

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
(Established by Govt. of A.P., Act. No. 30 of 2008)
ANANTHAPURAMU – 515 002 (A.P.) INDIA.

Course Structure for B.Tech-R15 Regulations

Electronics & Communication Engineering

B.TechIII-I Semester(ECE)

S. No.	Course Code	Subject	L	T	P	C
1.	15A05402	Computer Organization	3	1	-	3
2.	15A04501	Antennas and Wave Propagation	3	1	-	3
3.	15A04502	Digital Communication Systems	3	1	-	3
4.	15A04503	Linear Integrated Circuits and Applications	3	1	-	3
5.	15A04504	Digital System Design	3	1	-	3
6.	15A04505 15A04506	MOOCS-I a. Linux Programming & Scripting b. MEMS & Microsystems	3	1	-	3
7.	15A04507	IC Applications Laboratory	-	-	4	2
8.	15A04508	Digital Communication Systems Laboratory	-	-	4	2
9.	15A99501	Audit course – Social Values & Ethics	2	0	2	0
Total:			20	06	10	22

*Either by MOOCS manner or Conventional manner

B.TechIII-II Semester(ECE)

S. No.	Course Code	Subject	L	T	P	C
1.	15A52301	Managerial Economics and Financial Analysis	3	1	-	3
2.	15A04601	Microprocessors & Microcontrollers	3	1	-	3
3.	15A04602	Electronic Measurements and Instrumentation	3	1	-	3
4.	15A04603	Digital Signal Processing	3	1	-	3
5.	15A04604	VLSI Design	3	1	-	3
6.	15A04605 15A04606 15A02605 15A01608	CBCC-I a. MATLAB Programming b. Industrial Electronics c. Neural Networks & Fuzzy Logic d. Intellectual Property Rights	3	1	-	3
7.	15A04607	Microprocessors & Microcontrollers Laboratory	-	-	4	2
8.	15A04608	Digital Signal Processing Laboratory	-	-	4	2
9.	15A52602	Advanced English Language Communication (AELCS) Laboratory (Audit Course)	-	-	2	-
10.	15A04609	Comprehensive Online Examination-II	-	-	-	1
Total:			18	06	12	23

B.Tech IV-I Semester(ECE)

S. No.	Course Code	Subject	L	T	P	C
1.	15A04701	Optical Fiber Communication	3	1	-	3
2.	15A04702	Embedded Systems	3	1	-	3
3.	15A04703	Microwave Engineering	3	1	-	3
4.	15A04704	Data Communications and Networking	3	1	-	3
5.	15A04705 15A04706 15A04707	CBCC-II a. Radar Systems b. Adaptive Signal Processing c. FPGA Design	3	1	-	3
6.	15A04708 15A04709 15A04710	CBCC-III a. Digital Image Processing b. Cellular & Mobile Communication c. Real Time Systems	3	1	-	3
7.	15A04711	Microwave and Optical Communication Laboratory	-	-	4	2
8.	15A04712	VLSI & Embedded Systems Laboratory	-	-	4	2
Total:			18	06	08	22

B.TechIV-II Semester(ECE)

S. No.	Course Code	Subject	L	T	P	C
1.	15A04801 15A04802	MOOCS-II* a. Advanced Digital Signal Processing- Multirate & Wavlet b. Low Power VLSI Circuits & Systems	3	1	-	3
2.	15A04803 15A04804	MOOCS-III * a. Pattern Recognition & Applications b. RF Integrated Circuits	3	1	-	3
3.	15A04805	Comprehensive Viva Voce	-	-	4	2
4.	15A04806	Technical Seminar	-	-	4	2
5.	15A04807	Project Work	-	-	24	12
Total:			6	02	32	22

2 Theory + 1 Comprehensive Viva voce + 1 Technical Seminar + 1 Project work

*Either by MOOCS manner or Self-study or Conventional manner

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B. Tech III-I Sem. (ECE)

L	T	P	C
3	1	0	3

15A05402 COMPUTER ORGANIZATION

Course Objectives:

- To understand the structure, function, characteristics and performance issues of computer systems.
- To understand I/O transfer mechanism, design of I/O circuit interfaces and example bus standards (like PCI, SCSI, USB)
- To understand the basic processing unit and how they are connected and how it generates control signals (using hardwired and micro programmed approaches)

Course Outcomes:

- Identify functional units, bus structure and addressing modes
- Design the hardwired and micro-programmed control units.
- Understand pipelined execution and instruction scheduling

UNIT-I

Computer types, Functional units, basic operational concepts, Bus structures, Data types, Software: Languages and Translators, Loaders, Linkers, Operating systems.

Memory locations – addresses and encoding of information – main memory operations – Instruction formats and instruction sequences – Addressing modes and instructions – Simple input programming – pushdown stacks – subroutines.

UNIT-II

Register transfer Language, Register transfer, Bus and Memory Transfers, Arithmetic Micro operations, Logic Micro operations, shift Micro operations, Arithmetic Logic Shift Unit.

Stack organization, instruction formats, Addressing modes, Data transfer and manipulation, Execution of a complete instruction, Sequencing of control signals, Program Control.

UNIT-III

Control Memory, address Sequencing, Micro Program Example, Design of Control Unit.

Addition and Subtraction, Multiplication Algorithms, Division Algorithms, Floating Point Arithmetic Operations, Decimal Arithmetic Unit, Decimal Arithmetic Operations.

UNIT-IV

Peripheral Devices, Input-Output Interface, Asynchronous Data Transfer, Modes of Transfer, Priority Interrupt, Direct Memory Access (DMA), Input-Output Processor (IOP), Serial Communication.

Memory hierarchy, main memory, auxiliary memory, Associative memory, Cache memory, Virtual memory, Memory management hardware.

UNIT-V

Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline Vector Processing, Array Processors.

Characteristics of Multiprocessors, Interconnection Structures, Interprocessor Arbitration, Inter-processor Communication and Synchronization, Cache Coherence.

Text Books:

1. M. Morris Mano, "Computer system Architecture", Prentice Hall of India (PHI), Third edition.
2. William Stallings, "Computer organization and programming", Prentice Hall of India (PHI) Seventh Edition, Pearson Education (PE) Third edition, 2006.

Reference Books:

1. Carl Hamacher, Zvonks Vranesic, Safwat Zaky, "Computer Organization" 5th Edition, McGraw Hill, 2002.
2. Andrew S. Tanenbaum, "Structured Computer Organization", 4th Edition PHI/Pearson
3. John L. Hennessy and David A. Patterson, "Computer Architecture a quantitative approach", Fourth Edition Elsevier
4. Joseph D. Dumas II, "Computer Architecture: Fundamentals and Principles of Computer Design", BS Publication.

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15A04501 ANTENNAS & WAVE PROPAGATION**Course Objectives:**

- Fundamentals of electromagnetic radiation: Maxwell's equations, potential functions, wave equation, retarded potential, short current element, near and far fields, Poynting's theorem.
- Design of antenna arrays: principle of pattern multiplication, broadside and end fire arrays, array synthesis, coupling effects and mutual impedance, parasitic elements, Yagi-Uda antenna.

Course Outcomes:

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

- Approximate parametric equations for the calculation in the farfield region.
- Write parametric integral expressions for a given current source.
- Calculate electromagnetic fields for a given vector potential.
- Discover pattern multiplication principle for array antennas.

UNIT - I

Antenna Basics & Dipole antennas: Introduction, Basic antenna parameters- patterns, Beam Area, Radiation Intensity, Beam Efficiency, Directivity-Gain-Resolution, Antenna Apertures, Effective height, Fields from oscillating dipole, Field Zones, Shape-Impedance considerations, Polarization – Linear, Elliptical, & Circular polarizations, Antenna temperature, Antenna impedance, Front-to-back ratio, Antenna theorems, Radiation – Basic Maxwell's equations, Retarded potential-Helmholtz Theorem, Radiation from Small Electric Dipole, Quarter wave Monopole and Half wave Dipole – Current Distributions, Field Components, Radiated power, Radiation Resistance, Beam width, Natural current distributions, far fields and patterns of Thin Linear Center-fed Antennas of different lengths, Illustrative problems.

UNIT- II

VHF, UHF and Microwave Antennas - I: Loop Antennas - Introduction, Small Loop, Comparison of far fields of small loop and short dipole, Radiation Resistances and Directives of small and large loops (Qualitative Treatment), Arrays with Parasitic Elements - Yagi - Uda Arrays, Folded Dipoles & their characteristics. Helical Antennas-

Helical Geometry, Helix modes, Practical Design considerations for Monofilar Helical Antenna in Axial and Normal Modes. Horn Antennas- Types, Fermat's Principle, Optimum Horns, Design considerations of Pyramidal Horns, Illustrative Problems.

UNIT - III

VHF, UHF and Microwave Antennas - II: Micro strip Antennas- Introduction, features, advantages and limitations, Rectangular patch antennas- Geometry and parameters, characteristics of Micro strip antennas, Impact of different parameters on characteristics, reflector antennas - Introduction, Flat sheet and corner reflectors, parabola reflectors- geometry, pattern characteristics, Feed Methods, Reflector Types - Related Features, Lens Antennas - Geometry of Non-metallic Dielectric Lenses, Zoning , Tolerances, Applications, Illustrative Problems.

UNIT- IV

Antenna Arrays: Point sources - Definition, Patterns, arrays of 2 Isotropic sources- Different cases, Principle of Pattern Multiplication, Uniform Linear Arrays – Broadside Arrays, Endfire Arrays, EFA with Increased Directivity, Derivation of their characteristics and comparison, BSA with Non-uniform Amplitude Distributions - General considerations and Binomial Arrays, Illustrative problems.

Antenna Measurements: Introduction, Concepts- Reciprocity, Near and Far Fields, Coordination system, sources of errors, Patterns to be Measured, Pattern Measurement Arrangement, Directivity Measurement , Gain Measurements (by comparison, Absolute and 3-Antenna Methods).

UNIT – V

Wave Propagation: Introduction, Definitions, Characterizations and general classifications, different modes of wave propagation, Ray/Mode concepts, Ground wave propagation (Qualitative treatment) - Introduction, Plane earth reflections, Space and surface waves, wave tilt, curved earth reflections, Space wave propagation - Introduction, field strength variation with distance and height, effect of earth's curvature, absorption, Super refraction, M-curves and duct propagation, scattering phenomena, tropospheric propagation, fading and path loss calculations, Sky wave propagation - Introduction, structure of Ionosphere, refraction and reflection of sky waves by ionosphere, Ray path, Critical frequency, MUF, LUF, OF, Virtual height and Skip distance, Relation between MUF and Skip distance, Multi-HOP propagation, Energy loss in Ionosphere, Summary of Wave Characteristics in different frequency ranges, Illustrative problems.

TEXT BOOKS:

1. John D. Kraus and Ronald J. Marhefka and Ahmad S.Khan, "Antennas and wave propagation," TMH, New Delhi, 4th Ed., (special Indian Edition), 2010.
2. E.C. Jordan and K.G. Balmain, "Electromagnetic Waves and Radiating Systems," PHI, 2ndEdn, 2000.

REFERENCES:

1. C.A. Balanis, "Antenna Theory- Analysis and Design," John Wiley & Sons, 2ndEdn., 2001.
2. K.D. Prasad, SatyaPrakashan, "Antennas and Wave Propagation," Tech. India Publications, New Delhi, 2001.

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15A04502 DIGITAL COMMUNICATION SYSTEMS
Course Objectives:

- The students to be able to understand, analyze, and design fundamental digital communication systems.
- The course focuses on developing a thorough understanding of digital communication systems by using a series of specific examples and problems.

Course Outcomes:

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

- Understand the elements of DCS & the fundamentals concepts of sampling theorem along with different coding and modulation techniques
- Understand the basic principles of baseband and passband digital modulation schemes
- Analyze probability of error performance of digital systems and are able to design digital communication systems

UNIT – I

Source Coding Systems: Introduction, sampling process, quantization, quantization noise, conditions for optimality of quantizer, encoding, Pulse-Code Modulation (PCM), Line codes, Differential encoding, Regeneration, Decoding & Filtering, Noise considerations in PCM systems, Time-Division Multiplexing (TDM), Synchronization, Delta modulation (DM), Differential PCM (DPCM), Processing gain, Adaptive DPCM (ADPCM), Comparison of the above systems.

UNIT – II

Baseband Pulse Transmission: Introduction, Matched filter, Properties of Matched filter, Matched filter for rectangular pulse, Error rate due to noise, Inter-symbol Interference (ISI), Nyquist's criterion for distortion less baseband binary transmission, ideal Nyquist channel, Raised cosine filter & its spectrum, Correlative coding – Duo binary & Modified duo binary signaling schemes, Partial response signaling, Baseband M-array PAM transmission, Eye diagrams.

UNIT – III

Signal Space Analysis: Introduction, Geometric representation of signals, Gram-Schmidt orthogonalization procedure, Conversion of the Continuous AWGN channel into a vector channel, Coherent detection of signals in noise, Correlation receiver, Equivalence of correlation and Matched filter receivers, Probability of error, Signal constellation diagram.

UNIT - IV

Passband Data Transmission: Introduction, Passband transmission model, Coherent phase-shift keying – binary phase shift keying (BPSK), Quadrature shift keying (QPSK), Binary Frequency shift keying (BFSK), Error probabilities of BPSK, QPSK, BFSK, Generation and detection of Coherent BPSK, QPSK, & BFSK, Power spectra of above mentioned modulated signals, M-array PSK, M-array quadrature amplitude modulation (M-array QAM), Non-coherent orthogonal modulation schemes -Differential PSK, Binary FSK, Generation and detection of non-coherent BFSK, DPSK, Comparison of power bandwidth requirements for all the above schemes.

UNIT – V

Channel Coding: Error Detection & Correction - Repetition & Parity Check Codes, Interleaving, Code Vectors and Hamming Distance, Forward Error Correction (FEC) Systems, Automatic Retransmission Query (ARQ) Systems, Linear Block Codes – Matrix Representation of Block Codes, Convolutional Codes – Convolutional Encoding, Decoding Methods.

TEXT BOOKS:

1. Simon Hakin, "Communication Systems," Wiley India Edition, 4th Edition, 2011.
2. B.P. Lathi, & Zhi Ding, "Modern Digital & Analog Communication Systems", Oxford University Press, International 4th edition, 2010.

REFERENCES:

1. Sam Shanmugam, "Digital and Analog Communication Systems", John Wiley, 2005.
2. A. Bruce Carlson, & Paul B. Crilly, "Communication Systems – An Introduction to Signals & Noise in Electrical Communication", McGraw-Hill International Edition, 5th Edition, 2010
3. Bernard Sklar, "Digital Communications", Prentice-Hall PTR, 2nd edition, 2001.
4. Herbert Taub & Donald L Schilling, "Principles of Communication Systems", Tata McGraw-Hill, 3rd Edition, 2009.
5. J. G. Proakis, M Salehi, Gerhard Bauch, "Modern Communication Systems Using MATLAB," CENGAGE, 3rd Edition, 2013.

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15A04503 LINEAR INTEGRATED CIRCUITS AND APPLICATIONS**Course Objectives:**

- Design of OPAMPS, Classification of OPAMPS.
- To study and design various linear applications of OPAMPS.
- To study and design various non linear applications of OPAMPS

Course Outcomes:

- Understand the basic building blocks of linear integrated circuits and its characteristics.
- Analyze the linear, non-linear and specialized applications of operational amplifiers.
- Understand the theory of ADC and DAC.
- Realize the importance of Operational Amplifier.

UNIT – I

Differential Amplifiers: Differential amplifier configurations, Balanced and unbalanced output differential amplifiers, current mirror, level Translator.

