University of Pune

COURSE STRUCTURE FOR M.E. (Electronics) (Digital System)
(w. e. f. June – 2013)

SEMESTER I

CODE	SUBJECT	TEACHING SCHEME	EXAMINATION SCHEME					CREDITS
		Lect./ Pr (Hrs.)	Paper		TW	Oral/ Presentation	Total	
			In Semester Assessment	End Semester Assessment				
504101	Microelectronics	4	50	50	-	-	100	4
504102	Digital Signal Processing Architectures	4	50	50	-	-	100	4
504103	Embedded System Design	4	50	50	-	-	100	4
504104	Research Methodology	4	50	50	-	-	100	4
504105	Elective I	5	50	50	-	-	100	5
504106	Lab Practice-I	4	-	-	50	50	100	4
Total		25	250	250	50	50	600	25

SEMESTER II

CODE	SUBJECT	TEACHING SCHEME	EXAMINATION SCHEME					CREDITS
		Lect./ Pr (Hrs.)	Paper		TW	Oral/ Presentation	Total	
			In Semester Assessment	End Semester Assessment				
504107	Design for Testability	4	50	50	-	-	100	4
504108	PLDs and ASIC Design	4	50	50	-	-	100	4
504109	Random Signals and Processes	4	50	50	-	-	100	4
504110	Elective II	5	50	50	-	-	100	5
504111	Lab practice II	4	-	-	50	50	100	4
504112	Seminar I	4	-	-	50	50	100	4
Total		25	200	200	100	100	600	25

SEMESTER III

CODE	SUBJECT	TEACHING SCHEME	EXAMINATION SCHEME					CREDITS
		Lect./ Pr (Hrs.)	Paper		TW	Oral/ Presentation	Total	
			In-Semester Assessment	End Semester Assessment				
604101	Image processing and computer vision	4	50	50	-	-	100	4
604102	Wireless and mobile technologies	4	50	50	-	-	100	4
604103	Elective III	5	50	50	-	-	100	5
604104	Seminar II	4	-	-	50	50	100	5
604105	Project stage I	8	-	-	50	50	100	8
Total		25	150	150	100	100	500	25

SEMESTER IV

CODE	SUBJECT	TEACHING SCHEME	EXAMINATION SCHEME				CREDITS
		Lect./ Pr (Hrs.)	Paper	TW	Oral/ Presentation	Total	
604106	Seminar III	5	-	50	50	100	5
604107	Project stage II	20	-	150	50	200	20
Total		25	-	200	100	300	25

Elective I	1. Speech and Audio processing 2. Mathematics for Digital Systems 3. Artificial Neural Network 4. Semiconductor Device Modelling 5. *LATEX
Elective II	1. Fault Tolerant System Design 2. Multi-rate and Adaptive Signal Processing 3. Wireless Sensor Networks 4. Reconfigurable Computing 5. *Software Tools

Elective- III	1.Value Education, Human Rights and Legislative Procedures 2. Environmental Studies 3. Energy Studies 4. Disaster Management 5. Knowledge Management 6. Foreign Language 7. Economics for Engineers 8. Engineering Risk – Benefit Analysis 9. Technology Play 10. Optimization Techniques 11. Fuzzy Mathematics 12. Design and Analysis of Algorithms 13. CUDA

Note: Syllabus for Elective III is common for all discipline.

504101	Micro-Electronics	
Teaching Scheme: **Lectures : 4 Hrs/ Week**		**Examination scheme:** **Theory : 50 Marks(In Semester)** **50 Marks(End Semester)** **Credits : 4**
Module I		
Ideal I-V Characteristics, C-V Characteristics: MOS Capacitance models, MOS Gate Capacitance Model, MOS Diffusion Capacitance Model. Non ideal I-V Effects: Velocity Saturation and Mobility Degradation, Channel Length Modulation, Body Effect, Sub threshold Conduction, Junction Leakage, Tunneling, Temperature and Geometry Dependence. DC Transfer characteristics: Complementary CMOS Inverter DC Characteristics, Beta Ratio Effects, Noise Margin, Ratio Inverter Transfer Function, Pass Transistor DC Characteristics, Tristate Inverter, Switch- Level RC Delay Models.		
Module II		
CMOS Technologies: Background, Wafer Formation, Photolithography, Well and Channel Formation, Silicon Dioxide (SiO_2), Isolation, Gate Oxide, Gate and Source/Drain Formation, Contacts and Metallization, Passivation, Metrology. Layout Design Rules: Design Rules Background, Scribe Line and Other Structures, MOSIS Scalable CMOS Design Rules, Micron Design Rules. CMOS Process Enhancements: Transistors, Interconnect, Circuit Elements, Beyond Conventional CMOS. CMOS Fabrication and Layout: Inverter Cross-section, Fabrication Process, Layout Design rules, Gate Layout, Stick Diagrams.		
Module III		
Delay Estimation: RC Delay Models, Linear Delay Model, Logical Effort, Parasitic Delay. Logical Effort and Transistor Sizing: Delay in a Logic Gate, Delay in Multistage Logic Networks, choosing the Best Number of Stages. Power Dissipation: Static Dissipation, Dynamic Dissipation, Low-Power Design. Interconnect: Resistance, Capacitance, Delay, Cross talk. Design Margin: Supply Voltage, Temperature, Process Variation, Design Corners. Reliability, Scaling.		
Module IV		
Static CMOS Logic : Inverter, NAND Gate, Combinational Logic, NOR Gate, Compound Gates, Pass Transistors and Transmission Gates, Tristates, Multiplexers, Latches and Flip-Flops, Circuit Families: Static CMOS, Ratioed Circuits, Cascode Voltage Switch Logic, Dynamic Circuits, Differential Circuits, Sense Amplifier Circuits, BiCMOS Circuits, Low Power Logic Design, Comparison of Circuit Families, Analog Circuit Designs, MOS Small-signal Models, Common Source Amplifier, The CMOS Inverter as an Amplifier, Current Mirrors, Differential Pairs, CMOS Operational Amplifier topologies, Digital to Analog Converters, switched capacitors, Analog to Digital Converters, RF Circuits		

References:

1. J. M. Rabaey, A. Chandrakasan and B. Nikolic, *Digital Integrated Circuits : A Design Perspective*, Pearson/PHI (Low Price Edition)
2. S-M. Kang and Y. Leblebici, *CMOS Digital Integrated Circuits : Analysis and Design*, Third Edition, McGraw-Hill
3. B. Razavi, *Design of Analog CMOS Integrated Circuits*, McGraw-Hill
4. P. E. Allen and D. R. Holberg, *CMOS Analog Circuit Design*, Second Edition, Oxford University Press
5. P. Gray, P. J. Hurst, S. H. Lewis and R. Meyer, *Analysis and Design of Analog Integrated Circuits*, Fourth Edition,Wiley, 2001. (Low Price Edition)

Microelectronics

Laboratory Assignments/Experiments:

1. To implement three inputs NAND gate using static CMOS logic and draw the Layout for the same.
2. To implement the CMOS inverter using Static CMOS logic and find the impact of W/L on propagation delay and Power Dissipation.
3. Design and Implement Differential amplifier by using AIMSPICE. Analyze the circuit using DC Analysis and Transient analysis.
4. Design and Implement Cascade amplifier by using AIMSPICE. Adjust the W/L ratio and Plot the effect of W/L ratio on Output voltage.

Course Outcomes:

1. The student will understand the fundamentals of MOSFETs used in CMOS Technology.
2. The student will show the skills of designing analog and digital VLSI ICs..
3. The student will demonstrate the ability for using backend tools in IC technology.

504102	Digital Signal Processing Architectures	

Teaching Scheme: Lectures: 4 Hrs/ Week		Examination scheme: Theory : 50 Marks (In Semester) 50 Marks (End Semester) Credits : 4

Module I

Discrete Fourier Transform, properties of DFT, Decimation in time and decimation in frequency FFT, 2-D DFT and its applications, Linear filtering using DFT- Overlap and Save & overlap and Add algorithms, Goertzel algorithm, DTMF signal detection using Goertzel algorithm, Chirp Z transform, spectral resolution and selection of window length, spectral analysis of speech and ECG signal.

Module II

FIR filter design, Fourier series expansion method, windowing, Kaiser window, Gibbs phenomenon, Frequency sampling method, LPF and HPF design using frequency sampling method, IIR filter design using impulse invariant method and bilinear transformation method, mapping between S domain and Z domain for both the methods, Butterworth filter characteristics, Butterworth filter design using impulse invariant method and bilinear transformation method.

Module III

Multi rate DSP- Decimation by integer factor D, interpolation by integer factor I, sampling rate conversion by a factor of I/D, Efficient implementation of Decimator and interpolator, poly phase filter structure, Multistage filter design, application of multi rate DSP for oversampling ADC and sub band coding, transform domain processing, DCT, STFT and wavelet transform, energy compaction, decorrelation, Properties of STFT, restrictions on mother wavelet, Haar wavelet and multiresolution analysis, Daubechies wavelet, matrix multiplication method, wavelet packets.

Module IV

Introduction to Digital Signal Processors, DSP architectures, Study of Texas processors TMS320C54xx & TMS320C6713 and analog Device processors SHARC and Black fin with respect to multiple access memory, multiport memory, instruction pipeline etc. Study of development tools namely Code Composer Studio and Visual DSP++, Circular buffering, MAC, barrel shifter, Booth's multiplication algorithm, parallel processing and pipelining, retiming, folding and unfolding transformations, Introduction to Software Defined Radio architecture.

