of a PLL.

Designing Arithmetic Building Blocks: Introduction, The Adder, The Binary Adder: Definitions, The Full Datapaths in Digital Processor Architectures, Adder: Circuit Design Considerations, The Binary Adder: Logic Design Considerations, The Multiplier: The

Dr. HABIBULLA KHAN
Professor & Head
Dept. of ECE
KL University
Green Fields, Vaddeswaram
Guntur Dist. A.P, PIN-522 502

Multiplier: Definitions, Partial- Product Generation, Partial Product Accumulation, Final Addition, Multiplier Summary, The Shifter, Barrel Shifter, Logarithmic Shifter.

Designing Memory and Array Structures: Introduction, Memory Classification, Memory Architectures and Building Blocks, The Memory Core, Read-Only Memories, Nonvolatile Read-Write Memories, Read-Write Memories (RAM), Contents-Addressable or Associative Memory (CAM), Memory Peripheral Circuitry, The Address Decoders, Sense Amplifiers, Voltage Reference **Text Books:**, Drivers/Buffers, Timing and Control.

Text Books:

1. Kamran Ehraghian, Dauglas A. Pucknell and Sholeh Eshraghiam, "Essentials of VLSI Circuits and Systems" – PHI, EEE, 2005 Edition.
2. Neil H. E. Weste and David. Harris Ayan Banerjee,, "CMOS VLSI Design" - Pearson Education.

Reference Text Books:

1. Sung-Mo Kang, Yusuf Leblebici,"CMOS Digital Integrated Circuits" TMH 2003
2. Jan M. Rabaey, "Digital Integrated Circuits" Pearson Education, 2003
3. Wayne Wolf, "Modern VLSI Design ", 2nd Edition, Prentice Hall,1998.

Simulation Books:

1. Etienne Sicard, Sonia Delmas Bendhia, "Basics of CMOS Cell Design", TMH, EEE, 2005.

OPTIMIZATION TECHNIQUES AND APPLICATIONS IN VLSI DESIGN

Course Code: 13EC561 **L-T-P:3-0-0**
Prerequisite: **Credits: 3**

Syllabus

Statistical Modelling: Modelling sources of variations, Monte Carlo techniques, Process variation modelling- Pelgroms model, principal component based modelling, Quad tree based modelling, Performance modelling-Response surface methodology, delay modelling, interconnect delay models Statistical Performance, Power And Yield Analysis Statistical timing analysis, parameter space techniques, Bayesian networks Leakage models, High level statistical analysis, Gate level statistical analysis, dynamic power, leakage power, temperature and power supply variations, High level yield estimation and gate level yield estimation Convex Optimization Convex sets, convex functions, geometric programming, trade-off and sensitivity analysis, Generalized geometric programming, geometric programming applied to digital circuit gate sizing, Floor planning, wire sizing, Approximation and fitting- Monomial fitting, Max-monomial fitting, Polynomial fitting. Genetic Algorithm Introduction, GA Technology-Steady State Algorithm-Fitness Scaling-Inversion GA for VLSI Design, Layout and Test automation- partitioning-automatic placement, routing technology, Mapping for FPGA- Automatic test generation- Partitioning algorithm Taxonomy-Multiday Partitioning Hybrid genetic-encoding-local improvement-WDFR-Comparison of Cas-Standard cell placement-GASP algorithm-unified algorithm. Ga Routing Procedures And Power Estimation Global routing-FPGA technology mapping-circuit generation-test generation in a GA frame work-test generation procedures. Power estimation-application of GA-Standard cell placement-GA for ATG-problem encoding- fitness function-GA vs Conventional algorithm.

Reference Text Books:

1. Ashish Srivastava, Dennis Sylvester, David Blaauw "Statistical Analysis and Optimization for VLSI:Timing and Power" , Springer, 2005.

Dr. HABIBULLA KHAN
Prof. & Head
Dept. of ECE
KL University
Green Fields, Vaddeswaram
Guntur Dist. A.P, PIN-522 502

2. Pinaki Mazumder, E.Mrudnick, "Genetic Algorithm for VLSI Design,Layout and test Automation", Prentice Hall,1998.
3. Stephen Boyd, Lieven Vandenberghe "Convex Optimization", Cambridge University Press

Dr. HABIBULLA KHAN
Professor & Head
Dept. of ECE
KL University
Green Fields, Vaddeswaram
Guntur Dist. A.P, PIN-522 502