Operational amplifiers: Introduction, Block diagram, Ideal op-amp, Equivalent Circuit, Voltage Transfer curve, open loop op-amp configurations. Introduction to dual OP-AMP TL082 as a general purpose JFET-input Operational Amplifier.

UNIT-II

Introduction, feedback configurations, voltage series feedback, voltage shunt feedback and differential amplifiers, properties of Practical op-amp.

Frequency response: Introduction, compensating networks, frequency response of internally compensated op-amps and non compensated op-amps, High frequency op-amp equivalent circuit, open loop gain Vs frequency, closed loop frequency response, circuit stability, slew rate.

UNIT-III

DC and AC amplifiers, peaking amplifier, summing, scaling and averaging amplifiers, instrumentation amplifier, voltage to current converter, current to voltage converter, integrator, differentiator, active filters, First, Second and Third order Butterworth filter and its frequency response, Tow-Thomas biquad filter.

UNIT-IV

Oscillators, Phase shift and wein bridge oscillators, Square, triangular and sawtooth wave generators, Comparators, zero crossing detector, Schmitt trigger, characteristics and limitations.

Specialized applications: 555 timer IC (monostable&astable operation) & its applications, PLL, operating principles, Monolithic PLL, applications, analog multiplier and phase detection, Wide bandwidth precision analog multiplier MPY634 and its applications.

UNIT V

Analog and Digital Data Conversions, D/A converter – specifications – weighted resistor type, R-2R Ladder type, Voltage Mode and Current-Mode R-2R Ladder types - switches for D/A converters, high speed sample-and-hold circuits, A/D Converters – specifications – Flash type – Successive Approximation type – Single Slope type – Dual Slope type – A/D Converter using Voltage-to-Time Conversion – Over-sampling A/D Converters,

TEXT BOOKS:

1. D. Roy Chowdhury, “Linear Integrated Circuits”, New Age International (p) Ltd, 2nd Edition, 2003.
2. K.LalKishore, “Operational Amplifiers and Linear Integrated Circuits”, Pearson Education, 2007.

REFERENCES:

1. Ramakanth A. Gayakwad, “Op-Amps & Linear ICs”, PHI, 4th edition, 1987.
2. R.F.Coughlin& Fredrick Driscoll, “Operational Amplifiers & Linear Integrated Circuits”, 6th Edition, PHI.
3. David A. Bell, “Operational Amplifiers & Linear ICs”, Oxford University Press, 2nd edition, 2010.

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15A04504 DIGITAL SYSTEM DESIGN**Course Objectives:**

- To be able to use computer-aided design tools for development of complex digital logic circuits
- To be able to model, simulate, verify, analyze, and synthesize with hardware description languages
- To be able to design and prototype with standard cell technology and programmable logic
- To be able to design tests for digital logic circuits, and design for testability

Course Outcomes:

- Capable of using Computer-aided design tools to model, simulate, verify, analyze, and synthesize complex digital logic circuits.
- Efficient designing of any Digital System using basic structure ICs .
- Able to design and prototype with standard cell technology and programmable logic.
- Apply design test for digital logic circuits, and design for testability.

UNIT-I

CMOS LOGIC: Introduction to logic families, CMOS logic, CMOS logic families; BIPOLAR LOGIC AND INTERFACING: Bipolar logic, Transistor logic, TTL families, CMOS/TTL interfacing, low voltage CMOS logic and interfacing, Emitter coupled logic, Comparison of logic families, Familiarity with standard 74-series and CMOS 40-series-ICs – Specifications.

UNIT-II

HARDWARE DESCRIPTION LANGUAGES: HDL Based Digital Design, The VHDL Hardware Description Language–Program Structure, Types, Constants and Arrays, Functions and procedures, Libraries and Packages, Structural design elements, Dataflow design elements, Behavioral design elements, The Time Dimension, Simulation, Test Benches, VHDL Features for Sequential Logic Design, Synthesis

UNIT-III

COMBINATIONAL LOGIC DESIGN PRACTICES: Description of basic structures like Decoders, Encoders, Comparators, Multiplexers (74 –series MSI); Design of complex Combinational circuits using the basic structures; Designing Using combinational PLDs like PLAs, PALs ,PROMs CMOS PLDs; Adders & sub tractors, ALUs, Combinational multipliers; VHDL models for the above standard building block ICs.

UNIT-IV

SEQUENTIAL MACHINE DESIGN PRACTICES: Review of design of State machines; Standard building block ICs for Shift registers, parallel / serial conversion , shift register counters, Ring counters; Johnson counters, LFSR counter ; VHDL models for the above standard building block ICs.Synchronous Design example using standard ICs

UNIT –V

Design Examples (using VHDL): Barrel shifter, comparators, floating-point encoder, and dual parity encoder.

Sequential logic Design: Latches & flip flops, PLDs, counters, shift register and their VHDL models.

Text Books:

1. John F.Wakerly, “Digital Design Principles and Practices” 4th edition, Pearson Education., 2009
2. Charles H.Roth,Jr., “Fundamentals of Logic Design” 5th edition , CENGAGE Learning 2012.

References:

1. M.Morris Mano and Michael D. Cileti., “Digital Logic Design” 4th edition Pearson Education., 2013
2. Stephen Brown and ZvonkoVranesic, “Fundamentals of digital logic with VHDL design” 2nd edition McGraw Hill Higher Education.
3. J. Bhasker, “A VHDL PRIMER” 3rd edition Eastern Economy Edition, PHI Learning,2010.

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B. Tech III-I Sem. (ECE)

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**15A04505 LINUX PROGRAMMING & SCRIPTING
(MOOCS-I)**
Course Objectives:

- The goal of the course is the study of scripting languages such as PERL, TCL/TK, Python and BASH
- Creation of programs in the Linux environment
- The study of the principles of scripting languages
- The study of usage of scripting languages in IC design flow

Learning Outcomes:

- Ability to create and run scripts using Perl / TCL / Python in IC design flow
- Ability to use Linux environment and write programs for automation of scripts in VLSI tool design flow

UNIT I

LINUX BASICS: Introduction to Linux, File System of the Linux, General usage of Linux kernel & basic commands, Linux users and group, Permissions for file, directory and users, Searching a file & directory, zipping and unzipping concepts

UNIT II

LINUX NETWORKING: Introduction to Networking in Linux, Network basics & tools, File transfer protocol in Linux, Network file system, Domain Naming Services, Dynamic hosting configuration Protocol & Network information Services.

UNIT III

PERL SCRIPTING: Introduction to Perl Scripting, Working with Simple Values, Lists and Hashes, Loops and Decisions, Regular Expressions, Files and Data in Perl Scripting, References & Subroutines, Running and Debugging Perl, Modules, Object-Oriented Perl.

UNIT IV

TCL/ TK SCRIPTING: TCL Fundamentals, String and Pattern Matching, TCL Data Structures, Control Flow Commands, Procedures and Scope, EVAL, Working With UNIX, Reflection and Debugging, Script Libraries, TK Fundamentals, TK by Examples, The Pack Geometry Manager, Binding Commands to X Events, Buttons and Menus, Simple TK Widgets, Entry and List box Widgets Focus, Grabs and Dialogs

UNIT V

PYTHON SCRIPTING: Introduction to Python, Using the Python Interpreter, More Control Flow Tools, Data Structures, Modules, Input and Output, Errors and Exceptions, Classes, Brief Tour of the Standard Library.

Text Books:

1. Instructor reference material
 2. Python Tutorial by Guido van Rossum, and Fred L. Drake, Jr., editor, Release 2.6.4
 3. Practical Programming in Tcl and Tk by Brent Welch , Updated for Tcl 7.4 and Tk 4.0
 4. Teach Yourself Perl 5 in 21 days by David Till.
- Red Hat Enterprise Linux 4: System Administration Guide Copyright © 2005 Red Hat, Inc

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**15A04506 MEMS & MICRO SYSTEMS
(MOOCS-I)**
UNIT I

Introduction: Introduction to MEMS & Microsystems, Introduction to Microsensors, Evaluation of MEMS, Microsensors, Market Survey, Application of MEMS, MEMS Materials, MEMS Materials Properties, MEMS Materials Properties.

UNIT II

Microelectronic Technology for MEMS: Microelectronic Technology for MEMS, Micromachining Technology for MEMS, Micromachining Process, Etch Stop Techniques and Microstructure, Surface and Quartz Micromachining, Fabrication of Micromachined Microstructure, Microstereolithography,

UNIT III

Micro Sensors: MEMS Microsensors, Thermal Microsensors, Mechanical Micromachined Microsensors, MEMS Pressure Sensor, MEMS Flow Sensor, Micromachined Flow Sensors, MEMS Inertial Sensors, MEMS Gyro Sensor

UNIT IV

MEMS Accelerometers: Micromachined Micro accelerometers for MEMS, MEMS Accelerometers for Avionics, Temperature Drift and Damping Analysis, Piezoresistive Accelerometer Technology, MEMS Capacitive Accelerometer, MEMS Capacitive Accelerometer Process, MEMS for Space Application.

UNIT V

MEMS Applications: Polymer MEMS & Carbon Nano Tubes CNT, Wafer Bonding & Packaging of MEMS, Interface Electronics for MEMS, Introduction to BioMEMS and Micro Fluidics, Introduction to Bio Nano Technology, Bio Sensors, Fluidics, MEMS for Biomedical Applications (Bio-MEMS)

Text Books:

1. Nadim Maluf Kirt Williams "An Introduction to Microelectromechanical Systems Engineering", Second Edition, Artech House, Inc. Boston London, International Standard Book Number: 1-58053-590-9.
2. Varadan, V Kand Varadan "Microsensors, actuators, MEMS, and electronics for smart structures" Rai-Choudhury P (ed.) Handbook of Microlithography, Micromachining, and Microfabrication, SPIE Optical Engineering Press

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15A04507 IC APPLICATIONS LABORATORY

All experiments are based upon 741 / TL 082/ASLK Kits.

1. Study the characteristics of negative feedback amplifier

Aim: Design the following amplifiers:

- A unity gain amplifier
- A non-inverting amplifier with a gain of 'A'
- An inverting amplifier with a gain of 'A'

Apply a square wave of fixed amplitude and study the effect of slew rate on the three type of amplifiers.

Applications:

- Amplifying bioelectric potentials (ECG, EEG, EMG, EOG) and piezoelectric with high output impedance.
- Amplifying sensor output signals (temperature sensors, humidity sensors, pressure sensors etc.)

Sample questions

Explain the need for two stages in any instrumentation amplifier.

Why CMRR is high for instrumentation amplifiers?

Give some examples for low voltage, low frequency and higher output impedance signals.

How does the tolerances of resistors affect the gain of the instrumentation amplifier?

2. Design of an instrumentation amplifier

Aim: Design an instrumentation amplifier of a differential mode gain of 'A' using three amplifiers.**Applications:**

- Used in measuring instruments designed for achieving high accuracy and high stability.
- Used for amplifying low voltage, low frequency and higher output impedance signals.

Sample questions

Explain the need for two stages in any instrumentation amplifier.

Why CMRR is high for instrumentation amplifiers?

Give some examples for low voltage, low frequency and higher output impedance signals.

How does the tolerances of resistors affect the gain of the instrumentation amplifier?

3. Study the characteristics of regenerative feedback system with extension to design an astablemultivibrator

Aim:Design and test an astablemultivibrator for a given frequency.

Applications

- It can be used in signal generators and generation of timing signals.
- It can be used in code generators and trigger circuits.

Sample question

Discuss the difference between astable and bi-stable multivibrator.

Discuss the frequency limitation of astablemultivibrator.

Discuss the various applications of bi-stable multivibrator.

4. Study the characteristics of integrator circuit

Aim:Design and test the integrator for a given time constant.

Applications

- Used in function generators, PI/PID controllers.
- Used in analog computers, analog-to-digital converters and wave-shaping circuits.
- Used as a charge amplifier.

Sample questions

Compare the output with that of ideal integrator.

How will you design a differentiator and mention its drawback.

Discuss the limitation of the output voltage of the integrator.

How will you obtain drift compensation in an inverting integrator?

5. Design of Analog filters – I

Aim:Design a second order butterworth band-pass filter for the given higher and lower cut-off frequencies.

Applications:

- Used in signal conditioning circuits for processing audio signals.
- Used in measuring instruments.
- Used in radio receivers.

Sample questions

Discuss the effect of order of the filter on frequency response.

How will you vary Q factor of the frequency response.

Discuss the need for going to Sallen Key circuit.

Compare the performance of Butterworth filter with that of Chebyshev filter.

6. Design of Analog filters – II

Aim: Design and test a notch filter to eliminate the 50Hz power line frequency.

Applications

- Used for removing power supply interference.
- Used for removing spur in RF signals.

Sample questions

Explain the effect of supply frequency interference while amplifying sensor signals.

Suggest a method for adjusting the Q factor of the frequency response of notch filter.

What is the purpose of going for Twin T notch filter circuit?

7. Design of a self-tuned Filter

Aim: Design and test a high-Q Band pass self-tuned filter for a given center frequency.

Applications:

- Used in spectrum analyzers

Sample Question:

Discuss the effect of the harmonics when a square wave is applied to the filter

Determine the lock range of the self-tuned filter

8. Design of a function generator

Aim: Design and test a function generator that can generate square wave and triangular wave output for a given frequency.

Applications:

- Used in testing, measuring instruments and radio receivers.
- Used for obtaining frequency response of devices and circuits.
- Used for testing and servicing of Electronic equipments.
- Used in Electronic musical instruments.
- Used for obtaining audiograms (Threshold of audibility Vs frequency)

Sample questions

Discuss typical specifications of a general purpose function generator.

How can you obtain reasonably accurate sine wave from triangular wave.

Discuss the reason for higher distortion in sine wave produced by function generators.

What do you mean by Duty cycle and how can you vary the same in a function generator?

9. Design of a Voltage Controlled Oscillator

Aim: Design and test voltage controlled oscillator for a given specification (voltage range and frequency range).

Applications:

- Used in Phase Lock Loop (PLL) circuits.
- Used in frequency modulation circuits.
- Used in Function generators
- Used in frequency Synthesizers of Communication equipments.

Sample Questions

Discuss the following characteristics of a voltage controlled Oscillator.

- i) Tuning range
- ii) Tuning gain and
- iii) Phase noise

Compare the performances VCO based Harmonic Oscillators and Relaxation Oscillators

What are the various methods adopted in controlling the frequency of oscillation in VCOs

Discuss any one method of obtaining FM demodulation using a VCO.

10. Design of a Phase Locked Loop(PLL)

Aim: Design and test a PLL to get locked to a given frequency 'f'. Measure the locking range of the system and also measure the change in phase of the output signal as input frequency is varied with in the lock range.

Applications:

- Used in tracking Band pass filter for Angle Modulated signals.
- Used in frequency divider and frequency multiplier circuits.
- Used as Amplifiers for Angle Modulated signals.
- Used in AM and FM Demodulators
- Used in Suppressed Carrier Recovery Circuits

Sample Questions:

Draw the block diagram of a PLL based divider and multiplier and explain the functions performed by each block.

Distinguish between Lock range and Capture Range, Explain the method of estimating the same for a given PLL circuit.

Discuss the differences between Analog Phase Lock Loop and Digital Phase Lock Loop.

11. Automatic Gain Control (AGC) Automatic Volume Control (AVC)

Aim: Design and test an AGC system for a given peak amplitude of sine-wave output.

Applications

- Used in AM Receivers
- Used as Voice Operated Gain Adjusting Device (VOGAD) in Radio Transmitters
- Used in Telephone speech Recorders
- Used in Radar Systems

Sample Questions

Explain clearly the need for AGC in AM Receivers.