References:

1. Digital Signal Processing Principles, Algorithms and Applications", Pearson, Fourth Edition, Proakis, Manolakis,
2. K. K. Parhi, "VLSI Digital Signal Processing Systems- Design and Implementation", John Wiley & Sons, Inc.
3. Advanced Digital Signal Processing: Dr. Shaila Apte, Wiley India publication
4. Digital Signal Processing- Dr. Shaila Apte- Wiley India Publication

Digital Signal Processing Architectures

Laboratory Assignments/Experiments (at least two experiments from the list to be executed on any TMS 320 C xxx starter kit.)

- Design a system for DTMF signal detection. Write a program to detect the DTMF signal using Goertzel algorithm.
- Consider a signal as addition of signals with frequencies 120 Hz, 125 Hz and 150 Hz. Design a length of the window to resolve closely spaced frequencies. Write a program to resolve the frequencies and show the output which clearly indicates resolved signal peaks.
- Design a filter using frequency sampling method with following specifications. Sampling frequency 8000 Hz, cut off frequency 1000 Hz. Write a program for the filter design and plot magnitude and phase response of the filter.
- Design a LPF with same specifications as stated in problem 3 using Fourier series expansion method using Kaiser Window. Write a program for the filter design and plot magnitude and phase response for the filter.
- Record a speech file in your own voice. Design a system for sampling rate conversion by a factor of ¾. Write a program for the same and execute the program for a speech file with sampling frequency of 8000 Hz.
- Record a speech file in your own voice with sampling frequency of 8000 Hz. Design a system to decompose a speech signal using Daubechies wavelet using wavelet packet decomposition. Write a program to implement the system and plot the speech signal passed via each wavelet filter.

Course Outcomes:

1. The student will be capable of designing the system for linear filtering using DFT.
2. The student will show skills for design of FIR and IIR filters for any application.
3. The student will exhibit the knowledge of sampling rate conversion for any signal. The student will demonstrate the design of poly phase filters for sub band coding.
4. The student will demonstrate the ability to decompose any signal using STFT and wavelet transform.

504103	Embedded System Design	
Teaching Scheme: **Lectures 4Hrs/ Week**		**Examination scheme:** **Theory : 50 Marks (In Semester)** **50 Marks (End Semester)** **Credits : 4**

Module I

Introduction to Embedded Systems Introduction to Embedded Systems, Architecture of Embedded System, Design Methodology, Design Metrics, General Purpose Processor, System On chip.

Embedded system design and development: Embedded system design**,** Life-Cycle Models, Problem solving, The design process, Requirement identification, Formulation of requirements specification. Development tools.

System design specifications: System specifications versus system requirements, Partitioning and decomposing a system, Functional design, Architectural design, Functional model versus architectural model, Prototyping, Other considerations, Archiving the project.

Module II

ARM-9 Architecture: ARM-9-TDMI Processor core, ARM architectural support for high level language, ARM architectural support for system development, ARM architectural support for operating System, Memory subsystem architecture, Designing a cache system, Memory allocation, Communication protocols.

Module III

Embedded Linux and Device Driver

Introduction to Embedded Linux, Linux kernel: construction, Kernel Build system, kernel configuration, obtaining custom Linux kernel, Kernel initialisation, Porting Linux on ARM9, Device driver: Concepts, Module utilities, Driver methods, Device driver for LED, Keyboard, LCD

Module IV

Android Operating System

Introduction to Android technology, Structure of Android applications, Understanding Manifest, Working with Activities , Data stores, Network services and APIs, Intents, Content Providers and services, Advance Operations with Android, Telephony and SMS, Audio Video using the Camera, Project Discussion on Android.

References:

1. Embedded Real Time Systems: Concepts, Design & Programming, Dr. K.V.K.K. Prasad, Dreamtech Publication.
2. Embedded System Design: A unified Hardware/Software Introduction, Frank Vahid, and Tony Givargis, Wiley Publication.
3. Embedded Systems: Architecture, Programming and Design, second edition, Raj Kamal, Mc Graw Hill
4. Embedded Linux primer, second edition, Christopher Hallinan, Pearson publication
5. An Embedded Software Primer, David E. Simon, Pearson Education Publication

Embedded System Design

Laboratory Assignments/Experiments: (based on Linux Operating system):

1. Write a program for 4*4 Matrix Keypad Interface.
2. Study of Linux Kernel.
3. Write a device driver for LCD.
4. Study of Android operating system.
5. Write a program for I2C based ADC.

Course Outcomes:

- The student will show understanding of Embedded System
- The student will exhibit the knowledge of design metrics of Embedded systems
- The student will understand Linux operating system and device driver
- The student will demonstrate the knowledge of android operating system

504104	Research Methodology	

Teaching Scheme: Lectures: 4Hrs/ Week		Examination scheme: Theory : 50 Marks (In Semester) 50 Marks (End Semester) Credits : 4

Module I

Research Problem

Meaning of research problem, Sources of research problem, Criteria / Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem.

Basic instrumentation

Instrumentation schemes, Static and dynamic characteristics of instruments used in experimental set up, Performance under flow or motion conditions, Data collection using a digital computer system, Linear scaling for receiver and fidelity of instrument, Role of DSP is collected data contains noise.

Module II

Applied statistics

Regression analysis, Parameter estimation, Multivariate statistics, Principal component analysis, Moments and response curve methods, State vector machines and uncertainty analysis

Module III

.**Modelling and prediction of performance**

Setting up a computing model to predict performance of experimental system, Multiscale modelling and verifying performance of process system, Nonlinear analysis of system and asymptotic analysis, Verifying if assumptions hold true for a given apparatus setup, Plotting family of performance curves to study trends and tendencies, Sensitivity theory and applications

Module IV

Developing a Research Proposal

Format of research proposal, Individual research proposal, Institutional proposal. Proposal of a student – a presentation and assessment by a review committee consisting of Guide and external expert only. Other faculty members may attend and give suggestions relevant to topic of research.

References

1. 'Research methodology: an introduction for science & engineering students', by Stuart Melville and Wayne Goddard
2. 'Research Methodology: An Introduction' by Wayne Goddard and Stuart Melville
3. 'Research Methodology: A Step by Step Guide for Beginners', by Ranjit Kumar, 2nd Edition
4. 'Research Methodology: Methods and Trends', by Dr. C. R. Kothari
5. 'Operational Research' by Dr. S.D. Sharma, Kedar Nath Ram Nath & co.
6. Software Engineering by Pressman

Research Methodology

Laboratory Assignments/Experiments:

1. Regression analysis of any given problem.
2. Applying PCA for a given problem.
3. For a given system, design a computer model to test the performance of the system. Draw graphs for to study the trends.
4. Develop a research proposal for any system in your mind and present it in front of the committee.

Course Outcomes:

- The student will show understanding of regression analysis and principal component analysis..
- The student will exhibit the knowledge of design a computer model for a system.
- The student will be able to do asymptotic analysis.
- The student will demonstrate the preparation of a research proposal.

504105	Speech and audio processing	
ELECTIVE-I		
Teaching Scheme: **Lectures: 4 Hrs/ Week**		**Examination Scheme:** **Theory : 50 Marks (In Semester)** **50 Marks (End Semester)** **Credits : 4**

Module I

LTI model, LTV model, voiced and unvoiced decision making, speech parameters, pitch and formants, pitch frequency measurement using AMDDF and autocorrelation, Parallel processing approach, pitch period measurement using spectral domain, cepstral domain, relation between formants and LPC, evaluation of formants using cepstrum, log spectrum and Power spectral density estimate.

Module II

Homomorphic processing, Cepstral analysis, Mel scale, MFCC block schematic and function of each block, Perceptual linear prediction, STFT and wavelet analysis of speech, Linear prediction of speech, Forward linear prediction, autocorrelation method, Levinson Durbin algorithm, Burg algorithm Line spectral pair frequencies, transformation from LPC to LSP and LSP to LPC.

Module III

Speech quantization and coding, Uniform and non uniform quantizers, compounded quantizer, forward and backward adaptive quantizers, waveform coding of speech, PCM, compounded PCM, ADPCM, DM etc. Speech & audio coding standards.- G.726, LPC-10, speech processing applications speech recognition systems, DTW, HMM, VQ- HMM based speech recognition, speaker recognition, system overview, speech enhancement techniques for periodic, wide band and interfering speech, Text to speech synthesis, speech synthesis using LPC and formants,

Module IV

Music processing, classification of musical instruments, temporal features and timbral features, modulation features, music synthesis, additive and subtractive synthesis, wavetable synthesis, FM synthesis and physical modelling synthesis, MIDI specifications, streaming audio, audio standards, MP3 and MPEG-2 AAC.