CMOS RF CIRCUIT DESIGN

Course Code: 13EC566 **L-T-P:3-0-0**
Prerequisite: **Credits: 3**

Syllabus

Introduction to RF Design and Wireless Technology: Design and Applications, Complexity and Choice of Technology. Basic concepts in RF design: Nonlinearly and Time Variance, Inter symbol interference, random processes and noise. Sensitivity and dynamic range, conversion of gains and distortion

RF Modulation: Analog and digital modulation of RF circuits, Comparison of various techniques for power efficiency, Coherent and non-coherent detection, Mobile RF communication and basics of Multiple Access techniques. Receiver and Transmitter architectures, Direct conversion and two-step transmitters

RF Testing: RF testing for heterodyne, Homodyne, Image reject, Direct IF and sub sampled receivers.

BJT and MOSFET behaviour at RF Frequencies: BJT and MOSFET behaviour at RF frequencies, modelling of the transistors and SPICE model, Noise performance and limitations of devices, integrated parasitic elements at high frequencies and their monolithic implementation

RF Circuits Design: Overview of RF Filter design, Active RF components & modelling, Matching and Biasing Networks. Basic blocks in RF systems and their VLSI implementation, Low noise Amplifier design in various technologies, Design of Mixers at GHz frequency range, various mixers- working and implementation. Oscillators- Basic topologies VCO and definition of phase noise, Noise power and trade off. Radio frequency Synthesizers- PLLS, Various RF synthesizer architectures and frequency dividers, Design issues in integrated RF filters.

Text Books:

1. B. Razavi, "RF Microelectronics" PHI 1998
2. R. Jacob Baker, H.W. Li, D.E. Boyce "CMOS Circuit Design, layout and Simulation", PHI

Reference Books:

1. Thomas H. Lee "Design of CMOS RF Integrated Circuits" Cambridge University press 1998.
2. Y.P. Tsividis, "Mixed Analog and Digital Devices and Technology", TMH 1996

Dr. HABIBULLA KHAN
Professor & Head
Dept. of ECE
KL University
Green Fields, Vaddeswaram
Guntur Dist. A.P, PIN-522 502

ASIC DESIGN FLOW

Course Code: 13EC568 **L-T-P: 3-0-0**
Prerequisite: **Credits: 3**

Syllabus

Types of ASICs – Design flow – Economics of ASICs – ASIC cell libraries – CMOS logic cell data path logic cells – I/O cells – cell compilers.

ASIC Library design: Transistors as resistors – parasitic capacitance – logical effort programmable ASIC design software: Design system – logic synthesis – half gate ASIC.

Low level design entry: Schematic entry – low level design languages – PLA tools – EDIF – An overview of VHDL and verilog. Logic synthesis in verilog and & VHDL simulation.

CMOS System case studies: Dynamic warp processor: Introduction, the problem, the algorithm, a functional overview, detailed functional specification, structural floor plan, physical design, fabrication.

pixels-planes graphic engine: introduction, raster scan graphic fundamental, pixels-planes system overview, chip electrical design, chip organization and layout, clock distribution.

Hierarchical layout and design of single chip 32 bit CPU: Introduction ,design methodology, technology updatability and layout verification.

Floor planning & placement: Floor Planning Goals and Objectives, Measurement of Delay in floor planning, Floor planning tools ,I/O and Power planning, Clock planning ,Placement Algorithms.

Routing: Global routing, Detailed routing ,Special routing.

Text Books:

1. Application specific Integrated Circuits", J.S. Smith, Addison Wesley.
2. Principles of CMOS VLSI Design : A System Perspective, N. Westle & K. Eshraghian ,Addison – Wesley Pub.Co.1985.

Reference Text Books:

1. Basic VLSI Design :Systems and Circuits, Douglas A. Pucknell & Kamran Eshraghian, Prentice Hall of India Private Ltd. , New Delhi , 1989.
2. Introduction to VLSI System,C. Mead & L. Canway, Addison Wesley Pub
3. Introduction to NMOS & VLSI System Design, A. Mukharjee, Prentice Hall,
4. The Design & Analysis of VLSI Circuits, L. A. Glassey & D. W. Dobbepahl, Addison Wesley Pub Co. 1985.
5. Digital Integrated Circuits: A Design Perspective, Jan A. Rabey, Prentice Hall of India Pvt Ltd

Dr. HABIBULLA KHAN
Professor & Head
Dept. of ECE
KL University
Green Fields, Vaddeswaram
Guntur Dist. A.P, PIN-522 502

MEMS SYSTEM DESIGN

Course Code: 13EC593 **L-T-P:3-0-0**

Prerequisite: **Credits: 3**

Syllabus

MEMS and Microsystems, Microsystems and microelectronics, Microsystems and miniaturization, Working principle of micro system - Micro sensors, Micro actuators, MEMS with Micro actuators.