Draw the block diagram of feedback and feed forward AGC systems and explain the functions of each block.

Discuss any one gain control mechanism present in biological systems.

How can you use AGC in a Received Signal Strength Indicator (RSSI)

12. Design of a low drop out regulator

Aim: Design and test a Low Dropout regulator using op-amps for a given voltage regulation characteristic and compare the characteristics with TPS7250 IC

Applications:

- Used in Power Supply of all Electronic Instruments and Equipment's
- Used as Reference Power Supply in Comparators
- Used in Emergency Power Supplies
- Used in Current Sources

Sample Questions

Distinguish between Load Regulation and Line Regulation.

Mention some of the other important parameters in selecting a LDO.

What is power supply rejection ratio (PSRR)?

13. DC-DC Converter

Aim: Design of a switched mode power supply that can provide a regulated output voltage for a given input range using the TPS40200 IC

Applications:

- Used in DSL/Cable Modems
- Used in Distributed Power Systems

Sample Questions

Discuss the effect of varying the input voltage for a fixed regulated output voltage over the duty cycle of PWM.

References:

1. TL082: Data Sheet: <http://www.ti.com/lit/ds/symlink/tl082.pdf>
Application Note: <http://www.ti.com/lit/an/sloa020a/sloa020a.pdf>
2. MPY634: Data Sheet: <http://www.ti.com/lit/ds/symlink/mpy634.pdf>
Application Note: <http://www.ti.com/lit/an/sbfa006/sbfa006.pdf>
3. ASLK Pro Manual: [ASLK Manual](#)

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B. Tech III-ISem. (ECE)	L	T	P	C
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DIGITAL COMMUNICATIONS SYSTEMS LABORATORY				

Course Outcomes:

- After completion of the course the students will be able to experience real time behavior of different digital modulation schemes and technically visualize spectra of different digital modulation schemes

Minimum of Ten experiments to be conducted (Five from each Part-A&B)**HARDWARE EXPERIMENTS (PART – A)**

1. Time division multiplexing.
2. Pulse code modulation.
3. Differential pulse code modulation.
4. Delta modulation.
5. Frequency shift keying.
6. Differential phase shift keying.
7. QPSK modulation and demodulation.

SOFTWARE EXPERIMENTS (PART-B)**Modeling of Digital Communications using MATLAB**

1. Sampling Theorem – verification.
2. Pulse code modulation.
3. Differential pulse code modulation.
4. Frequency shift keying.
5. Phase shift keying.
6. Differential phase shift keying.
7. QPSK modulation and demodulation.

Equipment required for Laboratories:

1. RPS - 0 – 30 V
2. CROs - 0 – 20 M Hz.
3. Function Generators - 0 – 1 M Hz
4. RF Generators (3 Nos.) 0 – 1000 M Hz.
5. Multimeters
6. Lab Experimental kit for Pulse Code Modulation (Experiment No.3 of part – A)
7. Required Electronic Components (Active and Passive) which include required ICs

8. Arbitrary Wave form generators/ PNS generators – 2 Nos. (to generate digital data at required data rates)
9. Licensed MATLAB software for 30 users with required tool boxes.

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15A99501 SOCIAL VALUES & ETHICS (AUDIT COURSE)

(Common to all Branches)

UNIT - I

Introduction and Basic Concepts of Society: Family and Society: Concept of family, community, PRIs and other community based organizations and society, growing up in the family – dynamics and impact, Human values, Gender Justice.

Channels of Youth Moments for National Building:NSS & NCC: History, philosophy, aims & objectives; Emblems, flags, mottos, songs, badge etc.; Organizational structure, roles and responsibilities of various NSS functionaries. **Nehru Yuva Kendra (NYK):** Activities – Socio Cultural and Sports.

UNIT – II

Activities of NSS, NCC, NYK:

Citizenship: Basic Features Constitution of India, Fundamental Rights and Fundamental Duties, Human Rights, Consumer awareness and the legal rights of the consumer, RTI.

Youth and Crime: Sociological and psychological Factors influencing youth crime, Peer Mentoring in preventing crimes, Awareness about Anti-Ragging, Cyber Crime and its prevention, Juvenile Justice

Social Harmony and National Integration: Indian history and culture, Role of youth in peace-building and conflict resolution, Role of youth in Nation building.

UNIT – III

Environment Issues: Environment conservation, enrichment and Sustainability, Climate change, Waste management, Natural resource management (Rain water harvesting, energy conservation, waste land development, soil conservations and afforestation).

Health, Hygiene & Sanitation: Definition, needs and scope of health education, Food and Nutrition, Safe drinking water, Sanitation, Swachh Bharat Abhiyan.

Disaster Management: Introduction to Disaster Management, classification of disasters, Role of youth in Disaster Management. Home Nursing, First Aid.

Civil/ Self Defense: Civil defense services, aims and objectives of civil defense, Need for self defense training – Teakwondo, Judo, karate etc.,

UNIT – IV

Gender Sensitization: Understanding Gender – Gender inequality – Role of Family, Society and State; Challenges – Declining Sex Ratio – Sexual Harassment – Domestic

Violence; Gender Equality – Initiatives of Government – Schemes, Law; Initiates of NGOs – Awareness, Movements;

UNIT - V

Physical Education :Games & Sports: Health and Recreation – Biological basis of Physical activity – benefits of exercise – Physical, Psychological, Social; Physiology of Muscular Activity, Respiration, Blood Circulation.

Yoga: Basics of Yoga – Yoga Protocol, Postures, Asanas, Pranayama: Introduction of Kriyas, Bandhas and Mudras.

TEXT BOOKS:

1. NSS MANUAL
2. SOCIETY AND ENVIRONMENT: A.S.Chauha, Jain Brothers Publications, 6th Edition, 2006
3. INDIAN SOCIAL PROBLEM: G.R.Madan, Asian Publisher House
4. INDIAN SOCIAL PROBLEM: Ram Ahuja, Rawat Publications
5. HUMAN SOCIETY: Kingsley Davis, Macmillan
6. SOCIETY: Mac Iver D Page, Macmillan
7. SOCIOLOGY – THEMES AND PERSPECTIVES: Michael Honalambos, Oxford University Press
8. CONSTITUTION OF INDIA: D.D.Basu, Lexis Nexis Butterworth Publishers
9. National Youth Policy 2014 (available on www.yas.nic.in)
10. TOWARDS A WORLD OF EQUALS: A.Suneetha, Uma Bhrgudanda, DuggiralaVasantha, Rama Melkote, VasudhaNagraj, Asma Rasheed, GoguShyamala, Deepa Streenivas and Susie Tharu
10. LIGHT ON YOGA :B.K.S.Iyengar, Penguin Random House Publishers

www.un.org

www.india.gov.in

www.yas.nic.in

<http://www.who.int/countries/ind/en/>

<http://www.ndma.gov.in>

<http://ayush.gov.in/event/common-yoga-protocol-2016-0>

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B. Tech III-II Sem. (ECE)

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13A52301 MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS

Course Objectives: The objective of this course is to equip the student with the basic inputs of Managerial Economics and Economic Environment of business and to impart analytical skills in helping them take sound financial decisions for achieving higher organizational productivity.

Unit I
INTRODUCTION TO MANAGERIAL ECONOMICS

Managerial Economics – Definition- Nature- Scope - Contemporary importance of Managerial Economics - Relationship of Managerial Economics with Financial Accounting and Management. **Demand Analysis:** Concept of Demand-Demand Function - Law of Demand - Elasticity of Demand- Significance - Types of Elasticity - Measurement of elasticity of demand - Demand Forecasting- factors governing demand forecasting- methods of demand forecasting.

UNIT II
THEORY OF PRODUCTION AND COST ANALYSIS

Production Function- Least cost combination- Short-run and Long- run production function- Isoquants and Isocosts, MRTS - Cobb-Douglas production function - Laws of returns - Internal and External economies of scale - **Cost Analysis:** Cost concepts and cost behavior- Break-Even Analysis (BEA) -Determination of Break Even Point (Simple Problems)-Managerial significance and limitations of Break- Even Point.

UNIT III
INTRODUCTION TO MARKETS AND NEW ECONOMIC ENVIRONMENT

Market structures: Types of Markets - Perfect and Imperfect Competition - Features of Perfect Competition- Monopoly-Monopolistic Competition-Oligopoly-Price-Output Determination - Pricing Methods and Strategies-Forms of Business Organizations- Sole Proprietorship- Partnership – Joint Stock Companies - Public Sector Enterprises – New Economic Environment- Economic Liberalization – Privatization - Globalization.

UNIT IV
INTRODUCTION TO FINANCIAL ACCOUNTING AND ANALYSIS

Financial Accounting – Concept - Emerging need and Importance - Double-Entry Book Keeping- Journal - Ledger – Trial Balance - Financial Statements - Trading Account – Profit & Loss Account – Balance Sheet (with simple adjustments). Financial Analysis – Ratios – Liquidity, Leverage, Profitability, and Activity Ratios (simple problems).

UNIT V**CAPITAL AND CAPITAL BUDGETING**

Concept of Capital - Over and Undercapitalization – Remedial Measures - Sources of Short term and Long term Capital - Estimating Working Capital Requirements – Capital Budgeting – Features of Capital Budgeting Proposals – Methods and Evaluation of Capital Budgeting Projects – Pay Back Method – Accounting Rate of Return (ARR) – Net Present Value (NPV) – Internal Rate Return (IRR) Method (simple problems)

Learning Outcome: After completion of this course, the student will be able to understand various aspects of Managerial Economics and analysis of financial statements and inputs therein will help them to make sound and effective decisions under different economic environment and market situations.

TEXT BOOKS:

1. Managerial Economics 3/e, Ahuja H.L, S.Chand, 2013.
2. Financial Management, I.M.Pandey, Vikas Publications, 2013.

REFERENCES

1. Managerial Economics and Financial Analysis, 1/e, Aryasri, TMH, 2013.
2. Managerial Economics and Financial Analysis, S.A. Siddiqui and A.S. Siddiqui, New Age International, 2013.
3. Accounting and Financial Management, T.S.Reddy & Y. Hariprasad Reddy, Margham Publishers.

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15A04601 MICROPROCESSORS AND MICROCONTROLLERS				

Course Objectives:

- To understand the architecture of 8086 MICROPROCESSOR.
- To learn various 8086 Instruction set and Assembler Directives.
- To learn 8051 assembly Language programming

Course Outcomes :**After completion of this subject the students will be able to :**

1. Do programming with 8086 microprocessors
2. Understand concepts of Intel x86 series of processors
3. Program MSP 430 for designing any basic Embedded System
4. Design and implement some specific real time applications
Using MSP 430 low power microcontroller.

UNIT I

Introduction-8086 Architecture-Block Diagram, Register Organization, Flag Register, Pin Diagram, Timing and Control Signals, System Timing Diagrams, Memory Segmentation, Interrupt structure of 8086 and Interrupt Vector Table. Memory organization and memory banks accessing.

UNIT II

Instruction Formats -Addressing Modes-Instruction Set of 8086, Assembler Directives-Macros and Procedures.- Sorting, Multiplication, Division and multi byte arithmetic code conversion. String Manipulation instructions-Simple ALPs.

UNIT III

Low power RISC MSP430 – block diagram, features and architecture, Variants of the MSP430 family viz. MSP430x2x, MSP430x4x, MSP430x5x and their targeted applications, MSP430x5x series block diagram, Addressing modes, Instruction set Memory address space, on-chip peripherals (analog and digital), and Register sets. Sample embedded system on MSP430 microcontroller.

UNIT-IV

I/O ports pull up/down resistors concepts, Interrupts and interrupt programming. Watchdog timer. System clocks. Low Power aspects of MSP430: low power modes, Active vs Standby current consumption, FRAM vs Flash for low power & reliability.

Timer & Real Time Clock (RTC), PWM control, timing generation and measurements. Analog interfacing and data acquisition: ADC and Comparator in MSP430, data transfer using DMA.

UNIT-V:

Serial communication basics, Synchronous/Asynchronous interfaces (like UART, USB, SPI, and I2C). UART protocol, I2C protocol, SPI protocol. Implementing and programming UART, I2C, SPI interface using MSP430, Interfacing external devices. Implementing Embedded Wi-Fi using CC3100

Text Books:

1. "Microprocessor and Microcontrollers", N. Senthil Kumar, M. Saravanan, S. Jeevanathan, Oxford Publishers. 1 st Edition, 2010
2. "The X86 Microprocessors , Architecture, Programming and Inerfacing" , Lyla B. Das, Pearson Publications, 2010
3. MSP430 microcontroller basics. John H. Davies, Newnes Publication, 1 st Edition, 2008

References:

http://processors.wiki.ti.com/index.php/MSP430_LaunchPad_Low_Power_Mode
http://processors.wiki.ti.com/index.php/MSP430_16-Bit_Ultra-Low_Power_MCU_Training

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15A04602 ELECTRONIC MEASUREMENTS AND INSTRUMENTATION**Course Objectives:**

- Studies on various analyzers and signal generators and can analyze the frequency component of a wave generated and its distortion levels.
- Studies on the difference between the various parameters which are to be measured that are getting out from the different sensors.

Course Outcomes:

After the completion of the course the students will be able to

- Understand basic principles involved in the meters for measuring voltage, current, resistance, frequency and so on.
- Employ CRO for measuring voltage, current, resistance, frequency and so on.
- Understand principles of measurements associated with different bridges.
- Get complete knowledge regarding working of advanced instruments such as logic analyzers and spectrum analyzers.

UNIT-I

Performance characteristics of Instruments: Static characteristics, Accuracy, Precision, Resolution, Sensitivity, static and dynamic calibration, Errors in Measurement, and their statistical analysis, dynamic characteristics-speed of Response, fidelity, Lag and dynamic error. DC ammeters, DC voltmeters-multirange, range extension/solid state and differential voltmeters, AC voltmeters –multirange, range extension. Thermocouple type RF ammeter, ohm meters, series type, shunt type, multimeter for voltage, current and resistance measurements.

UNIT-II

Oscilloscopes: Standard specifications of CRO,CRT features, derivation of deflection sensitivity, vertical and horizontal amplifiers, horizontal and vertical deflection systems, sweep trigger pulse, delay line, sync selector circuits, probes for CRO – active, passive, and attenuator type, triggered sweep CRO, and Delayed sweep, dual trace/beam CRO, Measurement of amplitude, frequency and phase (Lissajous method).Principles of sampling oscilloscope, storage oscilloscope, and digital storage oscilloscope, Digital frequency counters, time & Period measurements.

UNIT-III

Signal generators-fixed and variable, AF oscillators, function generators, pulse, random noise, sweep, and arbitrary waveform generators, their standards, specifications and principles of working (Block diagram approach). Wave analyzers, Harmonic distortion analyzers, Spectrum analyzers, and Logic analyzers.

UNIT-IV

Review of DC Bridges: Wheatstone bridge, Wein Bridge, errors and precautions in using bridges, AC bridges: Measurement of inductance-Maxwell's bridge, Anderson Bridge. Measurement of capacitance- Schearing Bridge. Kelvin Bridge, Q-meter, EMI and EMC, Interference and noise reduction techniques.

UNIT-V

Sensors and Transducers - Active and passive transducers: Measurement of displacement (Resistance, capacitance, inductance; LVDT) Force (strain gauges) Pressure (piezoelectric transducers) Temperature (resistance thermometers, thermocouples, and thermistors), Velocity, Acceleration, Vibration, pH measurement Signal Conditioning Circuits.