References

1. R Rabiner and S.W. Schafer, “Digital processing of speech signals”; Pearson Education.
2. Ben Gold & Nelson Morgan, “Speech & Audio Signal Processing” 1 ed., Wiley.
3. Speech and Audio Processing- Shaila Apte-Wiley India publication
4. Kondoz “Digital Speech” Wiley publication

Speech and audio processing

Laboratory Assignments/Experiments :

1. Record a speech file in your own voice. Use AMDF to find pitch period for a voiced part of the segment. Write a MATLAB program for tracking pitch contour using AMDF method.
2. Write a program to find the impulse response coefficients for a vocal tract. Execute it and interpret your results. Use cepstral domain processing.
3. Write a program to track unvoiced part of utterance and use the program for Levinson Durbin recursion to find LPC for unvoiced signal.
4. Record 5 different words in your voice by uttering each word 10 times. Find LPC for each pitch synchronous segment and track 2^{nd} LPC contour for all utterances. Use dynamic time warping for template matching. Find recognition rate.
5. Use NOIZEUS speech database. Use babble noise and try to eliminate it using modification of real part of DFT of each segment. Draw spectrogram to check if the noise is removed.

Course Outcomes:

1. The student will use theory of speech production system to find pitch and formants for speech.
2. The student will show skills of drawing a cepstrum of speech signal.
3. The student will exhibit the knowledge of coding techniques to efficiently code speech signal.
4. The student will exhibit the knowledge of music processing for recognition of musical instrument.

504105	Mathematics for Digital Systems	
ELECTIVE-I		
Teaching Scheme: **Lectures: 4 Hrs/ Week**		**Examination Scheme:** **Theory : 50 Marks (In Semester)** **50 Marks (End Semester)** **Credits : 4**

Module I

Probability, relative frequency, Joint and conditional probability, Bayes' theorem, Independent events, permutations and combinations, Random variables, Probability density function, histogram, Cumulative distribution function, standard probability density functions, Gaussian variable, uniform exponential and Rayleigh distribution, Binomial and Poisson distribution, fitting a distribution function to a random variable, Chi square test, K_S test.

Module II

operations on random variables, expected value, moments, centre moments, skew and Kurtosis, characteristic function, moment generating function, computer generation of a random variable, central limit theorem, Introduction to linear algebra, vectors and vector spaces, eigen vectors and eigen values, characteristic equation.

Module III

Optimization techniques, objective functions, constraint handling, the structure of optimization, spaces, sets, elements, Gradient descent, problems in optimization, premature convergence, Deceptiveness, Epitasis, over fitting and oversimplification, Forma analysis, Genome design.

Module IV

Linear Prediction, Lattice structures for first order and second order filters, equations for forward predicted output and backward predicted output, Derivation of Normal equations, Levinson Durbin algorithm, Burg algorithm.

References

1.Probability, random variables and random signal principles- Peyton Peebles-4th edition, TMH publication
2. Probability-Aunon, Chandrashekhar
3. Advanced Digital Signal Processing- Shaila Apte- Wiley India Publication
4. Newest Version: http://www.it-weise.de/

Mathematics for Digital Systems

Laboratory Assignments/Experiments:

1. Record a speech signal in your own voice. Take 4096 samples of voiced speech and draw histogram for a signal. Try to fit a standard distribution for the signal.
2. Write a computer program for generating a Gaussian random variable using central limit theorem.
3. Record a speech signal in your own voice. Take 1024 samples of voiced speech and find LPC using Levinson & Durbin algorithm and convert LPC to LSP.
4. Consider a uniform random variable between 2 to 7. Find mean, variance and constant value of pdf.

Course Outcomes:

1. The student will be capable of drawing histogram for any random signal and fit the probability distribution for it.
2. The student will show skills for finding different moments and centre moments for the random variable.
3. The student will exhibit the knowledge of linear prediction for different applications in speech processing.
4. The student will exhibit the ergodicity and stationarity of the random process for estimation of autocorrelation.

504105	Artificial Neural Network	
ELECTIVE-I		
Teaching Scheme: **Lectures 4 Hrs/ Week**		**Examination Scheme:** **Theory : 50 Marks (In Semester)** **50 Marks (End Semester)** **Credits : 4**

Module I

Introduction to learning process, Introduction to Neural Network, Human Brain, Models of a Neuron, Neural networks viewed as Directed Graphs, Network Architectures, Knowledge Representation, Artificial Intelligence and Neural Networks, Error Correction learning, Memory based learning, Hebbian learning, Competitive, Boltzmann learning, Credit Assignment Problem. Memory, Adaption, Statistical nature of the learning process

Module II

Single layer Perceptrons**,** Adaptive filtering problem, Unconstrained Organization Techniques, Linear least square filters, least mean square algorithm, learning curves, Learning rate annealing techniques, perceptron —convergence theorem, Relation between perceptron and Baye's classifier for a Gaussian Environment, MULTI LAYER PERCEPTRONS, Back propagation algorithm XOR problem, Heuristics, Output representation and decision rule. Computer experiment, feature detection

Module III

Back propagation**, b**ack propagation and differentiation, Hessian matrix, Generalization, Cross validation, Network pruning Techniques, Virtues and limitations of back propagation learning, Accelerated convergence, supervised learning.

Module IV

Radial basis function network, Cover's theorem on the separability of patterns, Interpolation problem, Supervised Learning , Regularization Networks, Generalized Radial Basis Function Networks, Estimation of Regularization Parameter, approximation Properties of RBF Networks, comparison of RBF Networks and Multilayer Perceptron, kernel Regression and Its relation to RBF Networks, Self Organization Maps, Two basic feature mapping models, Self organization map, SOM algorithm, properties of feature map, computer simulations, learning vector quantization, Adaptive patter classification

References

1. Neural networks A comprehensive foundations, Simon Haykin, PHI edition.
2. Artifical neural networks - B.Vegnanarayana Prentice Hall of India Pvt. Ltd 2005
3. Introduction to Artificial Neural Systems Jacek M. Zurada, JAICO Publishing House .
4. Introduction to Neural Networks Using MATLAB, Sivanndam, Deepa, TMH publication

Artificial Neural Network

Laboratory Assignments/Experiments:

Note: Any suitable software can be used for performing experiment

1. Study and generation of different activation functions
2. Study of Multilayer Feed forward neural network for pattern recognition application
3. Study of back propagation algorithm
4. Study of Radial Basis function network
5. Pattern recognition using neural networks

Course Outcomes:

1. The student will use analogy of human neural network for understanding of artificial Learning algorithms..
2. The student will show skills for using back propagation algorithm.
3. The student will exhibit the knowledge of radial basis function network.
4. The student will show understanding of self organizing maps.

504105	Semiconductor Device Modelling	
ELECTIVE-I		
Teaching Scheme: **Lectures: 4 Hrs/ Week**		**Examination Scheme:** **Theory : 50 Marks (In Semester)** **50 Marks (End Semester)** **Credits : 4**

Module I

Solid State Device Physics, material Properties, Crystal structure, Energy band model, Equilibrium carrier concentrations, Drift and Diffusion mechanism, Recombination and generation of carriers, continuity equations, minority carrier diffusion equations, diffusion length quasi Fermi level concepts.

Module II

Semiconductor Junctions, p-n junctions: Poisson's equations, qualitative and quantitative analysis of pn junction diode, fabrication of p-n junctions, equilibrium conditions, forward and reverse biased junctions, reverse bias breakdown and transient response of p-n junction diode.

Metal semiconductor junctions: Schottky barriers, qualitative and quantitative analysis, built in potential, current-voltage relationships, rectifying and non-rectifying contacts, ohmic contacts, tunneling barrier, MOS Junctions: MOS structure, Energy band diagrams, flat band voltage, threshold voltage, Charge distributions, C-V characteristics, fixed oxide and interface charge effects

Module III

Bipolar Junction Transistors, BJT Fundamentals, Fabrication, Electrostatics, Operational considerations, Minority carrier distribution, non-ideal effects, Equivalent circuit models, Frequency limitations, switching characteristics, Advanced NJT structures, Power BJT. Field Effect Transistors- JFET: structure, qualitative and quantitative analysis, current-voltage characteristics, effect in real devices, high frequency and high speed issues MESFET: structure, qualitative and quantitative analysis, current-voltage characteristics

Module IV

MOSFET : basic operation and fabrication ; ideal MOS capacitor; effects of real surfaces; threshold voltages; output and transfer characteristics of MOSFET, effective mobility, charge sheet model, non ideal effects, oxide charges, threshold voltage considerations, short-channel effects, hot-carrier effects, advanced MOSFET structures, SPICE Models**,** Analytical and physical modeling, empirical and semi-empirical models, MOSFET Level 1, Level 2, Level 3 and BSIM Model, Model parameters and equations, SPICE models of p-n diode, Spice BJT model, Use of MATLAB in device modelling, AIMSPICE

References

1. B.G. Streetman and S. Banerjee, Solid State Electronic Devices, 5th edition, Prentice Hall of India
2. Y.Taur, and T.H.Ning , Fundamentals of Modern VLSI devices , Cambridge University press
3. R. S. Muller, T. I. Kamins, "Device Electronics for Integrated Circuits", John Wiley & Sons
4. Yannis Tsividis, "Operation and Modeling of the MOS Transistor", Oxford University Press
5. C. G. Montoro, M. C. Schneider, "MOSFET Modeling for Circuit Analysis And Design", World Scientific,

Semiconductor device modelling

Laboratory Assignments/Experiments:

1. Develop a MOSFET model and write a MATLAB code for verifying the I-V Characteristics of this device.
2. Develop a MOS capacitance model and write a MATLAB code for verifying the C-V Characteristics of this junction.
3. Develop a pn junction model and write a MATLAB code for verifying the I-V Characteristics of this junction

Course Outcomes:

1. The student will demonstrate the development of semiconductor devices.
2. The student will understand the device physics of the devices used in foundry.
3. The student will use the device models in VLSI tools.