Materials For MEMS - Substrate and wafer, silicon as a substrate material, silicon compound, silicon Piezo-resistors, Gallium Arsenide, quartz, Piezoelectric crystals, polymers and packaging Materials.

Fabrication Process - Photolithography,, Ion implantation, Oxidation, Chemical vapor deposition (CVD), Physical vapor deposition, Deposition by Epitaxy, Etching.

Manufacturing Process - Bulk Micromachining, Surface Micromachining, and LIGA Process. Micro system Design - Design consideration, process design, Mechanical design, Mechanical design using MEMS.

Mechanical packaging of Microsystems, Microsystems packaging, interfacing in Microsystems packaging, packaging technology, and selection of packaging materials, signal mapping and transduction.

Case study on strain sensors, Temperature sensors, Pressure sensors, Humidity sensors, Accelerometers, Gyroscopes , RF MEMS Switch, phase shifter, and smart sensors. Case study of MEMS pressure sensor Packaging.

Text Books:

1. Tai Ran Hsu," MEMS & Micro systems Design and Manufacture" Tata McGrawHill, New Delhi, 2002.
2. Julian W Gardner, "Microsensors MEMS and smart devices", John Wiley and sons Ltd,2001.
3. Chang Liu, "Foundation of MEMS", Pearson International Edition,2006.

Reference Text Books:

1. Stephen Santuria," Microsystems Design", Kluwer publishers, 2000.
2. Nadim Maluf," An introduction to Micro electro mechanical system design", Artech House,
3. Mohamed Gad-el-Hak, editor," The MEMS Handbook", CRC press Baco Raton,2000.
4. Gabriel M Rebeiz, "RF MEMS - Theory Design and Technology", John Wiley and Sons, 2003.

Dr. HABI
Prof
Dr. HABIBULLA KHAN
Professor & Head
Dept. of ECE
KL University
Green Fields, Vaddeswaram
Guntur Dist. A.P, PIN-522 502

NANO SENSORS AND ITS APPLICATIONS

Course Code: 13EC593 **L-T-P:3-0-0**
Prerequisite: **Credits: 3**

Syllabus

Sensor Characteristics And Physical Effects: Active and Passive sensors – Static characteristic - Accuracy, offset and linearity – Dynamic characteristics - First and second order sensors – Physical effects involved in signal transduction- Photoelectric effect – Photo dielectric effect – Photoluminescence effect – Electroluminescence effect – Hal effect – Thermoelectric effect – Peizoresistive effect – Piezoelectric effect – Pyroelectric effect – Magneto-mechanical effect (magnetostriction) – Magneto resistive effect.

Nano Based Inorganic Sensors: Density of states (DOS) – DOS of 3D, 2D, 1D and 0D materials – one dimensional gas sensors:- gas sensing with nanostructured thin films – absorption on surfaces – metal oxide modifications by additives – surface modifications – nano optical sensors – nano mechanical sensors – plasmon resonance sensors with nano particles – AMR, Giant and colossal magneto resistors – magnetic tunneling junctions.

Organic / Biosensors: Structure of Protein – role of protein in nanotechnology – using protein in nanodevices – antibodies in sensing – antibody in nano particle conjugates – enzymes in sensing – enzyme nanoparticle hybrid sensors – Motor proteins in sensing – transmembrane sensors – Nanosensors based on Nucleotides and DNA – Structure of DNA – DNA decoders and microarrays – DNA protein conjugate based sensors – Bioelectronic sensors – DNA sequencing with nanopores – sensors based on molecules with dendritic architectures – biomagnetic sensors.

Nano Sensors: Temperature Sensors, Smoke Sensors, Sensors for aerospace and defense: Accelerometer, Pressure Sensor, Night Vision System, Nano tweezers, nano-cutting tools, Integration of sensor with actuators and electronic circuitry Biosensors.

Applications: Cantilever array sensors - Cantilever sensors for diagnosis of diabetes mellitus - Cantilever sensors for cancer diagnosis - Nanotube based sensors - Nanotube based sensors for DNA detection - Nanotube based sensors for capnography - Nanowire based sensors - Nanowire based electrical detection of single viruses - Nanowire based electrical detection of biomolecules.

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Dept. of ECE
KL University
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Guntur Dist. A.P, PIN-522 502