TEXT BOOKS:

1. A.D. Helfrick and W.D. Cooper, "Modern Electronic Instrumentation and Measurement Techniques", PHI, 5th Edition, 2002.
2. H.S.Kalsi, "Electronic instrumentation", second edition, Tata McGraw Hill, 2004.
3. K. Lal Kishore, "Electronic Measurements & Instrumentations", Pearson Education, 2009.

REFERENCES:

1. H.S.Kalsi, "Electronic instrumentation", second edition, Tata McGraw Hill, 2004.
2. Ernest O Doebelin and Dhanesh N Manik, "Measurement Systems Application and Design", TMH, 5th Edition, 2009.
3. Oliver and Cage, "Electronic Measurement and Instrumentation", TMH.
4. Robert A.Witte, "Electronic Test Instruments, Analog and Digital Measurements", Pearson Education, 2nd Ed., 2004.
5. David A. Bell, "Electronic Instrumentation & Measurements", PHI, 2nd Edition, 2003.

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15A04603 DIGITAL SIGNAL PROCESSING

Course Objectives:

- Program a DSP chip to filter signals using either assembly language or a C compiler for the chip.
- Use Z transforms and discrete time Fourier transforms to analyze a digital system.

Course Outcomes:

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

- Formulate engineering problems in terms of DSP tasks.
- Apply engineering problems solving strategies to DSP problems.
- Design and test DSP algorithms.
- Analyze digital and analog signals and systems.
- Analyze and compare different signal processing strategies.

UNIT-I

Review of discrete-time signals and systems – Time domain analysis of discrete-time signals & systems, Frequency domain analysis of discrete-time signals and systems.

Discrete Fourier Transform: Frequency-domain sampling and reconstruction of discrete-time signals, Discrete Fourier Transform (DFT), The DFT as a linear transformation, Relationship of the DFT to other transforms, Properties of DFT, Linear filtering methods based on DFT, Frequency analysis of signals using the DFT.

UNIT-II

Efficient computation of the DFT – Direct computation of DFT, Divide and conquer approach to computation of DFT, Radix-2, Radix-4, and Split radix FFT algorithms, Implementation of FFT algorithms, Applications of FFT algorithms – Efficient computation of the DFT of two real sequences, $2N$ point real sequences, Use of the FFT algorithm in linear filtering and correlation, A linear filtering approach to computation of the DFT- the Goertzel, and the Chirp-z transform algorithms, Quantization errors in the computation of DFT.

UNIT-III

Structures for the realization of discrete-time systems, Structures for FIR systems - Direct form, Cascade form, Frequency sampling, and Lattice structures, Structures for IIR systems – Direct form, Signal flow graphs & Transposed, Cascade form, Parallel form and Lattice structures, Conversion from Lattice structure to direct form, lattice – Ladder structure.

UNIT-IV

General considerations – Causality and its implications, Characteristics of practical Frequency Selective Filters, Design of Finite Impulse Response (FIR) filters – Symmetric and asymmetric FIR filters, Design of linear phase FIR filters using windows, Design of linear phase FIR filters by the frequency sampling method, Design of optimum equi-ripple linear phase FIR filters, Comparison of design methods for linear phase FIR filters, Design of Impulse Invariance Response (IIR) filters from analog filters – IIR filter design by approximation of derivatives, by Impulse invariance, and by bilinear transformation methods, Characteristics of commonly used analog filters, Design examples of both FIR and IIR filters, Frequency transformation in the analog and digital domains, Illustrative problems.

UNIT-V

Introduction, Decimation, and interpolation, Sampling rate conversion by a rational factor, Implementation of sampling rate conversion, Multistage implementation of sampling rate conversion, Sampling rate conversion of bandpass signals, Sampling rate conversion by arbitrary factor, Applications of multirate signal processing.

TEXT BOOKS:

1. John G. Proakis, Dimitris G. Manolakis, "Digital signal processing, principles, Algorithms and applications," Pearson Education/PHI, 4th ed., 2007.
2. Sanjit K Mitra, "Digital signal processing, A computer base approach," Tata McGraw Hill, 3rd edition, 2009.

REFERENCES:

1. A.V.Oppenheim and R.W. Schaffer, & J R Buck, "Discrete Time Signal Processing," 2nd ed., Pearson Education, 2012.
2. B. P. Lathi, "Principles of Signal Processing and Linear Systems," Oxford Univ. Press, 2011.
3. Li Tan, Jean Jiang, "Digital Signal Processing, Fundamentals and Applications," Academic Press, Second Edition, 2013.

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15A04604 VLSI DESIGN

Course Objectives:

- To understand VLSI circuit design processes.
- To understand basic circuit concepts and designing Arithmetic Building Blocks.
- To have an overview of Low power VLSI.

Course Outcomes:

- Complete Knowledge about Fabrication process of ICs
- Able to design VLSI circuits as per specifications given.
- Capable of optimizing the design of Arithmetic / logic building Blocks at all levels of Design/Fabrication.
- Can implement circuit through various design styles (semi- Custom, Full Custom)

UNIT-I

Introduction: Basic steps of IC fabrication, PMOS, NMOS, CMOS & BiCMOS, and SOI process technologies, MOS transistors - MOS transistor switches – Basic gate using switches, working polar transistor Resistors and Capacitors.

Basic Electrical Properties of MOS and BiCMOS Circuits: Working of MOS transistors – threshold voltage; MOS design equations: $I_{ds}-V_{ds}$ relationships, Threshold Voltage, Body effect, Channel length modulation, g_m , g_{ds} , figure of merit ω_0 ; Pass transistor, NMOS Inverter, CMOS Inverter analysis and design, Various pull ups loads, Bi-CMOS Inverters.

UNIT-II

Basic Circuit Concepts: Capacitance, resistance estimations- Sheet Resistance R_s , MOS Device Capacitances, routing Capacitance, Analytic Inverter Delays, Driving large Capacitive Loads, Fan-in and fan-out.

VLSI Circuit Design Processes: VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layout, $2\mu\text{m}$ CMOS Design rules for wires, Contacts and Transistors Layout Diagrams for NMOS and CMOS Inverters and Gates, Scaling of MOS circuits, Limitations of Scaling.

UNIT-III

Gate level Design: Logic gates and other complex gates, Switch logic, Alternate gate circuits.

Physical Design: Floor-Planning, Placement, routing, Power delay estimation, Clock and Power routing

UNIT-IV

Subsystem Design: Shifters, Adders, ALUs, Multipliers, Parity generators, Comparators, Counters, High Density Memory Elements.

VLSI Design styles: Full-custom, Standard Cells, Gate-arrays, FPGAs, CPLDs and Design Approach for Full-custom and Semi-custom devices.

UNIT-V

VHDL Synthesis: VHDL Synthesis, Circuit Design Flow, Circuit Synthesis, Simulation, Layout, Design capture tools, Design Verification Tools.

Test and Testability: Fault-modeling and simulation, test generation, design for testability, Built-in-self-test.

TEXT BOOKS:

1. Kamran Eshraghian, Eshraghian Douglas and A. Pucknell, "Essentials of VLSI circuits and systems", PHI, 2013 Edition.
2. K.Lal Kishore and V.S.V. Prabhakar, "VLSI Design", IK Publishers

REFERENCES:

1. Weste and Eshraghian, "Principles of CMOS VLSI Design", Pearson Education, 1999.
2. Wayne Wolf, "Modern VLSI Design", Pearson Education, 3rd Edition, 1997.
3. John P. Uyemura, "Chip Design for Submicron VLSI: CMOS layout and Simulation", Thomson Learning.
4. John P. Uyemura, "Introduction to VLSI Circuits and Systems", John wiley, 2003.
5. John M. Rabaey, "Digital Integrated Circuits", PHI, EEE, 1997.

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**15A04605 MATLAB PROGRAMMING
(CBCC-I)**

Objectives:

- Understand the MATLAB Desktop, Command window and the Graph Window
- Be able to do simple and complex calculation using MATLAB
- Be able to carry out numerical computations and analyses
- Understand the mathematical concepts upon which numerical methods rely
- Ensure you can competently use the MATLAB programming environment
- Understand the tools that are essential in solving engineering problems

1. UNIT-I: Introduction to MATLAB

MATLAB Interactive Sessions, Menus and the toolbar, computing with MATLAB, Script files and the Editor Debugger, MATLAB Help System, Programming in MATLAB.

2. UNIT-II: Arrays

Arrays, Multidimensional Arrays, Element by Element Operations, Polynomial Operations Using Arrays, Cell Arrays, Structure Arrays.

3. UNIT-III: Functions & Files

Elementary Mathematical Functions, User Defined Functions, Advanced Function Programming, Working with Data Files.

4. UNIT-IV: Programming Techniques

Program Design and Development, Relational Operators and Logical Variables, Logical Operators and Functions, Conditional Statements, Loops, the Switch Structure, Debugging Mat Lab Programs.

Plotting :XY- plotting functions, Subplots and Overlay plots, Special Plot types, Interactive plotting, Function Discovery, Regression, 3-D plots.

5. UNIT-V: Linear Algebraic Equations

Elementary Solution Methods, Matrix Methods for (Linear Equations), Cramer's Method, Undet-ermined Systems, Order Systems.

TEXT BOOKS:

1. G. H. Golub and C. F. Van Loan, Matrix Computations, 3rd Ed., Johns Hopkins University Press, 1996.
2. B. N. Datta, Numerical Linear Algebra and Applications, Brooks/Cole, 1994 (out of print)
3. L. Elden, Matrix Methods in Data Mining and Pattern Recognition, SIAM Press, 2007

Misc. Useful Information:

- NA-digest, <http://www.netlib.org/na-digest-html>
- Society for Industrial and Applied Mathematics (SIAM), see <http://www.siam.org>
- Google "MATLAB Primer" or "MATLAB Tutorial" and you should be able to access lots of free MATLAB.

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**15A04606 INDUSTRIAL ELECTRONICS
(CBCS-I)**
Course Outcome:

After completion of the course the students will be able to

- Get an overview of semi-conductor devices (such as PN junction diode & Transistor) and their switching characteristics.
- Understand the characteristics of AC to DC converters.
- Understand about the practical applications Electronics in industries.

UNIT I

Scope of industrial Electronics, Semiconductors, Merits of semiconductors, crystalline structure, Intrinsic semiconductors, Extrinsic semiconductors, current flow in semiconductor, Open-circuited p-n junction, Diode resistance, Zener diode, Photoconductors and junction photo diodes, Photo voltaic effect, Light emitting diodes (LED)

UNIT II

Introduction, The junction transistor, Conventions for polarities of voltages and currents, Open circuited transistor, Transistor biased in the active region, Current components in transistors, Currents in a transistor, Emitter efficiency, Transport factor and transistor- α , Dynamic emitter resistance, Transistor as an amplifier, Transistor construction, Letter symbols for semiconductor Devices, Characteristic curves of junction transistor in common configuration, static characteristic curves of PNP junction transistor in common emitter configuration, The transistor in common collector Configuration.

UNIT III

AC to DC converters- Introduction, Classification of Rectifiers, Half wave Rectifiers, Full wave Rectifiers, Comparison of Half wave and full wave rectifiers, Bridge Rectifiers, Bridge Rectifier meter, Voltage multiplying Rectifier circuits, Capacitor filter, LC Filter, Metal Rectifiers, Regulated Power Supplies, Classification of Voltage Regulators, Short period Accuracy of Regulators, Long period .Accuracy of Voltage Regulator, Principle of automatic voltage Regulator, Simple D.C. Voltage stabilizer using Zener diode, D.C. Voltage Regulators, Series Voltage Regulators, Complete series voltage regulator circuit, Simple series voltage regulator.

UNIT IV

Resistance welding controls: Introduction, Resistance welding process, Basic Circuit for A.C. resistance welding, Types of Resistance welding, Electronic welding control used in Resistance welding, Energy storage welding. **Induction heating:** Principle of induction heating, Theory of Induction heating merits of induction heating, Application of induction heating, High frequency power source of induction heating. **Dielectric heating:** Principle of dielectric heating, theory of dielectric heating, dielectric properties of typical materials, electrodes used in dielectric heating, method of coupling of electrodes to the R.F. generator, Thermal losses in Dielectric heating, Applications.

UNIT V :

Ultrasonics: Introduction, Generation of Ultrasonic waves, Application of Ultrasonic waves, Ultrasonic stroboscope, ultrasonic as means of communication, ultrasonic flaw detection, Optical image on non-homogeneities, ultrasonic study of structure of matter, Dispersive study of structure of matter, Dispersive and colloidal effect of Ultrasonic, Coagulating action of Ultrasonic, separation of mixtures by ultrasonic waves, cutting and machining of hard materials by ultrasonic vibrations, Degassing of liquids by ultrasonic waves, Physico-chemical effects of ultrasonics, chemical effects of ultrasonics, Thermal effects of Ultrasonics, soldering and welding by ultrasonics, Ultrasonic Drying

Text Books:

1. G. K. Mithal, "Industrial Electronics", Khanna Publishers, Delhi, 2000.
2. J. Gnanavadeivel, R. Dhanasekaran, P. Maruthupandi, "Industrial Electronics", Anuradha Publications, 2011.

Reference Books:

1. F. D. Petruzella, "Industrial Electronics", McGraw Hill, Singapore, 1996.
2. M. H. Rashid, "power Electronics Circuits, Devices and Application", PHI, 3rd edition, 2004.
3. G. M. Chute and R. D. Chute, "Electronics in Industry", McGraw Hill Ltd, Tokyo, 1995.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B. Tech III-II Sem. (ECE)	L	T	P	C
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15A02605 NEURAL NETWORKS & FUZZY LOGIC (CBCC-I)				

Course Objectives:

- To analyze basic neural computational models.
- To get in detail knowledge regarding different algorithms related to neural learning
- To study about different issues related probability and fuzziness and different types of fuzzy associative memories.

Course Outcomes:

After completion of the course the students will be able to

- Get an overview of different types of neural network models.
- Understand the functioning of single; multi-layer feed forward neural networks, associative memories and their rules and algorithms.
- Understand about fundamentals of fuzzy logic, their rules and applications.

UNIT I

Introduction to Neural Networks: Biological neuron, McCulloch-pitts neuron model, Neuron Modelling for Artificial Neural Systems, Models of Artificial Neural Networks-feedforward and feedback networks, Neural Processing, Learning as approximation, Supervised and unsupervised learning, Neural Network Learning rules- Hebbian, Perceptron, Delta, Widrow-Hoff, Correlation, Winner-Take-All learning rules.

UNIT II

Single-Layer Neural Networks: Classification Model, Features and Decision Regions, Discriminant Functions, Linear Machine and Minimum Distance Classification, Training and Classification using Discrete Perceptron, Single-Layer Continuous Perceptron Networks, Multicategory Single-Layer Perceptron Networks, Hopfield Network – Discrete-time, Gradient type.

Multi-Layer Neural Networks: Linearly Nonseparable Pattern Classification, Delta Learning Rule for Multiperceptron Layer, Generalized Delta Learning Rule, Feed forward Recall and Error Back-propagation training, Learning Factors.

UNIT III

Associative Memories: Basic concepts, Linear Associator, Recurrent Auto associate Memory, Performance Analysis of Recurrent Auto associate Memory, Bidirectional Associate Memory(BAM): Memory Architecture, Association Encoding and Decoding, Stability Considerations, Memory Example and Performance Evaluation, Improved coding of memories, Multidirectional Associative Memory, Associative Memory of Spatial-Temporal Patterns.

UNIT IV

Fuzzy Set- Introduction: Basic concepts of fuzzy logic, Fuzzy sets and Crisp sets, Fuzzy set theory and operations, Properties of fuzzy sets, Fuzzy and Crisp relations, Fuzzy to Crisp conversion.