504105	***LATEX**	
ELECTIVE-I		
Teaching Scheme: Theory 1 Hrs/ Week		**Examination Scheme: Credits :1**
LaTeX /Document Structure, Document classes, Packages, The document environment, Book structure.		
References:		
http://miktex.org/ http://www.winedt.com/		
*For each Subject under Elective I the student Shall study LATEX for 1 credit.		

504106	Lab Practice I	
Teaching Scheme: **Practical 4 Hrs/ Week**		**Examination Scheme:** **Term Work : 50 Marks** **Oral/ Presentation: 50 Marks** **Credits :4**
Lab Practice I: The laboratory work will be based on completion of minimum two assignments/experiments confined to the courses of the semester.		

SEMESTER-II

504107	Design for testability	
Teaching Scheme: **Lectures 4 Hrs/ Week**		**Examination scheme:** **Theory : 50 Marks (In Semester)** **50 Marks (End Semester)** **Credits : 4**

Module I

design of combinational circuit building blocks: synthesis of logic functions using multiplexers, multiplexer synthesis using Shanon's expansion, demultiplexers, binary encoders and priority encoders, code converters, arithmetic comparison circuits, VHDL for combinational circuits. Registers and counters: shift registers, Asynchronous counters and synchronous counters, reset synchronization, using storage elements with CAD tools, using registers and counters with CAD tools, design example-bus structure.

Module II

Synchronous sequential circuits: basic design steps, state assignment problem, Mealy state model, design of finite state machines using CAD tools, -Moore type FSMs, serial adder, Mealy type and Moore type, Asynchronous sequential circuits, analysis and synthesis, state reduction, state assignments, Hazards-static and dynamic, a complete design example for vending machine controller.

Module III

Digital system design: Building block circuits, Flip flops and registers with enable input, SRAM, SRAM blocks in PLDs, design of bit counting circuit, shift and add multiplier, divider, clock synchronization, clock skew, switch debouncing, synchronous inputs to flip flops.

Module IV

testing of logic circuits: fault model, complexity of a test set, path sensitization, circuits with tree structures, random tests, testing of sequential circuits, built in self test.

References

1. Brown, Vranesic "Fundamentals of digital logic design with VHDL", McGraw Hill
2. John F. Wakerly,"Digital Design principles and practices", 3rd edition, PHI publications
3. Charles H. Roth, "Digital system design using VHDL", Thomson Publication

Design for testability

Laboratory Assignments/Experiments:

1. Take any combinational circuit and write VHDL code for it.
2. Design a bus structure using CAD tools.
3. Design a finite state machine (Moore type or Mealy type) using CAD tools.
4. Design a clock debouncing circuit and implement it.
5. Design a system to implement a self test for any sequential circuit.

Course Outcomes:

1. The student will use theory of combinational circuits for writing VHDL program.
2. The student will show skills for using registers and counters with CAD tools..
3. The student will exhibit the knowledge of static and dynamic Hazards for design of vending machine controller.
4. The student will exhibit the knowledge of sequential circuits for building a self-test.

504108	PLDs and ASIC Design	
Teaching Scheme: **Lectures 4 Hrs/ Week**		**Examination scheme:** **Theory : 50 Marks (In Semester)** **50 Marks (End Semester)** **Credits : 4**

Module I

System Design Basics, Combinational Circuits, Sequential Circuits, Timing, Power Dissipation, SoC, IP Design, Design methodology, System Modeling, Hardware-Software Co-design, Application Domains, Top down Approach to Design, Data Path, Control Path, Controller behaviour and Design, Pipelining, Resource sharing, FSM issues: Starring state, Power on Reset, State diagram optimization, State Assignment, Asynchronous Inputs, Output Races, fault Tolerance.

Module II

VHDL for System Design, Introduction to HDL, Behavioural, Data flow, Structural Models, Simulation Cycles, Process, Concurrent Statements, Sequential Statements, Loops, Delay Models, Sequential Circuits, FSM Coding, Library, Packages, Functions, Procedures, Operator Inference, Test bench. Complex Programmable Logic Devices**,** Review of PLDs, Design Flow, Programmable Interconnections, Complex PLD's (XC 9500, MAX - 7000, APEX), Architecture, Resources, Applications, Cool Runner CPLD.

Module III

Field Programmable Gate Arrays, Introduction to FPGA, Logic Block Architecture, Routing Architecture, Programmable Interconnections, Design Flow, Xilinx Spartan-II architecture, Xilinx Virtex-II Architecture, Altera, Actel FPGA Architectures, Boundary Scan, Programming FPGA's, Constraint Editor, Static Timing Analysis, One hot encoding, Case Study: Xilinx Virtex II Pro, Embedded System on Programmable Chip, Hardware-software co-simulation, Bus function models, BFM Simulation, Debugging FPGA Design, Chipscope Pro.

Module IV

ASIC Design, Custom IC Design Flow, RTL to GDS-II flow, logical and physical design steps, standard cells, ASIC Cell libraries, Gate Array Designs, Programming Technologies, Introduction to ASIC design EDA Tools: Cadence, Mentor and Synopsis. Design and development of serial/ parallel converter, Introduction to IP cores.

References

1. Jon F Wakerly, Digital Design: Principles and Practices, Prentice Hall.
2. Kevin Skahil, VHDL for programmable logic, Addison Wesley.
3. Zainalabedin Navabi, VHDL, analysis and modeling of digital systems, McGraw-Hill.
4. Ian Grout, Digital Systems Design with FPGAs and CPLDs, Elsevier
5. Michael John Sebastian Smith, Application-Specific Integrated Circuits, Addison Wesley

PLDs and ASIC Design
Laboratory Assignments/Experiments: 1. Interface a 4×4 matrix keypad with the CPLD and display the pressed key on the Liquid Crystal display interfaced with the same CPLD. 2. Design and implement the Analog to digital converter custom IC by using the RTL to GDS-II flow. 3. Design and implement the serial/parallel converters using VHDL. **4.** To implement decade counter on any FPGA experimental Kit and verify the output on seven segment LED display.
Course Outcomes: **1.** The student will show the skills of designing analog and digital VLSI ICs.. **2.** The student will use the the basics of the PLDs for designing IP Cores. **3.** The student will understand the reconfigurable system design

504109	Random signals and Processes	
Teaching Scheme: **Lectures 4 Hrs/ Week**		**Examination scheme:** **Theory : 50 Marks (In Semester)** **50 Marks (End Semester)** **Credits : 4**

Module I

probability, relative frequency, Joint and conditional probability, Bayes' theorem, Independent events, permutations and combinations, Random variables, Probability density function, histogram, Cumulative distribution function, standard probability density functions, Gaussian variable, uniform exponential and Rayleigh distribution, Binomial and Poisson distribution, fitting a distribution function to a random variable, Chi square test, K_S test,

Module II

operations on random variables and multiple random variables, expected value, moments, centre moments, skew and Kurtosis, characteristic function, moment generating function, computer generation of a random variable, central limit theorem, Joint density function, conditional distribution and density, statistical independence, sum of two random variables, sum of several random variables, expected value of a function of random variable, joint characteristic functions.

Module III

random processes, stationary and independence, wide sense and strict sense stationary, time averages and ensemble averages, ergodicity, autocorrelation and cross correlation, measurement of correlation functions, spectral characteristics of random processes, Power density spectrum and its properties, relation between power density spectrum and autocorrelation, Power spectrums of discrete time processes.

Module IV

Introduction to decision theory problem, simple binary hypothesis test, decision criterion, Bayes criterion, likelihood ratio test, Neyman-Pearson test, receiver operating characteristics, estimation theory, Bayes estimation, MMSE, MLE, MAP, Cramer- Rao Inequality

References

1. Probability, random variables and random signal principles- Peyton Peebles-4th edition, TMH publication
2. Probability-Aunon, Chandrashekhar
3. Advanced Digital Signal Processing- Shaila Apte- Wiley India Publication
4. Probability Theory, Random Variables and Stochastic Process M. Populis, McGraw Hill
5. Detection, Estimation, and Modulation Theory, Part I: Harry L. Van Trees, 2001 John Wiley & Sons, Inc.

Random signals and Processes

Laboratory Assignments/Experiments:

1. Record a speech signal in your own voice. Take 4096 samples of voiced speech and draw histogram for a signal. Try to fit a standard distribution for the signal.
2. Write a computer program for generating a Gaussian random variable using central limit theorem.
3. Record a speech signal in your own voice. Take 4096 samples of voiced speech and find the second, third order moments, skew and Kurtosis.
4. Record a speech signal in your own voice. Take 4096 samples of voiced speech and find the power spectrum for the process..

Course Outcomes:

1. The student will be capable of drawing histogram for any random signal and fit the probability distribution for it. .
2. The student will show skills for finding different moments and centre moments for the random variable...
3. The student will exhibit the knowledge of ergodicity and stationarity of the random process for estimation of autocorrelation.
4. The student will demonstrate the ability to use theory of detection and estimation for detection of targets

504110	Fault tolerant system design	
ELECTIVE-II		
Teaching Scheme: **Lectures: 4 Hrs/ Week**		**Examination Scheme:** **Theory : 50 Marks (In Semester)** **50 Marks (End Semester)** **Credits : 4**

Module I

Modelling: Basic Concept, Functional modelling at the logic level, Functional models at the register level, Structural models, Level of modelling. Type of simulation, unknown logic value, compiled simulation,

Module II

Event-driven simulation and Hazard Detection. Logical fault models, Fault detection and redundancy, Fault equivalence and fault location, Fault Dominance, Single stuck-fault models, multiple stuck fault model, stuck RTL variables, Fault variables. Testing for Single Stuck fault and Bridging fault.

Module III

General fault simulation techniques, Serial Fault simulation, Parallel fault simulation, Deductive fault simulation, Concurrent fault simulation, Fault simulation for combinational circuits, Fault sampling, Statistical fault analysis, General aspects of compression techniques, ones- count compression, transition – count compression, Parity – check compression, Syndrome testing and Signature Analysis Basic concepts, Multiple – Bit Errors.

Module IV

Checking circuits and self checking, self – checking checkers, Parity – check function, totally self-checking m/n code checkers, totally self-checking equality checkers, Self-checking Berger code checkers and self checking combinational circuits. Built In Self Test, Self-testing circuits for systems, memory & processor testing, PLA testing, automatic test pattern generation and Boundary Scan Testing JTAG.

References

1. M. Abramovici, M.A. Breuer, A.D. Friedman, “Digital systems testing and testable design”, Jaico Publishing House.
2. Diraj K. Pradhan, “Fault Tolerant Computer System Design”, Prentice Hall.

Fault tolerant system design

Laboratory Assignments/Experiments:

1. Design a system for Hazard detection.
2. Design a system for providing self check facility.
3. Design a system for self checking of combinational circuits.
4. Write a program to generate a test pattern and testing of a circuit using the test pattern.

Course Outcomes:

1. The student will use theory of logical fault models for testing single stuck fault.
2. The student will show skills for fault simulation for statistical fault analysis.
3. The student will exhibit the knowledge of self-checking for design of self-checking combinational circuits.

504110	Multirate and Adaptive Signal Processing	
ELECTIVE-II		
Teaching Scheme: **Lectures 4 Hrs/ Week**		**Examination Scheme:** **Theory : 50 Marks (In Semester)** **50 Marks (End Semester)** **Credits :4**

Module I

Multirate DSP: Sampling rate conversion by (I/D), efficient filter implementation, Poly phase filters, time variant filter structures, sampling rate conversion for band pass signals, design of phase shifter, design of QMF and filter banks sub band coding of speech.

Module II

adaptive FIR filtering, Newton steepest descent algorithm, Least Mean Square algorithm, Minimax Filter design, Equi-ripple filter design, alternation theorem etc including Remez exchange algorithm, applications of adaptive filters such as adaptive noise cancellation, adaptive equalizer, adaptive echo cancellers, beam forming and adaptive beam forming.

Module III

Adaptive IIR filters, Pade approximation technique and least squares techniques, Prony's method and Shank's method, Wiener filter, quantization effects in IIR filters.

Module IV

Spectral estimation, energy and power signals, energy and power density spectrum, power density spectrum estimation using DFT, method of periodogram, Bartlett method, Welch method, Blckman-Tukey method, Power spectrum estimation using AR model, bi-spectrum estimation.

References

1. Advanced Digital Signal Processing Principles, Algorithms and Applications", Pearson, Fourth Edition, Proakis, Manolakis,
2. Advanced Digital Signal Processing- Shaila Apte-Wiley India publication

Multirate and Adaptive Signal Processing

Laboratory Assignments/Experiments:

1. Design an FIR filter using FS method with Kaiser window to meet the following specifications. Cut-off frequency of 1000 Hz with sampling frequency of 10,000 Hz. Minimum stop band attenuation is 40 dB, $\omega_p = 0.15\pi$, $\omega_s = 0.25\pi$.
2. Design 9 coefficient FIR LPF using frequency sampling method with cut off frequency 2fs/9 where fs is sampling frequency. Plot the magnitude response of the resulting filter
3. Write a program for generating N multiple echos spaced Q samples apart.
4. Record a speech file in your own voice and use power spectrum estimation using Welch method to find the formants for a segment of size 1024 samples.
5. Record a speech file in your own voice with a sampling frequency of 8 KHz and use the sampling rate converter program to convert the sampling frequency to 24 KHz.

Course Outcomes:

1. The student will use theory of multirate processing for design of QMFs and sub band coding.
2. The student will show skills for design of adaptive filter for equalizer or echo cancellar.
3. The student will exhibit the knowledge of adaptive IIR filters for Wiener filter design.
4. The student will exhibit the knowledge of spectral estimation for power spectrum density estimate for speech.

504110	Wireless Sensor Network	
ELECTIVE-II		
Teaching Scheme: **Lectures: 4 Hrs/ Week**		**Examination Scheme:** **Theory : 50 Marks (In Semester)** **50 Marks (End Semester)** **Credits : 4**

Module I

Motivation for a Network of Wireless Sensor Nodes , Sensing and Sensors Wireless Networks, Challenges and Constraints, Applications (health care, agriculture, traffic and others), Node Architecture (the sensing subsystem, processor subsystem, communication interface) LMote, XYZ, Hogthrob node architectures.

Module II

Operating Systems -Functional and non functional Aspects, short overview of prototypes – Tiny OS, SOS, Contiki, LiteOS, sensor grid.Physical Layer- Basic Components, Source Encoding, Channel Encoding, Modulation, Signal Propagation.

Module III

Medium Access Control – types, protocols, standards and characteristics, challenges, Network Layer - Routing Metrics, different routing techniques.

Module IV

Power Management through - local power, processor, communication subsystems and other means, time Synchronization need, challenges and solutions overview for ranging techniques, Fundamentals, challenges and attacks of Network Security, protocol mechanisms for security.

References

1. Dargie, W. and Poellabauer, C., "Fundamentals of wireless sensor networks: theory and practice", John Wiley and Sons, 2010 ISBN 978-0-470-99765-9, pp. 168–183, 191–192
2. Sohraby, K., Minoli, D., Znati, T. "Wireless sensor networks: technology, protocols and applications, John Wiley and Sons", 2007 ISBN 978-0-471-74300-2, pp. 203–209
3. Hart, J. K. and Martinez, K. (2006) Environmental Sensor Networks:A revolution in the earth system science? Earth-Science Reviews, 78 . pp. 177-191.
4. Protocols and Architectures for Wireless Sensor Networks Holger Karl, Andreas Willig - 08-Oct-2007 - 524 page
5. Wireless Sensor Networks: An Information Processing Approach Feng Zhao, Leonidas J. Guibas - 06-Jul-2004 - 358 pages

Wireless Sensor Network

Laboratory Assignments/Experiments:

1. Installation of any OS on sensor node.
2. Reading data from sensor node.
3. Implement 50 stationary nodes topology using NS2 for data transmission and record QOS parameters of the networks/ test bed.
4. Implement 50 dynamic nodes topology using NS2 for data transmission and record QOS parameters of the networks / test bed.
5. On any above topology change the network layer/transport layer/MAC layer protocol and monitor the changes between any two protocols/ test bed using Network Simulator.

Course Outcomes:

1. The student will understand the architecture of WSN network.
2. The student will understand the physical layer related aspects of WSN network.
3. The student will exhibit the knowledge of power management in wireless communication systems.
4. The student will exhibit the knowledge of security aspects of WSN systems.

504110	Reconfigurable Computing	
ELECTIVE-II		
Teaching Scheme: **Lectures 4 Hrs/ Week**		**Examination Scheme:** **Theory : 50 Marks (In Semester)** **50 Marks (End Semester)** **Credits : 4**

Module I

General Purpose Computing, Domain-Specific Processors, Application-Specific Processors; Reconfigurable Computing , Fields of Application; Reconfigurable Device Characteristics, Configurable, Programmable and Fixed-Function Devices;

Module II

General-Purpose Computing, General-Purpose Computing Issues; Metrics: Density, Diversity and Capacity; Interconnects, Requirements, Delays in VLSI Structures; Partitioning and Placement, Routing; Computing Elements, LUT's, LUT Mapping, ALU and CLB's;

Module III

Retiming, Fine-grained & Coarse-grained structures; Multi-context; Different architectures for fast computing viz. PDSPs, RALU, VLIW, Vector Processors, Memories, CPLDs, FPGAs, Multi-context FPGA, Partial Reconfigurable Devices; Structure and Composition of Reconfigurable Computing Devices: Interconnect, Instructions, Contexts, Context switching, RP space model;

Module IV

Reconfigurable devices for Rapid prototyping, Non-frequently reconfigurable systems, Frequently reconfigurable systems; Compile-time reconfiguration, Run-time reconfiguration; Architectures for Reconfigurable computing: TSFPGA, DPGA, Matrix; Applications of reconfigurable computing: Various hardware implementations of Pattern Matching such as the Sliding Windows Approach, Automaton-Based Text Searching, Video Streaming.

References

1. Andre Dehon, "Reconfigurable Architectures for General Purpose Computing".
2. Christophe Bobda, "Introduction to Reconfigurable Computing", Springer Publication.
3. Maya Gokhale, Paul Ghaham, "Reconfigurable Computing", Springer Publication.
4. IEEE Journal papers on Reconfigurable Architectures.