UNIT V

Fuzzy Logic - Fuzzy Membership, Rules: Membership functions, inference in fuzzy logic, fuzzy if-then rules, Fuzzy implications and Fuzzy algorithms, Fuzzyfications&Defuzzificataions, Fuzzy Controller, Industrial applications.

Text Books:

1. JacekM.Zurada," Introduction to Artificial Neural Systems", West Publishing Company
2. Timothy J.Ross, " Euzzy Logic with Engineering Applications", Wiley Indian 3rd Edition

Reference Books:

1. George J.Klir/Bo Yuan, "Fuzzy Sets and Fuzzy Logic : Theory and applications", Prentice-Hall Edition
2. S.N.Sivanandam, S.Sumathi, S.N.Deepa, "Introduction to Neural Networks using MATLAB 6.0", TMH, 2006.
3. S.N.Sivanandam, S.Sumathi, S.N.Deepa, "Introduction to Fuzzy Logic using MATLAB 6.0", TMH, 2006
4. Simon Haykins, "Neural Networks", Pearson Education.

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B. Tech III-II Sem. (ECE)	L	T	P	C
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15A01608 INTELLECTUAL PROPERTY RIGHTS (CBCS – I)				

COURSE OBJECTIVE:

This course introduces the student to the basics of Intellectual Property Rights, Copy Right Laws Trade Marks and Issues related to Patents. The overall idea of the course is to help and encourage the student for startups and innovations.

UNIT – I

Introduction To Intellectual Property: Introduction, Types Of Intellectual Property, International Organizations, Agencies And Treaties, Importance Of Intellectual Property Rights.

UNIT – II

Trade Marks : Purpose And Function Of Trade Marks, Acquisition Of Trade Mark Rights, Protectable Matter, Selecting And Evaluating Trade Mark, Trade Mark Registration Processes.

UNIT – III

Law Of Copy Rights : Fundamental Of Copy Right Law, Originality Of Material, Rights Of Reproduction, Rights To Perform The Work Publicly, Copy Right Ownership Issues, Copy Right Registration, Notice Of Copy Right, International Copy Right Law.

Law Of Patents : Foundation Of Patent Law, Patent Searching Process, Ownership Rights And Transfer

UNIT – IV

Trade Secrets : Trade Secrete Law, Determination Of Trade Secrete Status, Liability For Misappropriations Of Trade Secrets, Protection For Submission, Trade Secrete Litigation.

Unfair Competition : Misappropriation Right Of Publicity, False Advertising.

UNIT – V

New Developments Of Intellectual Property: New Developments In Trade Mark Law ; Copy Right Law, Patent Law, Intellectual Property Audits.

International Overview On Intellectual Property, International – Trade Mark Law, Copy Right Law, International Patent Law, International Development In Trade Secrets Law.

TEXT BOOKS & REFERENCES:

1. Intellectual Property Rights, Deborah. E. Bouchoux, Cengage Learning.
2. Intellectual Property Rights– UnleashmyThe Knowledge Economy, PrabuddhaGanguli, Tate Mc Graw Hill Publishing Company Ltd.,

Course Outcomes:

On completion of this course, the student will have an understanding of the following:

- a) *Intellectual Property Rights and what they mean*
- b) *Trade Marks and Patents and how to register them*
- c) *Laws Protecting the Trade Marks and Patents*
- d) *Copy Right and laws related to it.*

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15A04607 MICROPROCESSORS AND MICROCONTROLLERS LABORATORY	0	0	4	2

Part A : 8086 Microprocessor Programs using NASM/8086 microprocessor kit.

1. Introduction to MASM Programming.
2. Programs using arithmetic and logical operations
3. Programs using string operations and Instruction prefix: Move Block, Reverse string, Sorting, String comparison
4. Programs for code conversion
5. Multiplication and Division programs
6. Sorting and multi byte arithmetic
7. Programs using CALL and RET instructions

Part B Embedded C Experiments using MSP430 Microcontroller

1. Interfacing and programming GPIO ports in C using MSP430 (blinking LEDs , push buttons)
2. Usage of Low Power Modes: (Use MSPEXP430FR5969 as hardware platform and demonstrate the low power modes and measure the active mode and standby mode current)
3. Interrupt programming examples through GPIOs
4. PWM generation using Timer on MSP430 GPIO
5. Interfacing potentiometer with MSP430
6. PWM based Speed Control of Motor controlled by potentiometer connected to MSP430 GPIO
7. Using ULP advisor in Code Composer Studio on MSP430
8. Low Power modes and Energy trace++:
 - a. Enable Energy Trace and Energy Trace ++ modes in CCS
 - b. Compute Total Energy, and Estimated lifetime of an AA battery.

Note : Any six experiment from Part A and Six experiments from Part B are to be conducted

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15A04608 DIGITAL SIGNAL PROCESSING LABORATORY**Course Outcomes:**

- Able to design real time DSP systems and real world applications.
- Able to implement DSP algorithms using both fixed and floating point processors.

List of Experiments: (Minimum of 5 experiments are to be conducted from each part) Software Experiments (PART – A)

1. Generation of random signal and plot the same as a waveform showing all the specifications.
2. Finding Power and (or) Energy of a given signal.
3. Convolution and Correlation (auto and cross correlation) of discrete sequences without using built in functions for convolution and correlation operations.
4. DTFT of a given signal
5. N – point FFT algorithm
6. Design of FIR filter using windowing technique and verify the frequency response of the filter.
7. Design of IIR filter using any of the available methods and verify the frequency response of the filter.
8. Design of analog filters.

Using DSP Processor kits (Floating point) and Code Composer Studio (CCS) (PART – B)

1. Generation of random signal and plot the same as a waveform showing all the specifications.
2. Finding Power and (or) Energy of a given signal.
3. Convolution and Correlation (auto and cross correlation) of discrete sequences without using built in functions for convolution and correlation operations.
4. DTFT of a given signal
5. N – point FFT algorithm
6. Design of FIR filter using windowing technique and verify the frequency response of the filter.
7. Design of IIR filter using any of the available methods and verify the frequency response of the filter.
8. Design of analog filters.

Equipment/Software Required:

1. Licensed MATLAB software with required tool boxes for 30 users.
2. DSP floating Processor Kits with Code Composer Studio (8 nos.)
3. Function generators
4. CROs
5. Regulated Power Supplies.

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**15A52602 ADVANCED ENGLISH LANGUAGE COMMUNICATION SKILLS
(AELCS) LAB (Audit Course)**
1. INTRODUCTION

With increased globalization and rapidly changing industry expectations, employers are looking for the wide cluster of skills to cater to the changing demand. The introduction of the Advanced Communication Skills Lab is considered essential at 3rd year level. At this stage, the students need to prepare themselves for their careers which may require them to listen to, read, speak and write in English both for their professional and interpersonal communication in the globalised context.

The proposed course should be a laboratory course to enable students to use 'good' English and perform the following:

- Gathering ideas and information and to organise ideas relevantly and coherently.
- Engaging in debates.
- Participating in group discussions.
- Facing interviews.
- Writing project/research reports/technical reports.
- Making oral presentations.
- Taking part in social and professional communication.

2. OBJECTIVES:

This Lab focuses on using multi-media instruction for language development to meet the following targets:

- To improve the students' fluency in English, through a well-developed vocabulary and enable them to listen to English spoken at normal conversational speed by educated English speakers and respond appropriately in different socio-cultural and professional contexts.
- Further, they would be required to communicate their ideas relevantly and coherently in writing.
- To prepare all the students for their placements.

3. SYLLABUS:

The following course content to conduct the activities is prescribed for the Advanced English Communication Skills (AECS) Lab:

UNIT-I: COMMUNICATION SKILLS

1. Reading Comprehension
2. Listening comprehension
3. Vocabulary Development
4. Common Errors

UNIT-II: WRITING SKILLS

1. Report writing
2. Resume Preparation
3. E-mail Writing

UNIT-III: PRESENTATION SKILLS

1. Oral presentation
2. Power point presentation
3. Poster presentation

UNIT-IV: GETTING READY FOR JOB

1. Debates
2. Group discussions
3. Job Interviews

UNIT-V: INTERPERSONAL SKILLS

1. Time Management
2. Problem Solving & Decision Making
3. Etiquettes

4. LEARNING OUTCOMES:

- Accomplishment of sound vocabulary and its proper use contextually
- Flair in Writing and felicity in written expression.
- Enhanced job prospects.
- Effective Speaking Abilities

5. MINIMUM REQUIREMENT:

The Advanced English Communication Skills (AECS) Laboratory shall have the following infra-structural facilities to accommodate at least 60 students in the lab:

- Spacious room with appropriate acoustics.
- Round Tables with movable chairs
- Audio-visual aids
- LCD Projector
- Public Address system
- P – IV Processor, Hard Disk – 80 GB, RAM–512 MB Minimum, Speed – 2.8 GHZ
- T. V, a digital stereo & Camcorder
- Headphones of High quality

6. SUGGESTED SOFTWARE:

The software consisting of the prescribed topics elaborated above should be procured and G

1. **Walden Infotech: Advanced English Communication Skills Lab**
2. **K-VAN SOLUTIONS-Advanced English Language Communication Skills lab**
3. **DELTA's key to the Next Generation TOEFL Test: Advanced Skills Practice.**
4. **TOEFL & GRE(KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)**
5. **Train2success.com**

7. BOOKS RECOMMENDED:

1. **Objective English for Competitive Exams**, Hari Mohana Prasad, 4th edition, Tata Mc Graw Hill.
2. **Technical Communication** by Meenakshi Raman & Sangeeta Sharma, O U Press 3rdEdn. 2015.
3. **Essay Writing for Exams, AudroneRaskauskiene, Irena Ragaisience&RamuteZemaitience,OUP, 2016**
4. **Soft Skills for Everyone**, Butterfield Jeff, Cengage Publications, 2011.
5. **Management Shapers Series** by Universities Press (India) Pvt Ltd., Himayatnagar, Hyderabad 2008.
6. **Campus to Corporate**, Gangadhar Joshi, Sage Publications, 2015
7. **Communicative English**,E Suresh Kumar &P.Sreehari, Orient Blackswan, 2009.
8. **English for Success in Competitive Exams**, Philip Sunil Solomon OUP, 2015

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15A04701 OPTICAL FIBRE COMMUNICATION
Course Objectives:

- The course gives an account of optical Communication starting with the basic of fiberoptics.
- To give clear understanding of various components such as Optical fibers, Photo detectors, connectors, coupling devices and optical amplifiers Knowledge of various components used in optical networks.
- Knowledge about Various topologies used to construct an optical networks.

Course Outcomes:

- Analyze the performance of both digital and analog optical fiber systems
- Calculate the system bandwidth, noise, probability of error and maximum usable bit rate of a digital fiber system
- Calculate the system link loss, distortion and dynamic range of an RF photonic link
- To perform characteristics of fiber sources and detectors, design as well as conduct experiment in software and hardware, and analyze the results to provide valid conclusions.

UNIT-I

Introduction to Optical Fibers: Evolution of fiber optic system- Element of an Optical Fiber Transmission link- Ray Optics-Optical Fiber Modes and Configurations –Mode theory of Circular Wave guides- Overview of Modes-Key Modal concepts- Linearly Polarized Modes –Single Mode Fibers-Graded Index fiber structure.

UNIT-II

Signal Degradation Optical Fibers: Attenuation – Absorption losses, Scattering losses, Bending Losses, Core and Cladding losses, Signal Distortion in Optical Wave guides - Information Capacity determination –Group Delay- Material Dispersion, Wave guide Dispersion, Signal distortion in SM fibers-Polarization Mode dispersion, Intermodal dispersion, Pulse Broadening in GI fibers-Mode Coupling –Design Optimization of SM fibers-RI profile and cut-off wavelength.

UNIT-III

Fiber Optical Sources and Coupling : Direct and indirect Band gap materials-LED structures –Light source materials –Quantum efficiency and LED power, Modulation of a LED, lasers Diodes-Modes and Threshold condition –Rate equations –External Quantum efficiency –Resonant frequencies –Temperature effects, Introduction to Quantum laser, source-to-fiber Power Launching, Lensing schemes, Fiber –to- Fiber joints, Fiber splicing.

UNIT-IV

Fiber Optical Receivers : PIN and APD diodes –Photo detector noise, SNR, Detector Response time, Avalanche Multiplication Noise –Comparison of Photo detectors – Fundamental Receiver Operation – preamplifiers, Error Sources –Receiver Configuration –Probability of Error – Quantum Limit.

UNIT-V

System Design and Applications: Design of Analog Systems: system specification, power budget, bandwidth budget.

Design of Digital Systems: system specification, rise time budget, power budget, Receiver sensitivity.

Text Books:

1. Gerd Keiser, "Optical Fiber Communication" McGraw –Hill International, Singapore, 3rd ed., 2000.
2. J.Senior, "Optical Communication, Principles and Practice", Prentice Hall of India, 1994.

References:

1. Max Ming-Kang Liu, "Principles and Applications of Optical Communications", TMH, 2010.
2. S.C.Gupta, "Text book on optical fiber communication and its applications", PHI, 2005.
3. Satish Kumar, "Fundamentals of Optical Fiber communications", PHI, 2009.

B. Tech IV-ISem. (ECE)

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15A04702 EMBEDDED SYSTEMS**Course Objectives:**

- To understand the fundamental concepts of Embedded systems.
- To learn the kernel of RTOS, architecture of ARM processor.

Course Outcomes:**After completion the students will be able to**

- Design of embedded systems leading to 32-bit application development.
- Understand hardware-interfacing concepts to connect digital as well as analog sensors while ensuring low power considerations.
- Review and implement the protocols used by microcontroller to communicate with external sensors and actuators in real world.
- Understand Embedded Networking and IoT concepts based upon connected MCUs

UNIT-I**Introduction to Embedded Systems**

Embedded system introduction, host and target concept, embedded applications, features and architecture considerations for embedded systems- ROM, RAM, timers; data and address bus concept, Embedded Processor and their types, Memory types, overview of design process of embedded systems, programming languages and tools for embedded design

UNIT-II**Embedded processor architecture**

CISC Vs RISC design philosophy, Von-Neumann Vs Harvard architecture. Introduction to ARM architecture and Cortex – M series, Introduction to the TM4C family viz. TM4C123x & TM4C129x and its targeted applications. TM4C block diagram, address space, on-chip peripherals (analog and digital) Register sets, Addressing modes and instruction set basics.

UNIT- III**Overview of Microcontroller and Embedded Systems**

Embedded hardware and various building blocks, Processor Selection for an Embedded System , Interfacing Processor, Memories and I/O Devices, I/O Devices and

I/O interfacing concepts, Timer and Counting Devices, Serial Communication and Advanced I/O, Buses between the Networked Multiple Devices. Embedded System Design and Co-design Issues in System Development Process, Design Cycle in the Development Phase for an Embedded System, Uses of Target System or its Emulator and In-Circuit Emulator (ICE), Use of Software Tools for Development of an Embedded System Design metrics of embedded systems - low power, high performance, engineering cost, time-to-market.

UNIT-IV

Microcontroller fundamentals for basic programming

I/O pin multiplexing, pull up/down registers, GPIO control, Memory Mapped Peripherals, programming System registers, Watchdog Timer, need of low power for embedded systems, System Clocks and control, Hibernation Module on TM4C, Active vs Standby current consumption. Introduction to Interrupts, Interrupt vector table, interrupt programming. Basic Timer, Real Time Clock (RTC), Motion Control Peripherals: PWM Module & Quadrature Encoder Interface (QEI).