"High Performance Computing Architectures" (HPCA) Society papers.

Reconfigurable Computing

Laboratory Assignments/Experiments:

1. To Design and implement 2:1 Multiplexer using Transmission Gate.
2. To Design and implement a Full adder using 4:1 Multiplexer.
3. To Design and implement Multi-context (4) 4-LUT and implement using HDL and download on FPGA.
4. To Design and implement 4 bit ALU.
5. To Design and implement the simple Distributed Arithmetic system using HDL.

Course Outcomes:

1. The student will understand concept of static and dynamic reconfiguration.
2. The student will use the basics of the PLDs for designing reconfigurable circuits.
3. The student will understand the reconfigurable system design using HDL

504110	***Software Tools**	
ELECTIVE-II		
Teaching Scheme: **Theory 1 Hrs/ Week**		**Examination Scheme:** **Credits :1**
Introduction to software tools such as Octave, MATLAB, LAB VIEW, RTLinux, VxWorks, µCOS-II, Tiny OS, ANDROID, Xilinx, Microwind, Tanner, TCAD Tools, NS-II, NS-III, OMNET++, OPNET, AWR Microwave office, CAD Feko, IE-3D.		
*For each Subject under Elective II the student Shall study open source/evaluation versions of at least two software tools mentioned above and should present term paper.		

504111	Lab Practice II	
Teaching Scheme: **Practical 4 Hrs/ Week**		**Examination Scheme:** **Term Work : 50 Marks** **Oral/ Presentation: 50 Marks** **Credits : 4**
Lab Practice II: The laboratory work will be based on completion of minimum two assignments/experiments from each course of the semester.		

504112	Seminar I	
Teaching Scheme: **Practical 4 Hrs/ Week**		**Examination Scheme:** **Term Work : 50 Marks** **Oral/ Presentation: 50 Marks** **Credits : 4**
Seminar I : Shall be on state of the art topic of student's own choice approved by an authority. The student shall submit the duly certified seminar report in standard format, for satisfactory completion of the work by the concerned Guide and head of the department/institute.		

SEMESTER-III

604101	Image processing and computer vision	

Teaching Scheme: Lectures :04/week		Examination Scheme: Term Work : 50 Marks Oral/ Presentation: 50 Marks Credits : 4

Module I

Image representation, image formation, gray scale transformations like log transformation, negation, all other types of transformations, Smoothing, transformations, Bit slicing, gray level slicing, Use of 3*3 mask for image processing, convolution of mask with the image, smoothing mask, masks for edge detection, Sobel and Prewitt operators, Laplacian operators, Laplacian of Gaussian, Use of first and second derivative, zero crossing for edge detection.

Module II

Canny edge detector, High boost filtering, Use of Histogram, histogram for images with low contrast, with high contrast and bright and dark images, Histogram equalization techniques, Transform domain image processing, introduction to two dimensional signal processing, use of two dimensional DCT and wavelet transform, applications of transforms for image coding, compression and filtering. Image processing applications

Module III

3-D vision tasks, Geometry for 3-D vision, Projective geometry, single camera calibration, two cameras, stereopsis, the geometry of two cameras, relative motion of the cameras, the essential matrix

Module IV

Fundamental matrix estimation from image point correspondences, Applications of epipolar geometry in vision, three and more cameras, stereo correspondence algorithms, active acquisition of range images, basics of radiometry and 3-D vision

References

1. Milan Sonka Vaclav Hlavac Roger Boyle,"Image Processing, Analysis, and Machine Vision",Second Edition, Thomson Publication
2. Rafel Gonzallez and R. Woods " Digital Image Processing", Second edition.

Image processing and computer vision

Laboratory Assignments/Experiments:

1. Design a system for edge detection using Sobel and Prewitt edge operator.
2. Write a generalized program to take the 3*3 mask from the user and convolve the given image with the mask.
3. Write a program to implement any 3 gray scale transformations on the image.
4. Use any image of size 512*512 and high pass filter it in WT domain.
5. Use any image and take Haar wavelet decomposition. Now code it properly in WT domain to achieve 50 % compression.

Course Outcomes:

1. The student will use edge detection operators to detect the edges in the image.
2. The student will show skills for designing the masks for different operations.
3. The student will exhibit the knowledge of transform domain for image enhancement
4. The student will exhibit the knowledge basics of radiometry for 3-D vision.

604102	Wireless and Mobile Technologies	
Teaching Scheme: **Lectures 04/week**		**Examination Scheme:** **Term Work : 50 Marks** **Oral/ Presentation: 50 Marks** **Credits : 4**

Module I

wireless transmission, multipath propagation, two ray model, path loss, different path loss models, Doppler shift, frequency selective fading, flat fading, fast fading and slow fading, Rayleigh fading, diversity-space, time and frequency. basics of mobile communication, cellular model, frequency reuse, hand off strategies, selection of energy thresholds for hand offs, static channel allocation, dynamic channel allocation schemes, coverage area for the cell etc

Module II

Medium access control, hidden and exposed terminals, near and far terminals, Fixed TDMA, Aloha, Slotted Aloha, CSMA, demand assigned multiple access, PRMA packet reservation multiple access, Reservation TDMA, Multiple access with collision avoidance, polling, inhibit sense multiple access, CDMA, Spread aloha multiple access

Module III

Mobile network layer, Mobile IP –IP packet delivery, Agent advertisement and discovery, Registration, tunnelling and encapsulation, optimizations, dynamic host configuration protocol, Ad hoc networks-destination sequence distance vector, Dynamic source routing, Hierarcical algorithms, etc., Mobile transport layer, traditional TCP, indirect TCP, snooping TCP, Mobile TCP, Fast transmit/fast recovery, selective retransmission, transmission oriented TCP

Module IV

GSM architecture, protocols, localization and calling, handover, security, IEEE 802.11 system architecture, protocol, physical layer, MAC layer, MAC management, HIPERLAN protocol architecture, physical layer, channel access control sub layer, MAC sub layer. Introduction to evolving standards

References

1. Schiller, “Mobile communications”-Pearson education
2. Rappaport “Wireless Communications” Principles and Practice, Pearson education
3. Lee “Mobile cellular telecommunications” McGraw Hill

Wireless and Mobile Technologies

Laboratory Assignments/Experiments:

1. Write a computer program for implementing CSMA medium access control.
2. Write a computer program for implementing Reservation TDMA.
3. Write a program for implementation of Dynamic source routing protocol.
4. Write a program for implementation of Dynamic channel allocation.

Course Outcomes:

1. The student will use theory of multipath fading for design of a two ray model.
2. The student will show skills of finding coverage area for cell.
3. The student will exhibit the knowledge of multiple access algorithms for analysis of CDMA systems.
4. The student will exhibit the knowledge of GSM architecture and IEEE 802.11 system architecture.

ELECTIVE-III

Select one subjects from Group-I, and one subject from Group-II from the following list as Elective-III.

Group		Subject	Credit
I	1	Value Education, Human Rights and Legislative Procedures	3
	2	Environmental Studies	3
	3	Energy Studies	3
	4	Disaster Management	3
	5	Knowledge Management	3
	6	Foreign Language	3
	7	Economics for Engineers	3
	8	Engineering Risk – Benefit Analysis	3
II	1	Technology Play	2
	2	Optimization Techniques	2
	3	Fuzzy Mathematics	2
	4	Design and Analysis of Algorithms	2
	5	CUDA	2

604103	Value Education, Human Rights and Legislative Procedures	Group I
ELECTIVE- III		
Teaching Scheme: **Lectures 3 Hrs/ Week**		**Examination Scheme:** **Theory :** **50 Marks (In Semester)** **50 Marks (End Semester)** **Credits : 3**

Module I

Values and Self Development-Social values and individual attitudes, Work ethics, Indian vision of humanism, Moral and non moral valuation, Standards and principles, Value judgments. Importance of cultivation of values, Sense of duty, Devotion, Self reliance, Confidence, Concentration, Truthfulness, Cleanliness, Honesty, Humanity, Power of faith, National unity, Patriotism, Love for nature, Discipline.

Module II

Personality and Behavior Development- Soul and scientific attitude, God and scientific attitude, Positive thinking, Integrity and discipline, Punctuality, Love and kindness, Avoiding fault finding, Free from anger, Dignity of labor, Universal brotherhood and religious tolerance, True friendship, Happiness vs. suffering love for truth, Aware of self destructive habits, Association and cooperation, Doing best, Saving nature.

Module III

Human Rights- Jurisprudence of human rights nature and definition, Universal protection of human rights, Regional protection of human rights, National level protection of human rights, Human rights and vulnerable groups.

Legislative Procedures- Indian constitution, Philosophy, fundamental rights and duties, Legislature, Executive and Judiciary, Constitution and function of parliament, Composition of council of states and house of people, Speaker, Passing of bills, Vigilance, Lokpal and functionaries

References:

1. Chakraborty, S.K., Values and Ethics for Organizations Theory and Practice, Oxford University Press, New Delhi, 2001.
2. Kapoor, S.K., Human rights under International Law and Indian Law, Prentice Hall of India, New Delhi, 2002.
3. Basu, D.D., Indian Constitution, Oxford University Press, New Delhi, 2002.
4. Frankena, W.K., Ethics, Prentice Hall of India, New Delhi, 1990.
5. Meron Theodor, Human Rights and International Law Legal Policy Issues, Vol. 1 and 2, Ox ford University Press, New Delhi, 2000.