Unit-V

Embedded communications protocols and Internet of things

Synchronous/Asynchronous interfaces (like UART, SPI, I2C, USB), serial communication basics, baud rate concepts, Interfacing digital and analog external device, Implementing and programming UART, SPI and I2C, SPI interface using TM4C. Case Study: Tiva based embedded system application using the interface protocols for communication with external devices “Sensor Hub BoosterPack” Embedded Networking fundamentals, IoT overview and architecture, Overview of wireless sensor networks and design examples. Adding Wi-Fi capability to the Microcontroller, Embedded Wi-Fi, User APIs for Wireless and Networking applications Building IoT applications using CC3100 user API.

Case Study: Tiva based Embedded Networking Application: “Smart Plug with Remote Disconnect and Wi-Fi Connectivity”

Text Books:

1. Embedded Systems: Real-Time Interfacing to ARM Cortex-M Microcontrollers, 2014, Create space publications ISBN: 978-1463590154.
2. Embedded Systems: Introduction to ARM Cortex - M Microcontrollers, 5th edition
Jonathan W Valvano, Createspace publications ISBN-13: 978-1477508992
3. Embedded Systems 2E Raj Kamal, Tata McGraw-Hill Education, 2011 ISBN-0070667640, 9780070667648
4. 0070667640, 9780070667648

References:

1. http://processors.wiki.ti.com/index.php/HandsOn_Training_for_TI_Embedded_Processors
2. http://processors.wiki.ti.com/index.php/MCU_Day_Internet_of_Things_2013_Workshop
3. http://www.ti.com/ww/en/simplelink_embedded_wi-fi/home.html
4. CC3100/CC3200 SimpleLink™ Wi-Fi® Internet-on-a-Chip User Guide Texas Instruments Literature Number: SWRU368A April 2014–Revised August 2015.

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15A04703	MICROWAVE ENGINEERING			

Course objectives:

The Objectives of the course are:

- TO develop the knowledge on transmission lines for microwaves, cavity resonators and wave guide components and applications.
- To understand the scattering matrix parameters and its use.
- To introduce the student the microwave test bench for measure different parameters like attenuation, VSWR, etc.,

Course Outcomes:

- Ability to analyze micro-wave circuits incorporating hollow, dielectric and planar waveguides, transmission lines, filters and other passive components, active devices.
- Ability to Use S-parameter terminology to describe circuits and to explain how microwave devices and circuits are characterized in terms of their "S"-Parameters.
- Ability to understanding of microwave transmission lines and how to Use microwave components such as isolators, Couplers, Circulators, Tees, Gyrotors etc.

UNIT-I

MICROWAVE TRANSMISSION LINES: Introduction, Microwave spectrum and bands, applications of Microwaves. Rectangular Waveguides- Solution of Wave Equation in Rectangular Coordinates, TE/TM mode analysis, Expressions for fields, Characteristic equation and cutoff frequencies, filter characteristics, dominant and degenerate modes, sketches of TE and TM mode fields in the cross-section. Mode characteristics- Phase and Group velocities, wavelengths and impedance relations, Illustrative Problems.

Rectangular Waveguides- Power Transmission and Power Losses, Impossibility of TEM Modes, Micro strip lines-introduction, Z_0 relations, effective dielectric constant, losses, Q-factor, Cavity resonators-introduction, Rectangular and cylindrical cavities, dominant modes and resonant frequencies, Q-factor and coupling coefficients, Illustrative Problems.

UNIT-II

WAVEGUIDE COMPONENTS AND APPLICATIONS: Coupling mechanisms- probe, loop, aperture types. Wave guide discontinuities-waveguide Windows, tuning screws and posts, matched loads. Waveguide attenuators-resistive card, rotary vane Attenuators; waveguide phase shifters-dielectric, rotary vane phase shifters. Wave guide multiport junctions-E plane and H plane Tees, Magic Tee, Directional couplers-2 hole, Bothe hole types, Illustrative Problems.

Ferrites-composition and characteristics, Faraday rotation; Ferrite components-Gyrator, Isolator, Circulator.

UNIT-III

MICROWAVE TUBES: Limitations and losses of conventional tubes at microwave frequencies. Microwave tubes-O type and M type classifications. O type tubes: 2 cavity klystrons-structure, Reentrant cavities, velocity modulation process and Applegate diagram, bunching process and small signal theory-Expressions for O/P power and efficiency. Reflex Klystrons-structure, Velocity Modulation, Applegate diagram, mathematical theory of bunching, power output, efficiency, oscillating modes and O/P characteristics, Effect of Repeller Voltage on Power O/P, Illustrative Problems.

HELIX TWTS: Significance, types and characteristics of slow wave structures; structure of TWT and amplification process (qualitative treatment), suppression of oscillations, gain considerations.

UNIT-IV

M-TYPE TUBES: Introduction, cross field effects, Magnetrons-different types, cylindrical travelling wave magnetron-Hull cutoff and Hartree conditions, modes of resonance and PI-mode operation, separation of PI-mode, O/P characteristics, Illustrative Problems.

MICROWAVE SOLID STATE DEVICES: Introduction, classification, applications, Transfer Electronic Devices, Gunn diode-principles, RWH theory, characteristics, basic modes of operation - Gunn oscillation modes. LSA Mode, Varactor Diode, Parametric Amplifier, Introduction to Avalanche Transit time devices (brief treatment only).

UNIT-V**MICROWAVE MEASUREMENTS:**

Scattering Matrix-Significance, Formulation and properties. S Matrix calculations for 2-port junction, E plane and H plane Tees, Magic Tee, Directional coupler, circulator and Isolator, Illustrative Problems

Description of Microwave bench-different blocks and their features, errors and precautions; Microwave power measurement-Bolometers, Measurement of attenuation, frequency standing wave measurements –measurement of low and high VSWR, cavity-Q, impedance measurements.

TEXT BOOKS:

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

REFERENCES:

1. Foundations for microwave engineering-R.E.Collin, IEEE press, John Wiley, 2ndedition, 2002.
2. Microwave circuits and passive devices-M.L.Sisodia and G.S.Raghuvanshi,Wiley Eastern Ltd.,New age International publishers Ltd., 1995.
3. Microwave engineering passive circuits-Peter A.Rizzi, PHI, 1999.
4. Electronic and Radio Engineering-F.E.Terman, McGraw-Hill, 4th Edition, 1995.
5. Microwave Engineering – A. Das, TMH, 2nd ed., 2009.

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15A04704 DATA COMMUNICATIONS & NETWORKING**UNIT-I****Introduction to Networks & Data Communications**

The Internet, Protocols & Standards, Layered Tasks, OSI Model, TCP / IP, Addressing, Line Coding Review, Transmission Media: Guided and unguided Media Review.

UNIT-II**Switching**

Datagram Networks, Virtual Circuit Networks, Structure of a switch, Ethernet Physical Layer, Data Link Layer: Error detection and Correction Data Link Control: Framing, Flow and Error Control Protocols, Noiseless Channel and Noisy Channel Protocol, HDLC, Point-to-Point Protocol.

UNIT-III**Multiple Access**

RANDOH, CDMA, CSMA/CD, CSMA/CA, Controlled Access, Channelization, Wired LANs: IEEE Standards, Standard Ethernet, Fast Ethernet, Gigabit Ethernet, Wireless LAN, IEEE 802.11, Bluetooth IEEE 802.16.

UNIT-IV**Network Layer**

Design Issues, Routing Algorithms, Congestion control, Algorithms. IPV4 Addresses, Connecting Devices, Virtual LAN IPV6 Addresses, Internet Protocol, Hardware Addressing versus IP Addressing, IP Data Gram.

UNIT-V**Transport Layer Protocol**

UDP and TCP, ATM, Cryptography, Network Security

Text Books:

1. B. A. Forouzan, "Data Communications and Networking", MGH, 4th ed. 2007.

Reference Books:

1. A. S. Tanenbaum, "Computer Networks", PHI.
2. W. Stallings, "Data and Computer Communication", PHI.

B. Tech IV-ISem. (ECE)

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**15A04705 RADAR SYSTEMS
(CBCCC-II)**

Course Objectives:

The objectives of course are:

- Radar fundamentals and analysis of radar signals.
- To understand various technologies involved in the design of radar transmitters and receivers.
- To learn various like MTI, Doppler and tracking radar and their comparison.

Course Outcomes:

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

- Understand radar fundamentals and analysis of the radar signals.
- Understand various radar transmitters and receivers.
- Understand various radar like MTI, Doppler and tracking radar and their comparison.

UNIT I

BASICS OF RADAR: Introduction, Maximum Unambiguous Range, Simple form of Radar Equation, Radar Block Diagram and Operation, Radar Frequencies and Applications, Prediction of Range Performance, Minimum Detectable Signal, Receiver Noise, Modified Radar Range Equation, Illustrative Problems.

RADAR EQUATION: SNR, Envelope Detector, False Alarm Time and Probability, Integration of Radar Pulses, Radar Cross Section of Targets (simple targets - sphere, cone-sphere), Transmitter Power, PRF and Range Ambiguities, System Losses (qualitative treatment), Illustrative Problems.

UNIT II

CW AND FREQUENCY MODULATED RADAR: Doppler Effect, CW Radar – Block Diagram, Isolation between Transmitter and Receiver, Non-zero IF Receiver, Receiver Bandwidth Requirements, Applications of CW radar, Illustrative Problems.

FM-CW Radar: Range and Doppler Measurement, Block Diagram and Characteristics (Approaching/ Receding Targets), FM-CW altimeter, Multiple Frequency CW Radar.

UNIT III

MTI AND PULSE DOPPLER RADAR: Introduction, Principle, MTI Radar with - Power Amplifier Transmitter and Power Oscillator Transmitter, Delay Line Cancellers – Filter Characteristics, Blind Speeds, Double Cancellation, And Staggered PRFs. Range

Gated Doppler Filters, MTI Radar Parameters, Limitations to MTI Performance, MTI versus Pulse Doppler radar.

UNIT IV

TRACKING RADAR: Tracking with Radar, Sequential Lobing, Conical Scan, Monopulse Tracking Radar – Amplitude Comparison Monopulse (one- and two-coordinates), Phase Comparison Monopulse, Tracking in Range, Acquisition and Scanning Patterns, Comparison of Trackers.

UNIT V

DETECTION OF RADAR SIGNALS IN NOISE: Introduction, Matched Filter Receiver – Response Characteristics and Derivation, Correlation Function and Cross-correlation Receiver, Efficiency of Non-matched Filters, Matched Filter with Non-white Noise.

RADAR RECEIVERS: Noise Figure and Noise Temperature, Displays – types. Duplexers – Branch type and Balanced type, Circulators as Duplexers. Introduction to Phased Array Antennas – Basic Concepts, Radiation Pattern, Beam Steering and Beam Width changes, Series versus Parallel Feeds, Applications, Advantages and Limitations.

TEXT BOOKS:

1. Introduction to Radar Systems – Merrill I. Skolnik, TMH Special Indian Edition, 2nd Edition, 2007.

REFERENCES:

1. Introduction to Radar Systems – Merrill I. Skolnik, 3rd Edition, Tata McGraw-Hill, 2001.
2. Radar Principals, Technology, Applications – Byron Edde, Pearson Education, 2004.
3. Radar Principles – Peebles, Jr., P.Z.Wiley, NweYork, 1998.

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**15A04706 ADAPTIVE SIGNAL PROCESSING
(CBCC-II)**

Course Objective:

- To study in detail about adaptive Systems.
- To study about various Linear optimum filtering techniques.
- To study about various techniques related Linear and Non Linear adaptive filtering.

Course outcome:

- After the course students is expected to be able to:
- Get complete knowledge regarding adaptive systems
- Design various linear optimum filters by employing different techniques associated withthem
- Understand various techniques related to with linear and nonlinear adaptive filtering and their design considerations

UNIT I:

Introduction to Adaptive Systems: Eigen Analysis - Eigen Value problem, Properties of eigen values and eigen vectors, Eigen filters, Eigen value computations, Adaptive Systems - Definitions, Characteristics, Applications and Examples of Adaptive systems, The adaptive linear combiner – Description, weight vectors, Desired response performance function, Gradient and Mean square error(MSE).

UNIT II:

Linear Optimum Filtering: Wiener Filters – Linear optimum filtering, Principle of Orthogonality, Wiener-Hopf equations, Error performance surface, Channel Equalization, Linearly constrained minimum variance filter, Linear Prediction – Forward and Backward linear prediction, Levinson-Durbin Algorithm, Properties of prediction error filters, AR modeling of stationary stochastic process, Lattice predictors, Joint process estimation, Kalman Filters - Recursive mean square estimation for scalar random variables, Kalman filtering problem, The innovations process, Estimation of the state using innovations process, Filtering, Initial conditions, Variants of the Kalman filter, Extended Kalman filter, Problem Solving.

UNIT III:

Linear Adaptive Filtering-I: Method of Steepest descent algorithm and its stability, Least Means Square (LMS) algorithm – Structure & operation of LMS algorithm, Examples, Stability & performance analysis of the LMS algorithm, Simulations of Adaptive equalization using LMS algorithm, Convergence aspects, Method of Least Squares (LS) - Statement, Data windowing, Minimum sum of error squares, Normal equations and linear least squares filters, Properties.

UNIT IV:

Linear Adaptive Filtering-II Recursive Least Squares (RLS) Algorithm – Matrix inversion lemma, The exponentially weighted RLS algorithm, Update recursion for the sum of weighted error squares, Example, Convergence Analysis, Simulation of adaptive equalization using RLS algorithm, Order Recursive Adaptive Filters – Adaptive forward and backward linear prediction, Least squares Lattice predictor, QR-Decomposition based Least squares Lattice filters & their properties, Simulation of Adaptive equalization using Lattice Filter.

UNIT V:

Nonlinear Adaptive Filtering: Blind deconvolution – Theoretical and practical considerations, Bussgang algorithm for blind equalization for real base band channels, Special cases of Bussgang algorithm, Simulation studies of Bussgang algorithms, SVD, Problem solving.

Text Books:

1. Simon Haykin, "Adaptive Filter Theory," Prentice Hall, 4th Edition, 2002.
2. Bernard Widrow, Samuel D. Stearns, "Adaptive Signal Processing," Prentice Hall, 2005.

References:

1. Paulo S.R. Diniz, Adaptive Filtering Algorithms and Practical Implementation, Third Edition, Springer, Kluwer Academic Publishers.
2. Alexander D Poularikas, Zayed M Ramadan, Adaptive Filtering Primer with MATLAB, CRC Press Taylor & Francis Group, 2008 Indian Edition.
3. Ali H. Sayed, Adaptive filters, IEEE Press, Wiley-Interscience, A John Wiley & Sons, INC., Publication.
4. S. Thomas Alexander, "Adaptive Signal Processing-Theory & Applications," Springer-Verlag, 1986

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B. Tech IV-ISem. (ECE)

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**15A04707 FPGA DESIGN
(CBCC-II)**
UNIT-I**Introduction to Field-programmable Gate Arrays**

Programmability and DSP. A Short History of the Microchip, Challenges of FPGAs, DSP System Basics, DSP System Definitions, DSP Transforms, Filter Structures, Adaptive Filtering , Basics of Adaptive Filtering

UNIT-II**Arithmetic Basics**

Number Systems, Fixed-point and Floating-point, Arithmetic Operations, Fixed-point versus Floating-point, Technology Review: Introduction, Architecture and Programmability, DSP Functionality Characteristics .Processor Classification, Microprocessors, DSP processors.