604103	Environmental Studies	Group I
ELECTIVE- III		
Teaching Scheme: **Lectures 3 Hrs/ Week**		**Examination Scheme:** **Theory:50 Marks (In Semester)** **50 Marks (End Semester)** **Credits 3**

Module I:

Introduction and Natural Resources: Multidisciplinary nature and public awareness, Renewable and nonrenewal resources and associated problems, Forest resources, Water resources, Mineral resources, Food resources, Energy resources, Land resources, Conservation of natural resources and human role.
Ecosystems: Concept, Structure and function, Producers composers and decomposers, Energy flow, Ecological succession, Food chains webs and ecological pyramids, Characteristics structures and functions of ecosystems such as Forest, Grassland, Desert, Aquatic ecosystems.

Module II

Environmental Pollution- Definition, Causes, effects and control of air pollution, water pollution, soil pollution, marine pollution, noise pollution, thermal pollution, nuclear hazards, human role in prevention of pollution, Solid waste management, Disaster management, floods, earthquake, cyclone and landslides.

Module III:

Social issues and Environment- Unsustainable to sustainable development, Urban problems related to energy, Water conservation and watershed management, Resettlement and re-habitation, Ethics, Climate change, Global warming, Acid rain, Ozone layer depletion, Nuclear accidents, holocaust, Waste land reclamation, Consumerism and waste products, Environment protection act, Wildlife protection act, Forest conservation act, Environmental issues in legislation, population explosion and family welfare program, Environment and human health, HIV, Women and child welfare, Role of information technology in environment and human health.

References:

1. Agarwal, K.C., Environmental Biology, Nidi Publication Ltd., Bikaner, 2001.
2. Bharucha Erach, Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmadabad, 2002.
3.Bukhootsow, B., Energy Policy and Planning, Prentice Hall of India, New Delhi, 2003.
4.Cunningham, W.P., et al. , Environmental Encyclopedia, Jaico Publishing House, Mumbai, 2003.

604103	Energy Studies	Group I

ELECTIVE- III

Teaching Scheme: Lectures 3 Hrs/ Week		Examination Scheme: Theory : 50 Marks (In Semester) 50 Marks (End Semester) Credits : 3

Module I:

Energy Sources : Fossil fuels, Nuclear fuels, hydel, solar, wind and bio fuels in India, Energy conservation, Nuclear energy through fission and fusion processes.

Module II:

Energy Conservation: Energy conversion from source to utility, Solar, Nuclear, Geothermal, Tide and Wind Energies.

Global Energy Scenario: Role of energy in economic development and social transformation, Overall energy demand, availability and consumption, Depletion of energy resources and its impact on economy, Non proliferation of nuclear energy. International energy policies of G-8, G-20, OPEC and European union countries.

Module III:

Indian Energy Scenario- Commercial and noncommercial forms of energy, Utilization pattern in the past, present and also future prediction, Sector wise energy consumption.

Energy Policy: Energy policy issues at global level, national level and state level, Energy conservation act 2001, Electricity act 2003, Energy pricing and its impact on global variations

References:

1. Jose Goldenberg, Thomas Johanson, and Reddy, A.K.N., Energy for Sustainable World, WileyEastern ,2005.
2. Charles E. Brown, World Energy Resources, Springer Publication, New York, 2002.
3. Culp, A.W., Principles of Energy Conversion, McGraw Hill New York, 2004.
4. Bukhootsow, B., Energy Policy and Planning, Prentice Hall of India, New Delhi, 2003.

604103	Disaster Management	Group I
ELECTIVE- III		
Teaching Scheme: **Lectures 3 Hrs/ Week**		**Examination Scheme:** **Theory : 50 Marks (In Semester)** **50 Marks (End Semester)** **Credits : 3**

Module I

Introduction :Concepts and definitions: disaster, hazard, vulnerability, risk, capacity, impact, prevention, mitigation). Disasters classification; natural disasters (floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides, coastal erosion, soil erosion, forest fires etc.); manmade disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills etc); hazard and vulnerability profile of India, mountain and coastal areas, ecological fragility

Module II

Disaster Impacts :Disaster impacts (environmental, physical, social, ecological, economical, political, etc.); health, psycho-social issues; demographic aspects (gender, age, special needs); hazard locations; global and national disaster trends; climate-change and urban disasters.

Module III

Disaster Risk Reduction (DRR) : Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; structural and non-structural measures; risk analysis, vulnerability and capacity assessment; early warning systems, Post-disaster environmental response (water, sanitation, food safety, waste management, disease control); Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programmes in India and the activities of National Disaster Management Authority.

References:

1. http://ndma.gov.in/ (Home page of National Disaster Management Authority).
2. http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of Home Affairs).
3. Pradeep Sahni, 2004, Disaster Risk Reduction in South Asia, Prentice Hall.
4. Singh B.K., 2008, Handbook of Disaster Management: techniques & Guidelines, Rajat Publication.
5. Ghosh G.K., 2006, Disaster Management ,APH Publishing Corporation.

604103	Knowledge Management	Group I
ELECTIVE- III		
Teaching Scheme: **Lectures 3 Hrs/ Week**		**Examination Scheme:** **Theory : 50 Marks (In Semester)** **50 Marks (End Semester)** **Credits : 3**

Module I

Introduction: Definition, evolution, need, drivers, scope, approaches in Organizations, strategies in organizations, components and functions, understanding knowledge; Learning organization: five components of learning organization, knowledge sources, and documentation. Essentials of Knowledge Management; knowledge creation process, knowledge management techniques, systems and tools.

Module II

Organizational knowledge management; architecture and implementation strategies, building the knowledge corporation and implementing knowledge management in organization. Knowledge management system life cycle, managing knowledge workers, knowledge audit, and knowledge management practices in organizations, few case studies

Module III

Futuristic KM: Knowledge Engineering, Theory of Computation, Data Structure.

References:

1. Knowledge Management – a resource book – A Thohothathri Raman, Excel, 2004.
2. Knowledge Management- Elias M. Awad Hasan M. Ghazri, Pearson Education
3. The KM Toolkit – Orchestrating IT, Strategy & Knowledge Platforms, Amrit Tiwana, Pearson, PHI, II Edn.
4. The Fifth Discipline Field Book – Strategies & Tools For Building A learning oganization PeterSenge et al. Nicholas Brealey 1994
5. Knowledge Management – Sudhir Warier, Vikas publications
6. Leading with Knowledge, Madanmohan Rao, Tata Mc-Graw Hill.

604103	Foreign Language	Group I
ELECTIVE- III		
Teaching Scheme: **Lectures 3 Hrs/ Week**		**Examination Scheme:** **Theory : 50 Marks (In Semester)** **50 Marks (End Semester)** **Credits : 3**
Module I:		
Pronunciation guidelines; Single vowels, Accentuated vowels, Vowels and consonants combinations, Consonants; Numbers 1-10 Articles and Genders; Gender in French, Plural articles, Some usual expressions. Pronouns and Verbs; The verb groups, The pronouns, Present tense, Some color Adjectives and Plural ; Adjectives, Some adjectives, Our first sentences, More Numbers.		
Module II:		
Sentences Structures; Some Prepositions, Normal Sentences, Negative Sentences, Interrogative Sentences, Exercises The Family; Vocabulary ,Conversation, Notes on Pronunciation, Notes on Vocabulary, Grammar, Liaisons Guideline. D'où viens-tu (Where do you come from); Vocabulary, Conversation, Notes on Vocabulary, Liaisons Guidelines . Comparer (Comparing); Vocabulary, Conversation, Notes on Vocabulary, Grammar Liaisons Guidelines, Ordinal Numbers		
Module III:		
Le temps (Time); Vocabulary, Grammar, Time on the clock Additional French Vocabulary; Vocabulary related to - The Family, Vocabulary related to - Where do you come from? French Expressions and Idioms; Day-to-day Life, At Work, The car, Sports, Specia Events Other French Flavours; Nos cousins d'Amérique - Québec et Accadie, Au pays de la bière et des frites, Mettez-vous à l'heure Suisse, Vé, peuchère, le français bien de chez nous		
Reference: http://www.jump-gate.com/languages/french/index.html		

604103	Engineering Economics	Group I
ELECTIVE- III		
Teaching Scheme: **Lectures 3 Hrs/ Week**		**Examination Scheme:** **Theory : 50 Marks (In Semester)** **50 Marks (End Semester)** **Credits : 3**

Module I:

Introduction to the subject: Micro and Macro Economics, Relationship between Science, Engineering, Technology and Economic Development. Production Possibility Curve, Nature of Economic Law, **Time Value of Money:** concepts and application. Capital budgeting; Traditional and modern methods, Payback period method, IRR, ARR, NPV, PI (with the help of case studies)

Module II:

Meaning of Production and factors of production, Law of variable proportions and returns to scale. Internal and external economies and diseconomies of scale. Concepts of cost of production, different types of costs; accounting cost, sunk cost, marginal cost, Opportunity cost. Break even analysis, Make or Buy decision (case study). Relevance of Depreciation towards industry. Meaning of market, types of market, perfect competition, Monopoly, Monopolistic, Oligopoly. (Main features). Supply and law of supply, Role of demand and supply in price determination.