UNIT-III**Current FPGA Technologies**

Introduction, Toward FPGA, Altera FPGATEchnologies, Xilinx FPGA Technologies, Detailed FPGA Implementation Issues: Introduction, Various Forms of the LUT, Memory Availability, Fixed Coefficient Design Techniques, Distributed Arithmetic, Reduced Coefficient Multiplier, Rapid DSP System Design Tools and Processes for FPGA: Introduction, Design Methodology Requirements for FPGA DSP, IP Core Generation Tools for FPGA, System level Design Tools for FPGA.

UNIT-IV**The IRIS Behavioral Synthesis**

Introduction of Behavioral Synthesis Tools, Hierarchical Design Methodology, Hardware Sharing Implementation (Scheduling Algorithm) for IRIS.DECISION ANALYSIS AND SUPPORT: Decision Making., Modeling throughout System Development, Modeling for Decision.

UNIT-V**Complex DSP Core Design for FPGA**

Motivation for Design for Reuse, Intellectual Property (IP) Cores, Evolution of IP Cores. Model-based Design for Heterogeneous FPGA: Dataflow Modeling and Rapid Implementation for FPGA DSP Systems, Rapid Synthesis and Optimization of Embedded Software from DFGs, System-level Modeling for Heterogeneous Embedded

DSP Systems, System level Design and Exploration of Dedicated Hardware Network, Adaptive Beam former Example, Low Power FPGA Implementation.

TEXT BOOKS:

1. Roger Woods, John McAllister, Gaye Light body, Ying Yi, FPGA-based Implementation of Signal Processing Systems, Wiley, 2008.
2. John V. Old Field, Richrad C. Dorf, Field Programmable Gate Arrays, Wiley, 2008.
3. Michel John Sebastian Smith, Application Specific Integrated Circuits, Addison Wesley Professional, 2008.
4. Stephen D. Brown, Robert J. Francis, Jonathan Rose, Zvonko G. Vranesic, Field Programmable Gate Arrays, 2nd Edition, Springer, 1992.

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**15A04708 DIGITAL IMAGE PROCESSING
(CBCC-III)**
OBJECTIVES:

- To know the fundamentals of Image Processing
- To know about various techniques of image enhancement, reconstruction and image compression.

Course Outcomes:

- Able to apply the Image processing concept for various fields of engineering and real life process as per needs & specifications.
- Get the skills to Heuristically develop new techniques to process images of any context
- Can experiment, analyze & interpret imagedata /processing data.

UNIT-I

Introduction to Digital Image processing – Example fields of its usage- Image sensing and Acquisition – image Modeling - Sampling, Quantization and Digital Image representation - Basic relationships between pixels, - Mathematical tools/ operations applied on images - imaging geometry.

UNIT-II

2D Orthogonal and Unitary Transforms and their properties - Fast Algorithms - Discrete Fourier Transform - Discrete Cosine Transforms- Walsh- Hadamard Transforms- Hoteling Transforms , Comparison of properties of the above.

UNIT-III

Background enhancement by point processing Histogram processing, Spatial filtering, Enhancement in frequency Domain, Image smoothing, Image sharpening, Colour image Enhancement

UNIT-IV

Degradation model, Algebraic approach to restoration – Inverse filtering – Least Mean Square filters, Constrained Least square restoration, Blind Deconvolution.
Image segmentation: Edge detection -, Edge linking , Threshold based segmentation methods – Region based Approaches - Template matching –use of motion in segmentation

UNIT-V

Redundancies in Images - Compression models, Information theoretic perspective- Fundamental coding theorem. Huffman Coding, Arithmetic coding, Bit plane coding, Run length coding, Transform coding, Image Formats and compression standards.

Text Books:

1. R.C .Gonzalez & R.E. Woods, "Digital Image Processing", Addison Wesley/Pearson education, 3rd Edition, 2010.
2. A .K. Jain, "Fundamentals of Digital Image processing", PHI.

References:

1. Rafael C. Gonzalez, Richard E woods and Steven L.Eddins, "Digital Image processing using MATLAB", Tata McGraw Hill, 2010.
2. S jayaraman, S Esakkirajan, T Veerakumar, "Digital Image processing",Tata McGraw Hill
3. William K. Pratt, "Digital Image Processing", John Wiley, 3rd Edition, 2004.

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B. Tech IV-ISem. (ECE)

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**15A04709 CELLULAR & MOBILE COMMUNICATION
(CBCC-III)**
OBJECTIVES:

- To enable the student to synthesis and analyze wireless and mobile cellular communication systems over a stochastic fading channel.
- To provide the student with an understanding of advanced multiple access techniques.
- To provide the student with an understanding of diversity reception techniques. • To give the student an understanding of digital cellular systems (GSM, CDMA One, GPRS, CDMA 2000, and W-CDMA).

Course Outcomes:

By the end of this course, the student will be able to analyze and design wireless and mobile cellular systems.

- The student will be able to understand impairments due to multipath fading channel.
- Understand the fundamental techniques to overcome the different fading effects.
- To understand Co-channel and Non Co-channel interferences.
- Able to familiar with cell coverage for signal and traffic, diversity techniques and mobile antennas.
- Understanding of frequency management, channel assignment and types of handoff.

UNIT I

CELLULAR MOBILE RADIO SYSTEMS:Introduction to Cellular Mobile system, performance criteria, uniqueness of mobile radio environment, operation of cellular systems, Hexagonal shaped cells, Analog and Digital Cellular systems.

ELEMENTS OF CELLULAR RADIO SYSTEM DESIGN:General description of the problem, concept of frequency channels, Co-channel Interference Reduction Factor, desired C/I from a normal case in a Omni directional Antenna system, Cell splitting, consideration of the components of cellular system.

UNIT II

INTERFERENCE: Introduction to Co-channel interference, real time co-channel interference, Co-channel measurement, design of Antenna system, Antenna parameters and their effects, diversity receiver, non-co-channel interference-different types.

UNIT III

CELL COVERAGE FOR SIGNAL AND TRAFFIC:Signal reflections in flat and hilly terrain, effect of human made structures, phase difference between direct and reflected paths, constant standard deviation, straight line path loss slope, general formula for mobile propagation over water and flat open area, near and long distance propagation antenna height gain, form of a point to point model.

UNIT IV

CELL SITE AND MOBILE ANTENNAS:Sum and difference patterns and their synthesis, Omni directional antennas, directional antennas for interference reduction, space diversity antennas, umbrella pattern antennas, minimum separation of cell site antennas, high gain antennas.

FREQUENCY MANAGEMENT AND CHANNEL ASSIGNMENT:Numbering and grouping, setup access and paging channels channel assignments to cell sites and mobile units, channel sharing and borrowing, sectorization, overlaid cells, non-fixed channel assignment.

UNIT V

HANDOFF:Handoff, dropped calls and cell splitting, types of handoff, handoff invitation, delaying handoff, forced handoff, mobile assigned handoff. Intersystem handoff, cell splitting, micro cells, vehicle locating methods, dropped call rates and their evaluation.

DIGITAL CELLULAR NETWORKS: GSM architecture, GSM channels, multiplex access scheme, TDMA, CDMA.

TEXT BOOKS:

1. Mobile cellular telecommunications-W .C. Y. Lee, Tata Mc-Graw Hill, 2nd Edition, 2006.
2. Wireless communications-Theodore. S. Rapport, Pearson Education, 2nd Edn., 2002.

REFERENCES:

1. Principles of Mobile communications-Gordon L. Stuber, Springer International 2nd Edition, 2007.
2. Wireless and Mobile Communications-Lee McGraw Hills, 3rd Edition, 2006.
3. Wireless communications and Networking-Jon W.Mark and WeihuaZhqung, PHI, 2005.
4. Wireless communication Technology-R.Blake, Thompson Asia Pvt.Ltd., 2004.

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**15A04710 REAL TIME SYSTEMS
(CBCC-III)**

Course Outcomes**After completion of the course students able to**

- Know about the basic concepts of embedded systems
- Understand the different architectural features of embedded systems
- Understand the goal embedded systems in real time design applications

UNIT-I**Introduction to Real Time System**

Introduction to Real time Embedded System, need for a real-time system, different kinds (reactive, time driven, deadline driven, etc..) Embedded system Design cycle, Types of Real Time systems, Real Time Applications and features, Issues in real time computing, aspects of real-time systems (timeliness, responsiveness, concurrency, predictability, correctness, robustness, fault tolerance and safety, resource limitations, RTOS necessity), real-time requirement specifications, modelling/verifying design tools (UML, state charts, etc..).

UNIT-II**Embedded Hardware for Real Time System**

Selection criteria for Real time system - Hardware and Software perspective, need for partitioning, criteria for partitioning (performance, criticality, development ease, robustness, fault tolerance and safety, resource limitations, etc..), System Considerations, Basic development environment-host vs target concept, CPU features, Architecture, I/O Ports, on-chip peripherals, Memory, Real time implementation considerations, bus architecture, Introduction to Interrupts, Interrupt vector table, interrupt programming, Pipeline and Parallelism concepts.

Case study of C2000 architecture, Real time applications by interfacing C2000 with sensors and actuators (example: Motor Control, Digital Power, and Power Line Communication)

UNIT III**Embedded Hardware – On chip Peripherals and Communication protocols –**

Role of peripherals for Real time systems, On-Chip peripherals & hardware accelerators, Peripherals [Direct Memory Access, Timers, Analog to Digital Conversion (ADC), DAC, Comparator, Pulse Width Modulation (PWM)], Need of real time

Communication, Communication Requirements, Timeliness, Dependability, Design Issues, Overview of Real time communication, Real time Communication Peripherals – I2C, SPI & UART

Case study - Illustration of configuring and interfacing the peripherals (timers, ADC, DAC, and PWM) and Real time communication protocols (I2C, SPI & UART) using C2000 platforms

UNIT IV

Embedded Software and RTOS

Software Architecture of real time System, Introduction to RTOS, role of RTOS, foreground Back ground system, pros and cons, Real time kernel, qualities of good RTOS, Functionalities of RTOS – Task Management, I/O management, Memory management, Inter Task Communication, Tasks, Task states, Task control block, attributes of TCB, Context switching, Interrupts handling, Multiprocessing and multitasking

Case study examples for demonstrating task management functionalities (ex: Task switching, task deleting, task suspending and resuming, managing priority and etc.,) using TI RTOS on C2000 platforms.

UNIT-V

Scheduling, Synchronization and Inter task communication in Real Time Systems

Basic Concepts for Real-Time Task Scheduling, Scheduling criteria, Overview of Scheduling policies, Task Synchronization – Need of synchronization, shared data problems and its ways of handling, Role of Semaphore, types of semaphores, semaphore functions, Inter task communication – Need of communication, Message Mailbox and Message Queues, RTOS problems - Priority inversion phenomenon, Deadlock phenomenon and steps to handle them.

Case study examples to demonstrate concepts of task synchronization (Semaphore) and Inter task communication (Mailbox and Message queues), using TI RTOS for C2000 platforms

TEXT BOOKS

1. Real-Time Systems by Jane W. S. Liu Prentice Hall; 1 edition ISBN: 978-0130996510
2. Krishna .C.M “Real Time Systems” Mc-Graw Hill Publication.
3. Hamid A. Toliyat and Steven G. Campbell, “DSP based Electromechanical Motion Control” CRC Press, 2003, ISBN 9780849319181.
4. Jean J Labrosse, “Embedded System Design blocks”, CMP books, Second Edition, ISBN 0-87930-604-1

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5. John H Davies, "MSP430 Microcontroller Basics" Newnes, 2nd edition, ISBN-13: 978-0750682763

REFERENCES

1. TMS320C28x CPU and Instruction Set Reference Guide, TI Literature Number: SPRU 430E, Revised January 2009
2. TMS320x28xx, 28xxx DSP Peripheral Reference Guide, TI Literature Number: SPRU566J, Revised April 2011
3. C2000 Teaching CD ROM from Texas Instruments
4. Intro to the TI-RTOS Kernel Workshop Lab Manual, by Texas Instruments, Rev 2.3 – December 2014
5. http://processors.wiki.ti.com/index.php/C2000_32-bit_Real-Time_MCU_Training

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B. Tech IV-ISem. (ECE)

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15A04711 MICROWAVE & OPTICAL COMMUNICATIONS LABORATORY
Course Outcomes:

- Capable of Applying microwave Concepts/ Microwave components and test them .
- Able to design and analyse an optical fiber communications link

Microwave Lab (PART – A) --- Any Seven (7) Experiments

1. Reflex Klystron Characteristics.
2. Gunn Diode Characteristics.
3. Attenuation Measurement.
4. Directional Coupler Characteristics.
5. VSWR Measurement.
6. Impedance Measurement.
7. Frequency and Wavelength measurements using slotted section.
8. Impedance Matching and Tuning
9. Scattering parameters of Magic Tee.
10. Radiation Pattern Measurement of horn Antennas (at least two antennas).

Optical Fiber Lab (PART – B) --- Any five (5) Experiments

1. Characterization of LED.
2. Characterization of Laser Diode.
3. Intensity modulation of Laser output through an optical fiber.
4. Measurement of Data rate for Digital Optical link.
5. Measurement of Numerical Aperture of the given fiber.
6. Measurement of losses for Analog Optical link.

Equipment required for Laboratories:

1. Regulated Klystron Power Supply 6 nos.
2. VSWR Meter 6 nos.
3. Milli/Micro Ammeters 10 nos.
4. Multi meters 10 nos.
5. CROs 8 nos.
6. GUNN Power Supply, Pin Moderator 4 nos.
7. Relevant Microwave components --
8. Fiber Optic Analog Trainer based LED 3 nos.
9. Fiber Optic Analog Trainer based laser 2 nos.
10. Fiber Optic Digital Trainer 1 no.
11. Fiber cables - (Plastic, Glass)

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15A04712 VLSI & EMBEDDED SYSTEMS LABORATORY

Note: The students are required to perform any **Six** Experiments from each Part of the following.

Part-A: VLSI Lab**Course Objective:**

- To design and draw the internal structure of the various digital integrated circuits
- To develop VHDL/Verilog HDL source code, perform simulation using relevant simulator and analyze the obtained simulation results using necessary synthesizer.
- To verify the logical operations of the digital ICs (Hardware) in the laboratory.

Course Outcome:

After completion of the course the students will be able to

- Design and draw the internal structure of the various digital integrated circuits
- Develop VHDL/Verilog HDL source code, perform simulation using relevant simulator and analyze the obtained simulation results using necessary synthesizer.
- Verify the logical operations of the digital IC's (Hardware) in the laboratory

Note: For the following list of experiments students are required to do the following.

- Target Device Specifications
- Simulation
- Synthesize the design
- Generate RTL Schematic.
- Generate Technology Map.
- Generate Synthesis report.
- Design Summary.

List of Experiments:

Note: Use VHDL/ Verilog HDL

1. Realization of Logic Gates.
2. 3- to - 8Decoder- 74138.
3. 8 x 1 Multiplexer-74151 and 2 x 4 De-multiplexer-74155.
4. 4-Bit Comparator-7485.

5. D Flip-Flop-7474.
6. Decade counter-7490.
7. Shift registers-7495.
8. ALU Design.

Part B : Embedded C Experiments using TM4C processor:

1. Learn and understand how to configure EK-TM4C123GXL Launchpad digital I/O pins. Write a C program for configuration of GPIO ports for Input and output operation (blinking LEDs, push buttons interface).

Exercises:

- a) Modify the code to make the red LED of EK-TM4C123GXL Launchpad blink.
 - b) Modify the code to make the green and red LEDs blink:
 - I. Together
 - II. Alternately
 - c) Alter the code to turn the LED ON when the button is pressed and OFF when it is released.
 - d) Modify the delay with which the LED blinks.
 - e) Alter the code to make the green LED stay ON for around 1 second every time the button is pressed.
 - f) Alter the code to turn the red LED ON when the button is pressed and the green LED ON when the button is released.
2. Learn and understand Timer based interrupt programming. Write a C program for EK-TM4C123GXL Launchpad and associated Timer ISR to toggle onboard LED using interrupt programming technique.

Exercises:

- a) Modify the code for a different timer toggling frequency.
 - b) Write the code to turn on interrupt globally.
3. Configure hibernation module of the TM4C123GH6PM microcontroller to place the device in low power state and then to wake up the device on RTC (Real- Time Clock) interrupt.

Exercises:

- a) Write a program to configure hibernation mode and wake up the EK-TM4C123GXL Launchpad when onboard switch SW2 is pressed.
4. Configure in-build ADC of TM4C123GH6PM microcontroller and interface potentiometer with EK-TM4C123GXL Launchpad to observe corresponding 12- bit digital value.

Exercises:

- a) Tabulate ten different position of the Potentiometer and note down the Digital value and calculate the equivalent analog value.

- b) Use the ADC to obtain the analog value from the internal temperature sensor.
 - c) Configure Dual ADC modules to read from 2 analog input (could be from 2 potentiometers)
 - d) What are the trigger control mechanism for this ADC?
 - e) What does the resolution refer on ADC Specification?
 - f) The current sampling method is single ended sampling. This ADC could also be configured to do differential sampling. What is the difference between the two methods of sampling?
5. Learn and understand the generation of Pulse Width Module (PWM) signal by configuring and programming the in-built PWM module of TM4C123GH6PM microcontroller.

Exercises:

- a) Change the software to output a set Duty Cycle, which can be user programmed.
 - b) Change the frequency of the PWM Output from 6.25 KHz to 10 KHz and do the tabulation again.
 - c) Generate Complementary signals, route it to two pins, and observe the waveforms.
 - d) What is dead band generation mean and where is it applied?
 - e) Is it possible to construct a DAC from a PWM? Identify the additional components and connection diagram for the same.
 - f) Sketch the gate control sequence of 3 phase Inverter Bridge and how many PWM generator blocks are required? Can we generate this from TIVA Launchpad?
6. Configure the PWM and ADC modules of TM4C123GH6PM microcontroller to control the speed of a DC motor with a PWM signal based on the potentiometer output.

Exercises:

- a) With the same ADC input configure 2 PWM generator modules with 2 different frequencies.
 - b) Read the Internal temperature sensor and control a DC Motor that could be deployed in fan Controller by observing the unit or ambient temperature.
 - c) What is the resolution of the PWM in this experiment?
 - d) What would be the maximum frequency that can be generated from the PWM generator?
 - e) Briefly explain an integrated application of ADC and PWM based control.
7. Learn and understand to connect EK-TM4C123GXL Launchpad to PC terminal and send an echo of the data input back to the PC using UART.

Exercises:

- a) Change the baud rate to 19200 and repeat the experiment.
 - b) What is the maximum baud rate that can be set in the UART peripheral of TIVA?
 - c) Modify the software to display "Switch pressed" by pressing a user input switch on the Launchpad.
8. Learn and understand interfacing of accelerometer in Sensor Hub Booster pack with EK-TM4C123GXL Launchpad using I2C.

Exercises:

- a) Make a LED ON when the acceleration value in the x axis crosses a certain limit, say +5.
 - b) What is the precaution taken in this experiment in order to avoid the overflow of UART buffer?
 - c) Change the value of PRINT_SKIP_COUNT to 100 and see the difference in the output.
 - d) Change MPU9150_ACCEL_CONFIG_AFS_SEL_2G to MPU9150_ACCEL_CONFIG_AFS_SEL_4G on line 461 of the same source file and Observe the difference.
9. USB bulk transfer mode:
Learn and understand to transfer data using bulk transfer mode with the USB2.0 peripheral of the TM4C123GH6PM device.

Exercises:

- a) What are the different modes offered by USB 2.0?
 - b) What are the typical devices that use Bulk transfer mode?
10. Learn and understand to find the angle and hypotenuse of a right angle triangle using IQmath library of TivaWare.

Exercises:

- a) Change the base and adjacent values in the program to other values, build the program and observe the values in the watch window.
 - b) Open IQmathLib.h and browse through the available functions. What function is to be used if the IQ number used in the program is to be converted to a string?
11. Learn and understand interfacing of CC3100 WiFi module with EK-TM4C123GXL Launchpad and configuration of static IP address for CC3100 booster pack.

Exercises:

- a) Try pinging the same IP address before connecting to the Access Point (AP) and note down the observation.
 - b) What is the difference between static IP address and dynamic IP address?
12. Configure CC3100 Booster Pack connected to EK-TM4C123GXL Launchpad as a Wireless Local Area Network (WLAN) Station to send Email over SMTP.

Exercises:

- a) In the terminal output window, we have received a debug message “Pinging...!”. Search in the code and change the message to “Pinging the website”. Repeat the experiment to observe this change in the Serial Window.
 - b) In line no:62 of main. C replace www.ti.com with any non-existing web address and repeat the experiment and observe what happens
 - c) In line no: 62 of main. C replace again with www.ti.com and repeat the experiment.
 - d) Identify the code that helps in establishing connection over SMTP. Modify the code to trigger E-mail application based upon external analog input.
 - e) How to configure the AP WLAN parameters and network parameters (IP addresses and DHCP parameters) using CC3100 API.
13. Configure CC3100 Booster Pack connected to EK-TM4C123GXL Launchpad as a HTTP server.

Exercises:

- a) Where are the webpages stored in the CC3100?
- b) What happens if we try to access a webpage, which is not there inside the CC3100?
- c) List 3 applications with a 3 to 4-line brief description that you think can be performed with this experimental setup.

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B. Tech IV-II Sem. (ECE)	L	T	P	C
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15A04801	ADVANCED DIGITAL SIGNAL PROCESSING-MULTIRATE & WAVELET (MOOCS-II)			

Course Objectives:

- To study about the digital signal processing algorithms and multi rate signal processing
- To study about the power spectral estimation by using Barlett, Welch & Blackmann & Tukey methods.
- The study about the effects of finite word length in fixed-point dsp systems.

Course Outcomes:

After completion of the course students will be able to

- Get complete knowledge regarding various algorithms associated with Digital signal processing and multi rate signal processing.
- Verify the power spectral estimation by using Barlett, Welch & Blackmann & Tukey methods.
- Understand the effects of finite word length in fixed-point DSP systems by using ADC and FFT algorithms

UNIT – I

A Beginning with some practical situations, which call for multi-resolution/ multi-scale analysis - and how time-frequency analysis and wavelets arise from them. Examples: Image Compression, Wideband Correlation Processing, Magnetic Resonance Imaging, Digital Communication Piecewise constant approximation - the Haar wavelet, Building up the concept of dyadic Multi-resolution Analysis (MRA), Relating dyadic MRA to filter banks.

UNIT – II

A review of discrete signal processing, Elements of multi-rate systems and two-band filter bank design for dyadic wavelets. Families of wavelets: Orthogonal and bi-orthogonal wavelets, Daubechies' family of wavelets in detail, Vanishing moments and

regularity, Conjugate Quadrature Filter Banks (CQF) and their design, Dyadic MRA more formally, Data compression - fingerprint compression standards, JPEG-2000 standards.

UNIT – III

The Uncertainty Principle: and its implications: the fundamental issue in this subject - the problem and the challenge that Nature imposes. The importances of the Gaussian function: the Gabor Transform and its generalization; time, frequency and scale - their interplay, The Continuous Wavelet Transform (CWT), Condition of admissibility and its implications. Application of the CWT in wideband correlation processing.

UNIT – IV

Journey from the CWT to the DWT: Discretization in steps, Discretization of scale - generalized filter bank, Discretization of translation - generalized output sampling, Discretization of time/ space (independent variable) - sampled inputs, Going from piecewise linear to piecewise polynomial, The class of spline wavelets - a case for infinite impulse response (IIR) filter banks, Variants of the wavelet transform and its implementation structures, the wave packet transform, Computational efficiency in realizing filter banks - Polyphase components, The lattice structure, The lifting scheme.

UNIT – V

An exploration of applications (this will be a joint effort between the instructor and the class). Examples: Transient analysis; singularity detection; Biomedical signal processing applications; Geophysical signal analysis applications; Efficient signal design and realization: wavelet based modulation and demodulation; Applications in mathematical approximation; Applications to the solution of some differential equations; Applications in computer graphics and computer vision; Relation to the ideas of fractals and fractal phenomena.

Textbooks:

1. Howard L. Resnikoff, Raymond O. Wells, "Wavelet Analysis: The Scalable Structure Information," Springer, 1998 available in India edition.
2. K. P. Soman, K. I. Ramachandran, "Insight Into Wavelets - From Theory to Practice", Prentice Hall of India, Eastern Economy Edition, Prentice Hall of India Private Limited, M-97, Connaught Circus, New Delhi - 110 001, Copyright 2004, ISBN Number 81-203-2650-4.
3. Michael W. Frazier, "An Introduction to Wavelets through Linear Algebra", Springer, ISBN 3-540-780-75-0, c 1999.

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4. P. P. Vaidyanathan, "Multirate Systems and Filter Banks", Pearson Education, Low Price Edition, ISBN 81 – 7758 – 942 – 3.

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B. Tech IV-II Sem. (ECE)

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15A04802 LOW POWER VLSI CIRCUITS AND SYSTEMS
(MOOCS-II)

Course Outcomes :

After completion of this subject, students will be able to

- Understand the concepts of velocity saturation, Impact Ionization and Hot Electron Effect
- Implement Low power design approaches for system level and circuit level measures.
- Design low power adders, multipliers and memories for efficient design of systems.

UNIT I

Introduction, Historical background, why low power, sources of power dissipations, low-power design methodologies.

MOS Transistors: introduction, the structure of MOS Transistor, the Fluid model, Modes of operation of MOS Transistor, Electrical characteristics of MOS Transistors, MOS Transistors as a switch.

UNIT II

MOS Inverters: introduction, inverter and its characteristics, configurations, inverter ratio in different situations, switching characteristics, delay parameters, driving parameters, driving large capacitive loads.

MOS Combinational Circuits: introduction, Pass-Transistor logic, Gate logic, MOS Dynamic Circuits.

UNIT III

Sources of Power Dissipation: introduction, short-circuit power dissipation, switching power dissipation, glitching power dissipation, leakage power dissipation.

Supply voltage scaling for low power: introduction, device features size scaling, architecture-level approaches, voltage scaling, multilevel voltage scaling, challenges, dynamic voltage and frequency scaling, adaptive voltage scaling.

UNIT IV

Minimizing Switched Capacitance: introduction, system-level approaches, transmeta's Crusoe processor, bus encoding, clock gating, gated-clock FSMs, FSM state encoding, FSM Partitioning, operand isolation, precomputation, logic styles for low power.

UNIT V

Minimizing Leakage Power: introduction, fabrication of multiple threshold voltages, approaches for minimizing leakage power, Adiabatic Logic Circuits, Battery-Driven System, CAD Tools for Low Power VLSI Circuits.

TEXT BOOKS

1. Ajit. Pal, Low power VLSI Circuits and systems, springer
2. Sung Mo Kang, Yusuf Leblebici, CMOS Digital Integrated Circuits, Tata Mcgrag Hill.
3. Neil H. E. Weste and K. Eshraghian, Principles of CMOS VLSI Design, 2nd Edition, Addison Wesley (Indian reprint).
4. A. Bellamour, and M. I. Elmasri, Low Power VLSI CMOS Circuit Design, Kluwer Academic Press, 1995.
5. Anantha P. Chandrakasan and Robert W. Brodersen, Low Power Digital CMOS Design, Kluwer Academic Publishers, 1995.

REFERENCES

1. Kaushik Roy and Sharat C. Prasad, Low-Power CMOS VLSI Design, Wiley-Interscience, 2000.

B. Tech IV-II Sem. (ECE)

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15A04803 PATTERN RECOGNITION & APPLICATIONS
(MOOCS-III)

UNIT – I

Introduction: Feature extraction and Pattern Representation Concept of Supervised and Unsupervised classification Introduction to Application Areas.

UNIT – II

Statistical Pattern Recognition

Bayes Decision Theory, Minimum Error and Minimum Risk Classifiers, Discriminant Function and Decision Boundary Normal Density, Discriminant Function for Discrete Features, Parameter estimation

UNIT – III

Dimensionality Problem

Dimension and accuracy, Computational Complexity, Dimensionality Reduction, Fisher Linear Discriminant, Multiple Discriminant Analysis

Nonparametric Pattern Classification

Density Estimation, Nearest Neighbour Rule, Fuzzy Classification

UNIT – IV

Linear Discriminant Functions Separability, Two Category and Multi Category Classification, Linear Discriminators, Perceptron Criterion, Relaxation Procedure, Minimum Square Error Criterion, Widrow-Hoff Procedure, Ho-Kashyap Procedure, Kesler's Construction.

Neural Network Classifier Single and Multilayer Perceptron, Back Propagation Learning, Hopfield Network, Fuzzy Neural Network

UNIT – V

Time Varying Pattern Recognition

First Order Hidden Markov Model, Evaluation, Decoding, Learning

Unsupervised Classification

Clustering, Hierarchical Clustering, Graph Based Method, Sum of Squared Error Technique Iterative Optimization

Textbooks:

1. Richard O. Duda, Peter E. Hart and David G. Stork, "Pattern Classification", JohnWiley& Sons, 2001.
2. Earl Gose, Richard Johnsonbaugh and Steve Jost, "Pattern Recognition and Image Analysis", Prentice Hall, 1999.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B. Tech IV-II Sem. (ECE)

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**15A04804 RF INTEGRATED CIRCUITS
(MOOCS-III)**
UNIT – I

Introduction RF systems – basic architectures, Transmission media and reflections, Maximum power transfer, Passive RLC Networks, Parallel RLC tank, Q, Series RLC networks, matching, Pi match, T match, Passive IC Components Interconnects and skin effect, Resistors, capacitors Inductors

UNIT – II

Review of MOS Device Physics - MOS device review, Distributed Systems, Transmission lines, reflection coefficient, the wave equation, examples, Lossy transmission lines, Smith charts – plotting Γ , High Frequency Amplifier Design, Bandwidth estimation using open-circuit time constants, Bandwidth estimation, using short-circuit time constants, Rise time, delay and bandwidth, Zeros to enhance bandwidth, Shunt-series amplifiers, tuned amplifiers, Cascaded amplifiers

UNIT - III

Noise - Thermal noise, flicker noise review, Noise figure, LNA Design, Intrinsic MOS noise parameters, Power match versus, noise match, large signal performance, design examples & Multiplier based mixers. Mixer Design, Subsampling mixers.

UNIT – IV

RF Power Amplifiers, Class A, AB, B, C amplifiers, Class D, E, F amplifiers, RF Power amplifier design examples, Voltage controlled oscillators, Resonators, Negative resistance oscillators, Phase locked loops, Linearized PLL models, Phase detectors, charge pumps, Loop filters, and PLL design examples

UNIT - V

Frequency synthesis and oscillators, Frequency division, integer-N synthesis, Fractional frequency, synthesis, Phase noise, General considerations, and Circuit examples, Radio architectures, GSM radio architectures, CDMA, UMTS radio architectures

Textbooks:

1. The design of CMOS Radio frequency integrated circuits by Thomas H. Lee
Cambridge university press, 2004.
2. RF Micro Electronics by Behzad Razavi, Prentice Hall, 1997.

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