Module III:

Indian Economy, nature and characteristics. Basic concepts; fiscal and monetary policy, LPG, Inflation, Sensex, GATT, WTO and IMF. Difference between Central bank and Commercial banks

Text Books:

1. Jain T.R., Economics for Engineers, VK Publication
2. Singh Seema, Economics for Engineers, IK International

Reference Books:

1. Chopra P. N., Principle of Economics, Kalyani Publishers
2. Dewett K. K., Modern economic theory, S. Chand
3. H. L. Ahuja., Modern economic theory, S. Chand
4. Dutt Rudar & Sundhram K. P. M., Indian Economy
5. Mishra S. K., Modern Micro Economics, Pragati Publications
6. Pandey I.M., Financial Management; Vikas Publishing House
7. Gupta Shashi K., Management Accounting, Kalyani Publication

604103	Engineering Risk – Benefit Analysis	Group I
ELECTIVE- III		
Teaching Scheme: **Lectures 3 Hrs/ Week**		**Examination Scheme:** **Theory : 50 Marks (In Semester)** **50 Marks (End Semester)** **Credits : 3**

Module I :

Introduction- Knowledge and Ignorance, Information Uncertainty in Engineering Systems, Introduction and overview of class; definition of Engineering risk; overview of Engineering risk analysis. Risk Methods: Risk Terminology, Risk Assessment, Risk Management and Control, Risk Acceptance, Risk Communication, Identifying and structuring the Engineering risk problem; developing a deterministic or parametric model System Definition and Structure: System Definition Models, Hierarchical Definitions of Systems, and System Complexity.

Module 2:

Reliability Assessment: Analytical Reliability Assessment, Empirical Reliability Analysis Using Life Data, Reliability Analysis of Systems.

Module 3:

Reliability and probabilistic risk assessment (RPRA), decision analysis (DA), and cost-benefit analysis (CBA). All of these pertain to decision making in the presence of significant uncertainty. In ERBA, the issues of interest are: The risks associated with large engineering projects such as nuclear power reactors, the International Space Station, and critical infrastructures; the development of new products; the design of processes and operations with environmental externalities; and infrastructure renewal projects

Books:

1. Risk Analysis in Engineering and Economics, B. M. Ayyub, Chapman-Hall/CRC Press, 2003.
2. Hoyland, Arnljot, and Rausand, Marvin. *System Reliability Theory*. Hoboken, NJ: Wiley-Interscience, 1994. ISBN: 9780471471332.
3. Clemen, Robert, " Making Hard Decisions: An Introduction to Decision Analysis (Business Statistics) " PHI publications

604103	Optimization Techniques	Group II
ELECTIVE- III		
Teaching Scheme: **Lectures 2 Hrs/ Week**		**Examination Scheme:** **Theory : 50 Marks (In Semester)** **50 Marks (End Semester)** **Credits : 2**

Module I :

First and second order conditions for local interior optima (concavity and uniqueness), Sufficient conditions for unique global optima; Constrained optimization with Lagrange multipliers; Sufficient conditions for optima with equality and inequality constraints;

Module 2:

Recognizing and solving convex optimization problems. Convex sets, functions, and optimization problems. Least-squares, linear, and quadratic optimization. Geometric and semidefinite programming. Vector optimization. Duality theory. Convex relaxations. Approximation, fitting, and statistical estimation. Geometric problems. Control and trajectory planning

Books:

1. Stephen Boyd and Lieven Vandenberghe, *Convex Optimization*, Cambridge University Press.
2. A. Ben-Tal, A. Nemirovski, *Lectures on Modern Convex Optimization: Analysis,Algorithms, and Engineering Applications*, SIAM.
3. D. P. Bertsekas, A. Nedic, A. E. Ozdaglar, *Convex Analysis and Optimization*,Athena Scientific.
4. D. P. Bertsekas, *Nonlinear Programming*, Athena Scientific.
5. Y. Nesterov, *Introductory Lectures on Convex Optimization: A Basic Course*, Springer.
6. J. Borwein and A. S. Lewis, *Convex Analysis and Nonlinear Optimization:Theory and Examples*, Springer**.**

604103	Fuzzy Mathematics	Group II
ELECTIVE- III		
Teaching Scheme: **Lectures 2 Hrs/ Week**		**Examination Scheme:** **Theory : 50 Marks (In Semester)** **50 Marks (End Semester)** **Credits : 2**
Module I :		
Definition of a Fuzzy set; Elements of Fuzzy logic. Relations including, Operations, reflexivity, symmetry and transitivity; Pattern Classification based on fuzzy relations		
Module II:		
Fuzzy Models: Mamdani , Sugeno, Tsukamoto		
Books: 1. Neuro-Fuzzy and Soft Computing by S.R.Jung, Sun, Mizutani,		

604103	Design and Analysis of Algorithm	Group II
ELECTIVE- III		
Teaching Scheme: **Lectures 2 Hrs/ Week**		**Examination Scheme:** **Theory :** **50 Marks (In Semester)** **50 Marks (End Semester)** **Credits : 2**
Module I :		
Introduction- Fundamental characteristics of an algorithm. Basic algorithm analysis –Asymptotic analysis of complexity bounds– best, average and worst-case behaviour, standard notations for expressing algorithmic complexity. Empirical measurements of performance, time and space trade-offs in algorithms.		
Module II:		
Properties of big-Oh notation – Recurrence equations – Solving recurrence equations – Analysis of linear search. Divide and Conquer: General Method – Binary Search – Finding Maximum and Minimum – Merge Sort – Greedy Algorithms: General Method – Container Loading – Knapsack		
Books: Algorithm Design – Jon Kleinberg and Eva Tardos Introduction to Algorithms – T.H. Corman et. Al		

604103	CUDA	Group II
ELECTIVE- III		
Teaching Scheme: **Lectures 2 Hrs/ Week**		**Examination Scheme:** **Theory : 50 Marks (In Semester)** **50 Marks (End Semester)** **Credits : 2**
Module I :		
History of GPUs leading to their use and design for HPC- The Age of Parallel Processing, The Rise of GPU Computing ,CUDA, Applications of CUDA, Development Environment, Introduction to CUDA C, Kernel call, Passing Parameters, Querying Devices, Using Device Properties		
Module II:		
Parallel Programming in CUDA C - CUDA Parallel Programming, Splitting Parallel Blocks, Shared Memory and Synchronization, Constant Memory, Texture Memory, CUDA events, Measuring Performance with Events.		
Books: 1. Programming Massively Parallel Processors: A Hands-on Approach –second edition by David B. Kirk, Wen-mei W. Hwu. 2. CUDA by Example - An Introduction to General-Purpose GPU Programming by Jason Sanders ,Edward Kandrot- Addison Wesley 3. GPU Computing Gems Emerald Edition -Applications of GPU Computing Series by Wen-mei, W. Hwu 4. CUDA Programming: A Developer's Guide to Parallel Computing with GPUs by shane cook		

604104	Seminar II	
Teaching Scheme: **Practical 4 Hrs/ Week**		**Examination Scheme:** **Term Work : 50 Marks** **Oral/ Presentation: 50 Marks** **Credits :4**
<u>Seminar II :</u> shall be on the topic relevant to latest trends in the field of concerned branch, preferably on the topic of specialization based on the electives selected by him/her approved by authority. The student shall submit the seminar report in standard format, duly certified for satisfactory completion of the work by the concerned guide and head of the Department/Institute.		

604105	Project Stage- I	
Teaching Scheme: **Practical 8 Hrs/ Week**		**Examination Scheme:** **Term Work : 50 Marks** **Oral/ Presentation: 50 Marks** **Credits :8**

Project Stage – I

Project Stage – I is an integral part of the project work. In this, the student shall complete the partial work of the project which will consist of problem statement, literature review, project overview, scheme of implementation (Mathematical Model/SRS/UML/ERD/block diagram/ PERT chart, etc.) and Layout & Design of the Set-up. As a part of the progress report of Project work Stage-I, the candidate shall deliver a presentation on the advancement in Technology pertaining to the selected dissertation topic.

The student shall submit the duly certified progress report of Project work Stage-I in standard format for satisfactory completion of the work by the concerned guide and head of the Department/Institute.

SEMESTER-IV

604106	Seminar III	
Teaching Scheme: **Practical 5 Hrs/ Week**		**Examination Scheme:** **Term Work : 50 Marks** **Oral/ Presentation: 50 Marks** **Credits :5**
Seminar III: shall preferably an extension of **seminar II.** The student shall submit the duly certified seminar report in standard format, for satisfactory completion of the work by the concerned guide and head of the Department/Institute.		

604107	Project Stage- II	
Teaching Scheme: **Practical 20 Hrs/ Week**		**Examination Scheme:** **Term Work : 150 Marks** **Oral/ Presentation: 50 Marks** **Credits :20**
Project Stage – II In Project Stage – II, the student shall complete the remaining part of the project which will consist of the fabrication of set up required for the project, work station, conducting experiments and taking results, analysis & validation of results and conclusions. The student shall prepare the duly certified final report of project work in standard format for satisfactory completion of the work by the concerned guide and head of the Department/Institute.		